PROCEEDINGS OF **SINN UND BEDEUTUNG 28**

2024

edited by
Geraldine Baumann
Daniel Gutzmann
Jonas Koopman
Kristina Liefke
Agata Renans
and Tatjana Scheffler

Sinn und Bedeutung 28 took place from September 5–8, 2023
and was hosted at the Ruhr University Bochum.

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Foreword

It is our pleasure to present the Proceedings of *Sinn und Bedeutung 28* – the first-ever SuB to be held by the growing group of semanticists at Ruhr University Bochum (RUB), Germany. SuB28 took place at RUB's Convention Center from September 5-9, 2023. The conference was jointly organized by the RUB Institute for Linguistics, the Linguistic Data Science Lab, the Institute for German Language and Literature, and the Departments of Philosophy I and II. The conference featured a three-day main session (Sept. 6-8) and a one-day special session on 'The Semantics and Pragmatics of Co-Speech Communication' (Sept. 5, organized by Tatjana Scheffler).

The main session comprised 45 contributed talks and two poster sessions (plus lightning talks, with 14 posters each) as well as three invited talks (by Dorothy Ahn, Hazel Pearson, and Graham Priest). The special session hosted seven contributed talks plus one invited talk (by Cornelia Ebert). As is common for SuB, the Proceedings include contributions from the invited, contributed, and poster sessions alongside contributions to the workshop. The original program of SuB28 is available here: `https://www.ruhr-uni-bochum.de/sub28/program.html.en`

Contributed talks were selected from 176 original submissions (for the special and the main session combined), based on reviews by 171 members of the international SuB program committee. SuB28 counted a total of 140 registered participants (88 post-PhD, 52 PhD and pre-PhD students). 125 participants attended the conference in person. 15 participants joined the conference virtually/via Zoom. Of the total number of participants, 75 were international [= not based at a German university], 65 were national.

SuB28 was funded by a grant (no. 514546065) for international scientific events from the German Research Foundation, DFG. The organization, administration, and planning of SuB28 was greatly helped by Christiane Dahl, to whom we extend our warmest gratitude. On-site, we received invaluable assistance from Lea Fricke, Emil Eva Rosina, and Simon Dominik Vonlanthen and from the student assistants Geraldine Baumann, Yonca Christine Klisch, Jonas Koopman, Simon Kreutz, Dennis Reisloh, and Leonie Uhling. Since Geraldine Baumann and Jonas Koopman were centrally involved in compiling the Proceedings, they have been included in the list of editors.

We are looking forward to hosting many more such events in Bochum!

Kristina Liefke with Geraldine Baumann, Daniel Gutzmann, Jonas Koopman, Agata Renans, and Tatjana Scheffler

Bochum, November 2024

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A four-way distinction in English definite expressions

Dorothy AHN — *Rutgers University*

Abstract. Analyses of pronouns, definite descriptions, and demonstratives range from treating them to be independent of each other to treating them with parallel semantics. In this paper, I compare the semantic contribution of different building blocks of these expressions and propose to delineate the semantic space of definite descriptions along two dimensions: between the form of the content (pronominal vs. description) and the mechanism of reference (anaphoric vs. deictic). To support this, I provide two pieces of evidence. First, I show that deictic and anaphoric pronouns have distinct semantic and distributional properties. Second, I show that the NP content of a definite description makes the same semantic contribution as the gender inference of a pronoun.

Keywords: pronouns, definite descriptions, demonstratives, presuppositions.

1. Introduction: definite expressions

It is well-known that a pronoun like English *she*, a definite description like *the linguist*, and a demonstrative description like *that linguist* overlap in their semantic contribution and distribution (Heim, 1983; Neale, 1988; Evans, 1980; Roberts, 2003; Elbourne, 2005, 2008: a.o.). For example, in a context where there is one unique female entity who is a linguist, as provided by the context in (1), it is possible for the three sentences in (1a), (1b), and (1c) to refer to the same entity.

(1) I have a meeting with a linguist who sent me her CV yesterday.
   a. It turns out that she studies semantics.
   b. It turns out that the linguist studies semantics.
   c. It turns out that that linguist studies semantics.

Despite this overlap, these expressions have important differences that are highlighted in the literature. For example, pronouns are highlighted for their flexibility in reference and assignment dependence (Sudo, 2012). Definite descriptions, on the other hand, are highlighted for their licensing requirements, with debates on whether they require uniqueness, familiarity, or something else (Frege, 1892; Heim, 1983; Roberts, 2003; Schwarz, 2009; Coppock and Beaver, 2015), or what the nature of this requirement is (Russell, 1905; Strawson, 1950). Demonstratives are highlighted for their deictic reference to entities in the physical context, and whether their reference is rigidly denoted (Kaplan, 1989; King, 2001; Roberts, 2002; Ebert et al., 2020). This is reflected in the general analyses we assume for these expressions, where pronouns are treated as variables, definite descriptions as carrying some uniqueness- or maximality-denoting operator, and demonstratives carrying some deictic component. Other analyses treat them as sharing the same underlying mechanism but minimally differing in their licensing condition or implications. For example, some analyze pronouns as definite descriptions with minimal differences (Evans, 1980; Elbourne, 2005; Abbott, 2008; Neale, 1988), while some analyze definite descriptions as variables that require familiarity like pronouns (Heim, 1982, 1983; Roberts, 2003). As for demonstratives, many have argued that they are marked definite descriptions, carrying some additional presupposition or restriction (Wolter, 2006; King, 2001; Elbourne,

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2008; Nowak, 2021; Roberts, 2002). I call the latter view where all three definite expressions are considered to share some underlying mechanism the 'uniform view'.

In this paper, I propose a variant of the uniform view, where pronouns, definite descriptions, and demonstratives share one general mechanism. I diverge from previous accounts in proposing a four-way distinction in English definite expressions where they differ along two dimensions. The first dimension is the form of the expression: pronominal vs. descriptive. The second dimension is the mechanism of reference: deictic vs. non-deictic. Thus, instead of a three-way distinction between pronouns, definites, and demonstratives, what results is a division as shown in (2), with some personal pronouns such as *he* and *she* occupying two cells.

(2) English definite expressions:

	pronominal	description
deictic	*he, she, that, those*	*that linguist*
non-deictic	*he, she, it, they*	*the linguist*

There are two parts to this analysis. The first is establishing that deictic expressions differ from anaphoric expressions in semantically-relevant ways. Specifically, I argue that deictic expressions carry an overt linker to the actual context, and that English pronouns are ambiguous between deictic and anaphoric forms and furthermore compete with demonstrative pronouns. In doing so, I diverge from the general practice of treating deixis as subsumed under anaphora (Heim and Kratzer, 1998: a.o.). I show that this analysis correctly captures the distribution of demonstratives that host relative clauses, and the distribution of different pronouns that have been pointed out by Elbourne (2013). Once the two underlying structures for anaphoric and deictic expressions are established, the second part of the analysis shows that pronominal expressions and descriptive expressions make the same exact semantic contribution, namely presupposing that the given referent meets some property. The only difference between a pronoun like *she* and a definite description like *the linguist* is what property it requires of the referent: ϕ-features like gender for the pronoun and the NP for the definite description.[1] This parallel between pronouns and definite descriptions is similar to what is assumed in familiarity theories of definites (Heim, 1982, 1983), though the formal details differ. In this work, I provide evidence that the semantic contribution of the NP restriction of a definite description is identical to that of ϕ-features of a pronoun. Specifically, I show that both are backgrounded in nature and show presuppositional behaviors.

After establishing the difference between anaphoric and deictic definites and the parallel between pronominal and descriptive definites, I propose an analysis of these expressions where the ϕ and NP contents are presupposed and the linker argument responsible for deictic reference is at-issue.

The organization of the paper is as follows. In the rest of the introduction, I present Elbourne's (2013) D-type theory, where pronouns are analyzed as definite descriptions with elided NPs. I will present some of the main aspects of the D-type theory and show its limitations, which will be addressed in the following sections. Because what I propose here is similar to D-type theory in spirit but has nontrivial differences, I will call the analysis in this paper the D-2 theory

[1] Gutzmann and McCready (2014) have already made this argument of locating the descriptive content of definite descriptions and pronouns at the use-conditional dimension, where they require the referent to meet the descriptive content.

of pronouns. In Section 2, I discuss the distinction between deictic and anaphoric content, focusing on demonstrative descriptions vs. definite descriptions. I show that demonstratives should be analyzed as carrying a linker to the actual world, which definite descriptions lack. Then, in Section 3, I add pronouns to the picture, showing that they realize the same anaphoric and deictic reference, but with ϕ information and not NP content. Then, in Section 3.1 I provide novel evidence that this content they carry is backgrounded for both pronouns and definite descriptions.

1.1. Pronouns vs. definite descriptions

Pronouns and definite descriptions are generally highlighted for different characteristics: pronouns for being flexible and assignment-dependent, and definite descriptions for their licensing condition such as uniqueness and existence. The different foci in analyzing them are reflected in the way they are analyzed in formal semantics. In general, a pronoun is analyzed as a variable that is sensitive to indexing (Heim and Kratzer, 1998). Thus, a pronoun *she* with an index *i* evaluated against the assignment *g* returns the individual that the assignment function *g* assigns *i* to. Their ϕ-features such as gender and number are assumed to be presupposed of that entity (Heim and Kratzer, 1998; Sudo, 2012; Elbourne, 2013: a.o.). A general denotation of a pronoun *she* is shown in (3).

(3) $[\![\text{she}_i]\!]^g$ = g(i), if g(i) is female; undefined otherwise

On the other hand, definite articles are often analyzed as taking an NP as an argument and returning some entity that meets that NP restriction. Under the Fregean account of definite descriptions, a definite description such as *the linguist* presupposes an existence of a unique entity that is a linguist and returns that unique linguist as an output. This is shown in (4a) from Heim and Kratzer (1998), where existence of a unique entity such that f(x) is true is specified, and in (4b) from Elbourne (2005), where this uniqueness is relativized to a situation variable.

(4) a. $[\![\text{the}]\!] = \lambda$f: f$\in D_{<e,t>}$ and there is exactly one x$\in C$ such that $f(x) = 1$. the unique $y \in C$ such that $f(y) = 1$ (Heim and Kratzer, 1998)

b. $[\![\text{the}]\!] = \lambda \text{f}_{<e,t>}.\lambda$s: s$\in D_s \wedge \exists!$x f(x)(s)=1. ιx f(x)(s) = 1

(i) [[the NP] s]

(ii) ιx f(x)(s) = 1 is defined if there is exactly one entity *y* such that f(y)(s) = 1; when defined it returns that very individual; if not defined, no semantic value is returned (Elbourne, 2005)

In the way the two kinds of expressions are analyzed, pronouns are seen as dependent, referring to something that is already established in the context, while definite descriptions are seen as expressions that can stand on their own, as long as some uniqueness condition is met.

The denotations in (3) and (4) make use of the same building blocks of meaning, though they are implemented through different mechanisms. Relativized uniqueness and existence, for example, are presupposed through the ι operator in (4) but are subsumed under the mechanism of anaphora in (3): for a successful anaphoric reference, the intended antecedent must exist uniquely in the relevant context. The information that restricts the entity is also present in the two denotations but derived in different ways: the gender information is presupposed of a given

entity in (3) while the NP information is taken to be restrictions of an ι operator in (4). These similarities have motivated a number of uniform analyses. For example, many have argued that pronouns are (elided) definite descriptions (Elbourne, 2005; Evans, 1980; Abbott, 2008; Hawthorne and Manley, 2012; Bi and Jenks, 2019), definite descriptions carrying index information (Schlenker, 2005; Royer, 2022), or descriptions with ϕ information (von Heusinger, 2002; Postal, 1966). Thus, these accounts derive the meaning of pronouns from definitions similar to (4). Others have argued that definite descriptions should be analyzed as being anaphoric, thus deriving the meaning of definites from definitions similar to (3). This view is represented by familiarity theory of definites (Heim, 1982, 1983; Roberts, 2003), where definite descriptions require their referent to be familiar to the discourse, just as a pronoun is. More recently, definite articles across languages have been observed to distinguish unique and familiar uses morphosyntactically, thus motivating accounts where definite articles have an option of carrying an anaphoric index in addition to the NP in its restriction in a structure similar to (4) (Schwarz, 2009).

1.2. D-type theory of pronouns

I take D-type theories of pronouns, specifically that of Elbourne (2013) as the departure point of this work because, as noted above, the main purpose of this paper is to argue for a nearly full parallel between pronouns and definite descriptions. While details differ, the main argument in D-type theories of pronouns is that pronouns have the semantics of a definite description. For example, Elbourne argues that a pronoun has the same semantics as a definite article in a definite description but with the NP deleted. The restrictions that come with NP ellipsis account for the formal link between the antecedent and the pronoun, while the similarities between the two expressions are captured through uniform semantics that presuppose the uniqueness of an entity meeting the NP denotation in a given situation.

While this paper will adopt the main intuition of Elbourne (2013) and argue for a uniform account of pronouns and definite descriptions, there are two aspects of this work that will not be maintained. The first is the uniform treatment of deixis and anaphora. Many works in formal semantics subsume deixis under anaphora, formally deriving them through indices. This assumption is evident in Heim's (1983) treatment of contextually perceived entities as familiar entities, and Roberts's (2003) categorizing deictically available entities as weakly familiar. In Elbourne (2013), the difference between deixis and anaphora boil down to the difference in identifying the deleted NP. In anaphoric cases, the NP is present in the discourse and overtly mentioned, while in deictic cases, those that involve 'a strong visual clue in the immediate environment' (p.197), the NP is contextually provided and presumably shared across conversation participants. Crucially, there is no distinction in the semantics of the pronoun between deictic and anaphoric uses. I will discuss in the next section a motivation for making this distinction, which will categorize 'non-deictic' or anaphoric pronouns *it* and *they* separately from 'deictic' pronouns *that* and *those*, and ambiguous pronouns *she* and *he*.

Second, Elbourne (2013) abstracts away from discussing ϕ-features of pronouns, noting that they should be analyzed 'probably as presuppositions' (p.193). Thus, under this assumption, pronouns differ from definite descriptions in that they additionally carry ϕ-feature requirements

as presuppositions. In Section 3.1 I will argue for doing away with this distinction, showing that the NP property of a definite description shows the same presuppositional behavior as ϕ-features of a pronoun, thus occupying the same status as them.

2. Anaphoric vs. deictic definites

It has long been observed that definite expressions allow deictic reference to entities in the actual context, but different studies make use of the term 'deixis' differently. Some use the term 'deictic' for an entity as long as the entity is present in the context (Wolter, 2006; Heim, 1982; Heim and Kratzer, 1998), while others restrict it for cases where the speaker actually intends to point out or demonstrate an entity (Roberts, 2002; Ebert et al., 2020). In this paper, I follow the definition in the latter group, where there is a clear indication of demonstrating an entity. As shown in (5), it is often difficult to determine whether what is involved is a true deixis with a demonstration or an anaphoric reference to an already-established entity. For example, it is possible that after attending to the cat walking in, the discourse referent that corresponds to the cat has been introduced and established in the context for the speaker to refer anaphorically to it. The latter anaphoric option is what Heim (1982) assumes when she notes that definites can refer to entities introduced by context.

(5) a. (Context: a cat walks in) The cat is hungry.
b. (Context: a dog walks in) It is going to bite.

In order to clearly distinguish between deictic and anaphoric contexts, I focus on contrastive uses as in (6). If the speaker points to two different cats, the demonstrative is licensed, but the definite is not.

(6) a. That cat$_{\rightarrow}$ is happy, and that cat$_{\rightarrow}$ is not.
b. #The cat$_{\rightarrow}$ is happy, and the cat$_{\rightarrow}$ is not.

While the contrast in (6) may be seen as the failure of the uniqueness presupposition, I argue that this is a failure of the definite article to incorporate the pointing information restrictively (Ahn and Davidson, 2018; Ebert et al., 2020). Extending this to pronouns, we see that demonstrative pronouns such as *that* and *those* allow contrastive deixis in contrast to *it* (Maclaran, 1982). Animate pronouns also allow contrastive deixis as shown in (7c), though *they* shows some variation. Note that anaphorically, *they* can refer to animate and inanimate entities. In deictic uses, however, *they* is degraded with inanimate entities. For example, (7d) is felicitous if the speaker is pointing to two groups of people, but not as good if the speaker is pointing to two sets of computers.

(7) a. That$_{\rightarrow}$ is broken, and that$_{\rightarrow}$ is not.
b. ??It$_{\rightarrow}$ is broken, and it$_{\rightarrow}$ is not.
c. She$_{\rightarrow}$ is happy, and she$_{\rightarrow}$ is not.
d. ?They$_{\rightarrow}$ are {happy/broken}, and they$_{\rightarrow}$ are not.

Analyzing deixis as a restrictive incorporation of pointing information derives from intuitions of previous works. Ebert et al. (2020) show that demonstratives combine with gestures in restrictive ways while definite descriptions do not. Elbourne (2005); Nowak (2021); King (2001)

compare demonstrative descriptions to definite descriptions and argue that demonstratives carry an additional argument. Specifically, they argue that while the uniqueness operator takes just the NP argument as its restriction for definite descriptions, it takes an additional restriction for demonstrative descriptions. In Ahn (2022), the intuitions from Ebert et al. (2020) and the additional restriction view are combined: demonstratives are analyzed as realizing a binary maximality operator, so that it takes two arguments rather than one. One of the arguments is the NP while the other is a deictic 'linker' to the actual context. The main information that the linker takes is a depictive content from the actual world like location of an entity or iconic properties, but Ahn (2022) argues that clausal arguments can also be hosted in this linker position. While the grouping of depictive content and clausal arguments is not readily obvious, it aligns with the developmental path of pointing where it serves as 'proto-declaratives' and 'proto-imperatives' in language development (Bates, 1976), thus replacing entire clauses rather than just predicates.

One important consequence of this view is that deixis is no longer subsumed under the general mechanism of anaphora but derived through a separate mechanism. Under accounts that subsume deixis under anaphora, it is difficult to explain why expressions that allow anaphora do not always allow deixis. For example, the definite description is known to allow anaphoric uses, but it does not allow deictic uses as in (6b). Under this account, deictic uses are not predicted to be possible with definite descriptions because deixis requires this linker argument, and only demonstratives carry an argument slot for this linker.

Now that deixis is argued to involve a separate mechanism from anaphora, the next question is whether and how this applies to pronouns. We have already noted that pronouns vary in whether they allow deixis. Singular animate pronouns *she* and *he* allow deixis freely, while *they* has some restrictions. In contrast, *it* does not allow deictic uses altogether. I argue following Ahn (2022, 2019) that just like descriptions, pronouns have demonstrative and definite, or deictic and non-deictic/anaphoric, variants. Pronominal demonstratives *that* and *those* naturally fit into the demonstrative category, but I further argue that animate personal pronouns *she* and *he* are ambiguous between the anaphoric and the deictic categories while *it* and *they* are in the anaphoric category. The categorization is not lexically specified, but derives from competition with the demonstratives. For example, the restriction of *it* and *they* seem to come from the competition with demonstrative pronouns *that* and *those*. Because English demonstrative pronouns are often restricted to inanimate entities, the animate pronouns *she* and *he* are not constrained by them and can be used both as deictic and anaphoric kinds. For example, note that in contexts where the plural demonstrative *this* is appropriate for animate entities and thus is available as in (8a), the use of the pronoun *she* is degraded as in (8b), supporting this competition-based account.

(8) a. This$_{\rightarrow}$ is my sister, and this$_{\rightarrow}$ is my mother.
b. ?She$_{\rightarrow}$ is my sister, and she$_{\rightarrow}$ is my mother.

Further evidence for dividing the set of English pronouns into deictic and anaphoric kinds comes from the observation that the pronouns vary in their ability to host NPs and relative clauses. Note that certain pronouns can co-occur with NPs as in (9) (Postal, 1966).

(9) You troops will embark but the other troops will remain.

While examples like (9) is used in Elbourne (2005) and Elbourne (2013) to support the idea that pronouns are semantically like determiners, what is interesting is that not all pronouns support this NP-carrying uses. As the sentences in (10) show, while the first-person plural pronoun *we* allows NP restrictions, other pronouns do not.

(10) a. We linguists agree.
b. ?{He/She} linguist agrees.
c. ?It cup fell.
d. ?They linguists agree.

This seems to be due to the competition with demonstratives: while *you* and *we* do not have corresponding first- and second-person demonstratives, the others can all be replaced with third-person demonstratives *that* and *those*.

Furthermore, pronouns allow relative clauses at varying degrees. Pronouns like *he* can host relative clauses with the absence of nouns, as in (11), as discussed in Elbourne (2013).

(11) He who reads never fails.

Elbourne (2013) notes that the hosting of relative clauses is one of the strongest arguments for analyzing pronouns as definite descriptions with NP deletion. Under this view, because relative clauses are commonly analyzed as being hosted by NPs, pronouns that carry relative clauses provide evidence that there is an underlying NP. However, Elbourne notes that not all pronouns host relative clauses. For example, *it* does not host a relative clause as shown in (12).

(12) *It which rolls gathers no moss.

Zobel (2015) also notes that while *he* and *she* allow relative clauses, *they* is quite degraded in such uses. This pronoun-internal variation is considered a puzzle in Elbourne (2013), where (12) is suggested to be due to *it* not being compatible with phonological stress. However, this explanation cannot apply to the degradedness of *they*.

I argue that this pronoun-internal variation in the ability to host relative clauses can be captured by the deictic vs. anaphoric distinction in pronouns and the competition with deictic demonstratives. Note that the variation resembles the variation we saw with the contrastive deictic uses of pronouns. Following Ahn (2022), I assume that the linker argument of a demonstrative can also host relative clauses. Because the linker argument is outside the NP restriction under this account, the presence of an underlying NP is not relevant to the ability to host a relative clause. Instead, what matters is which of the pronouns can be used deictically. Because English *it* and *they* are not deictic and do not allow this linker argument, the degradedness of relative clauses with these expressions is readily predicted.

Thus, in this section, I have proposed to move away from the general assumption of subsuming deixis under the mechanism of anaphora and deriving it through a separate mechanism. The analysis I adopt is that of Ahn (2022) where deictic expressions carry an additional linker argument that is specified to be a deictic pointing or a clausal argument. I show that this deictic vs. anaphoric distinction divides English pronouns into two categories, which resolves Elbourne's puzzle in the original D-type theory, namely that only certain pronouns host relative clauses. Under the current proposal, relative clauses are hosted by pronouns not through a hidden NP but through the linker argument, and thus non-deictic pronouns that lack this linker argument are correctly predicted to disallow contrastive deixis and relative clauses.

3. Pronominal vs. descriptive definites

Now that the deictic vs. non-deictic distinction in English pronouns is motivated, I move on to discuss the difference between pronominal expressions and descriptive expressions. Unlike the deictic vs. non-deictic distinction, I argue that there is no structural difference between pronominal and descriptive expressions. They share the same exact structure, either the deictic one with the linker or the non-deictic one without, and only differ in the amount of content they carry: pronominal expressions simply carry ϕ-information while descriptive expressions carry the NP information. Thus, in this account, the semantic contributions of a pronoun's ϕ-features and a definite description's NP are exactly the same.

Gutzmann and McCready (2014) argue for a multidimensional analysis for definite descriptions, where their propositional content and the user-conditional content are distinguished. Truth-conditionally, all that the definite description returns is the relevant entity, while use-conditionally, it requires the referent to meet the NP property. In doing so, they draw a parallel to pronouns, where pronouns look the same except what they require use-conditionally is their ϕ-requirements. In support of this view, I provide evidence that the gender information of a pronoun and the NP description of a definite description have the same presuppositional nature. Specifically, I review the presuppositional nature of pronouns' gender inference as discussed in previous works and show that in anaphoric uses, the NP content of a definite description has the same exact properties. This motivates a fully parallel account of the two, which is what I present in the next section.

3.1. NP vs. gender information

The ϕ-features of a pronouns are generally assumed to be presuppositions (Sudo, 2012). I discuss the different characteristics identified for the gender inference of a pronoun and show that the NP inference of a definite description, namely that the given entity is in the set denoted by the NP, looks the same. In doing so, I will follow the arguments in Sudo (2012) closely, as this work provides a wide range of expected and unexpected properties of the gender inference. Throughout this paper, I focus on gender information that have semantic consequences, and leave other ϕ-features such as number and person aside (see Sauerland, 2008; Kratzer, 2009; Sauerland et al., 2005: for more discussion). The goal of this paper is not to evaluate whether the gender inference of a pronoun should be analyzed as a presupposition or not, but to show that the NP inference of a definite description behaves exactly like the gender inference.

3.1.1. ϕ-features as presuppositions

One of the defining characteristic of a presupposition is that it is not straightforwardly rejectable. This applies to the gender inference of pronouns as we see in (13), where rejecting the truth of this sentence does not reject the assumption that the agent is female.

(13) She$_7$ is drinking coffee.
  a. No that is not true. (*does not mean*: g(7) is not female.)

This presupposition is maintained in quantified contexts as well. In (14), what is presupposed is that every kid is female, and this does not get rejected if the sentence is false.

(14) Every kid drank her coffee.

Another defining characteristic of presuppositions is their projection behavior. In (15), adopted from Sudo (2012), the attitude holder of the sentence is implied to believe the gender inference of the phonologist.

(15) Kate said that John attended a talk by some phonologist. We have no clue whether or not she's telling us the truth. Kate believes/doubts/hopes that John criticized her. (attitude holder is implied to believe the gender inference) (Sudo, 2012: 25)

Gender features of a pronoun also show local accommodation. Local accommodation is shown with the presupposition trigger *stop* in (16a). While Sudo (2012) notes that local accommodation for gender inference is much harder, it is possible with prosodic stress, as in (16).

(16) a. Rafael did not stop using Mac, because he never owned a Mac. (Sudo, 2012: 24)
b. #I don't know her personally, because he is a man. (Sudo, 2012: 24)
c. I don't know HER personally, because he is a man.

Sudo (2012) notes that, unlike the presupposed content of the trigger *stop*, gender inference of a pronoun is not part of the asserted content. Consider (17) as an example. What (17) means is that exactly one student used to use Mac and no longer does. As for the others, the sentence requires that they either never used Mac or are still using it, thus showing that the presupposition that the student used to use Mac is part of what is negated.

(17) Exactly one student stopped using Mac. (Sudo, 2012: 59)

On the other hand, the gender inference of a reflexive pronoun *herself* in (18) is not part of the negation. Here, (18) means that only one student criticized their self and is female. The sentence also asserts that no one else, female or not, criticized themselves. Unlike (17), it does not mean that either they are not female or did not criticize themselves.

(18) Exactly one student criticized herself(, namely Mary) (Sudo, 2012: 61)

Sudo (2012) presents an analysis of pronouns that maintain their gender inference as presuppositions and accounts for the exceptional characteristics. Leaving the details aside, I assume that the gender inference of pronouns is presupposed. In the following section, I show that these properties hold of the NP restriction of a definite description as well.

3.1.2. NP restriction as presuppositions

We now go over the properties listed in the previous section and compare them to the NP inference of the definite description. First, we see that the NP inference is not straightforwardly rejectable when used with a definite description, as in (19). For example, even if the addressee rejects the two sentences in (19), the addressee is not rejecting the fact that the relevant individuals are linguists (see also Gutzmann and McCready (2014)).

(19) a. The linguist is drinking coffee.

b. Every linguist drank the coffee that the philosopher made for the linguist.

We also see that the NP inference projects, as shown in (20). Here, the attitude holder is implied to believe that the person is a phonologist.

(20) Kate said that John attended a talk by some linguist. We have no clue whether or not she's telling us the truth. Kate believes/doubts/hopes that John criticized the phonologist.
(attitude holder is implied to believe that the person is a phonologist)

The NP inference can also be locally accommodated. Just as prosodic stress on *her* highlights the gender property which then can be rejected in subsequent discourse, prosodic stress on the noun highlights the NP property which then can be rejected. This is shown in (21).

(21) a. #I don't know the linguist personally, because she is a philosopher/not a linguist.
b. I don't know the LINGUIST personally, because she is a philosopher.

Similar to gender inference and different from presuppositions of *stop*, the NP inference is also not part of the asserted content. This is much harder to detect for descriptions because of binding restrictions, but we can come up with a variable-bound reading of a definite, which we know is possible from works like Elbourne (2013), Schlenker (2005), and Schwarz (2009). Consider the discourse in (22). When the question under discussion (QUD) is set properly for a bound reading, the NP inference of the definite description *the student* is not part of the asserted content. For example, this sentence means that only one student complained, and is a student, and that no one else, student or not, complained. It does not mean that for others, either they were not students or did not complain. To get this reading to be prominent, we need broad focus on both *one* and *student* (Uli Sauerland, p.c.), or specify the student as 'one particular student' or 'this one student' to ensure a referential reading rather than a quantified reading.

(22) QUD: Did anyone from the conference complain about the poster dimension?
Only ONE STUDENT complained that the poster dimensions provided by the conference were not compatible with what the student prepared.

In summary, what we see is that in anaphoric uses, the NP restriction of a definite description makes the same contribution as the ϕ-features of a pronoun: providing a presupposition that the entity under discussion meets a certain property. The only difference is that what a pronoun requires of the entity is that the entity meets one of a few grammatically-determined set of properties such as gender or animacy, while the requirement of a definite description is more flexible given the wide range of NPs that can be used. Semantically, however, the contribution is the same. This presupposition can remain backgrounded, or become at-issue and thus locally accommodated with appropriate prosodic marking, but remain not part of the asserted content otherwise.

4. Analysis: a four-way distinction

In the last section, I motivated two divergences from Elbourne (2013). The first was a distinction internal to pronouns that corresponded to deictic and anaphoric kinds. The motivation for this was that not all pronouns allow deictic reference or hosting of relative clauses. By deriving

deixis not from anaphora but from a linker argument of a demonstrative, I showed that only demonstrative pronouns, namely animate pronouns such as *he* and *she*, are correctly predicted to allow deixis and to host relative clauses. Definite pronouns that lack the linker argument were correctly predicted to disallow such uses. The second divergence was removing the difference between pronouns and definite descriptions in Elbourne (2013), namely in that pronouns presuppose ϕ-features. I showed through a comparison of properties of the gender inference of a pronoun and the NP restriction of a definite description that the semantic contribution of the two kinds of information are the same.

Based on this, I propose a uniform analysis of pronouns and definite descriptions that a) distinguish deictic and anaphoric uses and b) treat ϕ-features on par with NP restrictions.

The distinction between deictic and anaphoric pronouns results in a four-way distinction in definite expressions along two dimensions. The first dimension is anaphoric vs. deictic, where the difference is that the latter has an additional linker argument that can host deixis or relative clauses. The second dimension is the content of the restriction where pronouns carry ϕ-requirements and descriptions carry NP restrictions.

As for the denotations, I adopt the analysis in Ahn (2022), whose denotations are shown in (23). In the anaphoric expressions *it* and *the book*, a supremum operator is used to take restrictions and return a unique entity that meets those restrictions. For the demonstrative expressions, the binary supremum take an additional restriction. The denotations in (23c) and (23d) show deictic uses of *that* and *that book*, respectively, where the speaker points to some location A. The predicate $\rightarrow (A)(x)$ is true iff x is located at A.

(23) a. $[\![\text{it}]\!] = \text{sup}[\lambda \text{x.inanimate(x)}]$
b. $[\![\text{the book}]\!] = \text{sup}[\lambda \text{x.book(x)}]$
c. $[\![\text{that}_{\rightarrow \text{A}}]\!] = \text{bi-sup}[\lambda \text{x.inanimate(x)}][\lambda \text{x.}\rightarrow\text{(A)(x)}]$
d. $[\![\text{that book}_{\rightarrow \text{A}}]\!] = \text{bi-sup}[\lambda \text{x.book(x)}][\lambda \text{x.}\rightarrow\text{(A)(x)}]$

Note that in (23), the contribution of the gender inference of pronouns and that of the NP inference of definite descriptions are the same: they both serve as restrictions to the supremum operator. These denotations are sufficient to derive the similarities between pronouns and descriptions, but there is an additional distinction that needs to be made between this restriction (gender or NP) and the restriction added by the linker. As we saw in Section 3.1, the gender and NP restriction of a pronoun and a definite description, respectively, were backgrounded. The backrounded nature of gender inference is what motivates a presuppositional analysis of gender inference (Sudo, 2012) and the use-conditional analysis of NP and ϕ (Gutzmann and McCready, 2014). On the other hand, the linker argument seems to be never backgrounded always at-issue. Ebert et al. (2020) specifically argue that the role of demonstratives is to make the pointing at-issue, analyzing demonstratives as 'dimension-shifters', that shift the originally not-at-issue information of the pointing gesture to at-issue. Adopting this intuition, I argue that the linker argument should be at-issue by default while the description is not-at-issue by default. I further extend the at-issue analysis of Ebert et al. (2020) by arguing that what is at-issue is not just the pointing gesture but anything that is hosted by the linker argument of a demonstrative. Consider (24) from Wolter (2006) for example. Wolter (2006) notes that the intended reading of (24) requires the prosodic stress on the relative clause as indicated by brackets and capitalization.

(24) [THAT hero] [who KILLS the dragon] [will INHERIT the kingdom].

What we observe is that the content of the relative clause is at-issue, while the referent of the entity that meets the relative clause is not. The resulting interpretation is similar to a free relative: *whoever* kills the dragon will inherit the kingdom. In other words, it is the content of the relative clause that entails the content of the VP rather than the entity itself. This is also supported by a modified example in (25), where the content of the two relative clauses are what entail the content of the respective VPs, and there is no specific entities that the speaker has in mind.

(25) That hero WHO KILLS THE DRAGON will become the king, and that hero WHO FINDS THE DRAGON will become the next king.

Combining the two intuitions, the two dimensions in which definite expressions differ are formalized as follows. The deictic and non-deictic difference is encoded by the presence and the absence of an at-issue linker restriction. Demonstrative pronouns and demonstrative descriptions carry a linker restriction that definite pronouns and description do not. The pronominal vs. descriptive distinction is made in the content carried in the presupposition: pronominal expressions presuppose ϕ-features while descriptive expressions presuppose NP restrictions. The proposed denotations are shown in (26).

(26) a. $[\![\text{it}_i]\!]^g = \iota x{:}\phi(x).x{=}g(i)$
b. $[\![\text{the book}_i]\!]^g = \iota x{:}\text{book}(x).x{=}g(i)$
c. $[\![\text{that}]\!]^g = \lambda y.\iota x{:}\phi(x).R(x,y)$
d. $[\![\text{that book}]\!]^g\ \lambda y.\iota x{:}\text{book}(x).R(x,y)$

The main novelties of the current proposal is that non-deictic pronouns and descriptions are analyzed against the assignment function and simply returns the entity that carries the given index, which could also be abstracted later in the derivation for quantificational binding. The contribution of the ϕ and the NP information are presuppositions added to the entity. Analyzed this way, the pronoun does not differ from common assumptions. What is different is that a definite description has the same exact denotation except with an NP presupposition rather than a ϕ presupposition.

The deictic expressions, however, do not simply return the entity from an assignment function, and instead takes an additional argument y and returns the unique entity that stands in some relevant relation R with y. For example, a deictic use of the pronominal *that* would take a location variable for y and return the unique entity x such that the 'located-at' relation holds between x and y. For *that* hosting a relative clause such as *that which rolls*, y would have to be a clausal argument, with R denoting a 'defined-by' relation. While I leave the possibilities of y and R open here, it is possible to constrain them further as in Ahn (2022). There might also be language-specific constraints for which kinds of relations are denoted by which demonstratives: not every language allows deictic demonstratives to host relative clauses, restricting them for only deictic reference (Ahn, 2017). Yu (2023) argues that Mandarin demonstratives should also be able to take prepositions and names as arguments in addition to locations and clausal arguments. How the parameters of deictic demonstratives are further constrained is left for future investigation.

I elaborate further on the idea of a definite description carrying NP presupposition. Generally,

definite descriptions are analyzed as carrying uniqueness and/or existence presuppositions (cf. Coppock and Beaver (2015) for an analysis of English *the* as lacking an existence presupposition). Gutzmann and McCready (2014) argue instead that the contribution of the NP and the gender content should be located in the use-conditional dimension, where they simply require the referent to meet the descriptive information. Thus, in famous misdescription contexts as in (27) from Donnellan (1966) where the speaker mistakes someone for drinking a martini, the NP content does not affect the propositional content. Instead, all it does is check whether the entity returned by the definite description meets that description at the user-conditional dimension.

(27) The man drinking a martini is tall. (Donnellan, 1966)

While the formal details differ, the argument in this paper is fully parallel to that of Gutzmann and McCready (2014). Instead of analyzing the misdescription in (27) as a presupposition failure, where the presupposition that is not met is the *existence* and the *uniqueness* of a man drinking a martini, I argue that the presupposition that is not met is that of the NP content: namely that the entity in question *is* a man drinking a martini. Describing this context as a case of an NP presupposition failure rather than a case of existence and uniqueness presupposition failure does not change the resulting interpretation. Moreover, analyzed this way, we have a full parallelism with the oddity that results when a speaker mistakenly uses a female pronoun for a given entity when the conversation participants are aware that the entity is male and uses masculine pronouns.

One important consequence of this analysis is that all definite expressions are seen as either anaphoric or deictic. There is, for example, no separate denotation for definite descriptions that are solely based on uniqueness, as there is in Schwarz (2009). For this, I adopt the intuition from the familiarity theory of definites as in Heim (1983) and Roberts (2003), assuming that definites always refer to something that is familiar to the conversation participants. Specifically following Roberts (2003), I assume that when familiarity is not met, uniqueness is implicated through conversational expectations, accounting for the use of definite expressions in non-familiar contexts (see Köpping (2020) for a more recent attempt to subsume uniqueness under familiarity).

4.1. Accounting for the differences

Despite the uniform analysis proposed and the many similarities observed above, the question remains as to why pronouns and definite descriptions differ so much. For example, we rarely see pronouns used attributively while definite descriptions are used attributively very frequently. Also, gender information, which seems conventionalized and grammaticalized, seems to be fundamentally different from NP information which is lexical and arbitrary.

While this distributional difference is real, they don't necessarily challenge the view that pronouns and definite descriptions are parallel in their underlying semantic structure. Note that under this analysis, pronouns and definite descriptions still do differ in the presupposition content: pronouns presuppose ϕ-information while definite descriptions presuppose NP information. I argue that this difference is sufficient to account for the distributional differences. Consider the first difference that definite descriptions seem to be used attributively much more often than

pronouns. Attributive uses of information are licensed when the information is helpful in disambiguating interpretation. It seems natural that an NP would be more helpful in disambiguation than gender, which can only divide the set of possible entities into a few classes depending on the language inventory. Moreover, attributive uses of pronouns are indeed possible, when gender is sufficiently informative. Consider for example the sentence in (28), where the gender information of the two pronouns are sufficient to distinguish the two guests in discussion.

(28) Every time I invite a man and a woman, he brings the flowers and she brings the wine.

Thus it seems more economical to assume that pronouns and definite descriptions are parallel in their semantic structure but the difference in the rate of attributive uses is due to the fact that NPs help identify the intended referent out of alternatives more readily than gender information.

The second difference is that gender information is much more conventionalized than lexically specified NPs. This difference is simply a reflection of the difference in the content, and thus not problematic for the analysis. However, analyzing pronouns and definite descriptions as only differing in the conventionalization rate of the presupposed content does result in an interesting prediction that pronouns are special definite descriptions that develop after definite descriptions. This prediction does not seem to be met on the surface given that many languages make use of pronouns and lack definite determiners. However, if we consider the fact that even in those languages bare nouns can be used to refer anaphorically to a familiar entity, the pattern does seem to hold. Across languages, anaphoric reference with nouns (with or without determiners) is possible, but not every language has pronouns that are morphologically independent from nouns. Many languages instead make use of demonstrative descriptions that contain lexical or conventionalized nouns such as *thing* and *human* (Ahn, 2019). Of course this is not necessarily claiming that pronouns always develop out of nouns through conventionalization. However, this seems to be compatible with the current state of many languages that do not have separate pronouns and instead a limited set of demonstrative descriptions with (conventionalized) nouns such as Korean, Japanese, and Turkish. For example, in Korean, a morphologically-complex expression that contains a demonstrative and the noun *ay* (‘kid’) phonologically reduced to a single syllable is often used like a pronoun in the informal register.

(29) *kyay*: *ku* (demonstrative ‘that’) + *ay* (NP, ‘kid’)
  a. Ecey kyay pwa-ss-ta.
  yesterday her see-PAST-DECL
  ‘I saw her yesterday.’

In Japanese, the pronouns make use of a demonstrative accompanied by a small set of nouns indicating people. For example, (30a) combines the demonstrative with a free morpheme *hito* (‘person’), while (30b) combines the demonstrative with a bound morpheme *itsu* meaning ‘guy’, which is not a free morpheme in the language.

(30) a. a/so-no hito
  DEM-GEN person
  ‘that person’
  b. ko/a/so-itsu
  DEM-guy
  ‘this/that guy’

Leaving aside the diachronical prediction of this analysis, what we can conclude is that the difference between gender information and NP information seems to be a language-specific development that can differ across languages. Some languages make use of animacy distinction but not gender distinction for their pronouns as in Thai or Mandarin.

5. Conclusion

In this paper, I have argued for a four-way distinction in definite expressions. While maintaining the intuitions of previous accounts that have considered pronouns, definite descriptions, and demonstratives in a uniform way, this analysis makes two important divergences. The first is in semantically distinguishing the mechanism in which deixis and anaphora arise. Deixis is realized through a separate linker that deictic expressions carry as additional arguments, while anaphora is realized through indexing. Pronouns are argued to be ambiguous between deictic and non-deictic types, which resolve a puzzle presented in Elbourne (2013). The second is in semantically equating the contribution made by gender information of pronouns and the NP information of descriptions. Both kinds of information are shown to be backgrounded and presupposed, with the ability of being prosodically stressed and highlighted for local accommodation. The final analysis places the NP and the gender information in the presupposition and the deictic linker argument in the restriction of an ι operator. I argue that the distributional differences – specifically where attributive uses of pronouns are much more restricted – are simply due to pragmatics of informativity rather than semantic differences.

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On the natural language metaphysics of amounts[1]

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Abstract. In DPs like *the amount of nuts you ate* or *the number of cooks you hired*, a quantity noun (*amount*, *number*) combines with an entity noun (*nuts*, *cooks*). Such *quantity DPs* are surprisingly flexible: they can saturate not only quantity predicates, like *be 50 grams* or *be three*, but also predicates of ordinary entities, like *eat* or *hire*. To explain this flexibility, Scontras (2017) takes quantity DPs to denote not primitive quantities like 50g or 3, but set theoretic constructs that somehow *contain* the entities described by the entity noun (e.g., nuts or cooks). We explore a choice point in developing this approach: the relevant set theoretic structures—we call them *rich amounts*—can be construed either as sets of entities, given by the entity noun's extension, or as properties, based on the entity noun's intension. We show that this choice constitutes a dilemma. The dilemma arises with reference to quantity DPs without modifiers (e.g., *the amount of nuts*) and quantity DPs with relativization from an intensional context (e.g., *the amount of nuts you want to eat*). Construing rich amounts as sets of entities yields a credible analysis of the former data, but not of the latter. Construing them as properties can capture the latter data, but requires auxiliary assumptions without independent support to accommodate the former. As the two choices exhaust the relevant analytical possibilities, the dilemma questions the utility of rich amounts for semantic composition.

Keywords: amounts, quantities, predication, *de dicto* readings, maximization.

1. Introduction

A DP with *amount of*, like (1), seems to refer to an amount. But what is an amount? More precisely, how should amounts be construed for the purposes of semantic composition in natural language? What is, in the sense of Bach (1986), the natural language metaphysics of amounts?

(1) the amount of nuts you ate

One answer identifies amounts with the abstract quantities that the natural sciences posit in studying the physical world, quantities like 50g, 30ml, or the cardinality 3 (see, e.g., de Boer 1995). However, Scontras (2017) suggests that this answer is called into question by the distribution of phrases like (1), and the truth conditions that they can give rise to. These phrases can participate in both *quantity predication* and *entity predication*: they can saturate quantity predicates, like *is 50 grams* in (2a), but also predicates of ordinary entities, like *ate* in (2b).

(2) a. [The amount of nuts you ate] is 50 grams.
b. I ate [the amount of nuts you ate].

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For the quantity predication in (2a), the assumption that the subject DP denotes an abstract quantity is entirely plausible. But the entity predication in (2b) is puzzling. Abstract quantities cannot be eaten, and, yet, the sentence in (2b) is felicitous. This is so in virtue of (2b) describing not the eating of an abstract entity, but the eating of concrete nuts. But if the DP in (1) refers to an abstract quantity, how can such a meaning emerge compositionally?

Scontras (2017) proposes that, for the purposes of semantic composition, amounts are not primitives of the sort assumed in the natural sciences, but set theoretic constructs that are built from, hence contain, instantiating ordinary entities. On this view, the amount denoted by (1) is constructed from instantiating pluralities of nuts. We will refer to any constructs that broadly fit this description as *rich amounts*, and use the term *lean amount* to refer to the primitive quantities posited in the natural sciences.

In this paper, we scrutinize Scontras' proposal, call it the *rich amount strategy*, by exploring a choice point in the construction of rich amounts. How exactly does the entity nominal, here *nuts*, enter into the construction of a rich amount? Should rich amounts be construed as *sets*, built from the entity nominal's extension, or as *properties*, based on the entity nominal's intension? We will demonstrate that the choice between these two elaborations of the rich amount strategy, call them the *set solution* and the *property solution*, constitutes a dilemma.

The dilemma arises with reference to quantity DPs that lack a relative clause or other modifier, such as (3a), and quantity DPs that feature relativization from an intensional context, like (3b). We will see that the set solution affords a theoretically parsimonious analysis of DPs like (3a), but that DPs like (3b) are beyond its reach. Conversely, while the property solution captures the interpretation of DPs like (3b), to capture data like (3a), it would have to be supplemented with auxiliary assumptions that presently lack independent support.

(3) a. the amount of nuts
b. the amount of ambrosia that you want to eat

The choice between a set construal and a property construal of rich amounts exhausts the space of relevant analytical options, and, therefore, our argument represents a challenge to the rich amount strategy at large.

We will present the set and the property solutions in the next two sections. Sections 4 and 5 will then present the two horns of the dilemma that the data in (3) give rise to. In a preliminary exploration of possible solutions to the dilemma, Section 6 discusses possible amendments to the property solution, and Section 7 concludes.

Before proceeding, it will be useful to comment on the scope of the phenomenon to be discussed, and the type of data that we use as illustration. The noun *amount* is just one representative of a class of nouns, call them *quantity nouns*, that share the grammatical properties relevant for the present discussion. Other quantity nouns are, for example, *quantity*, *number*, *volume*, *range*, *share*, *allocation*, *quota*, *proportion*, and *ratio*. Such nouns have much the same syntactic distribution as *amount*. They can form DPs of a shape parallel to those in (1) and (3), and such DPs, which we will call *quantity DPs*, permit both quantity and entity predication. For the quantity noun *number*, this is illustrated in (4) and (5).

(4) the number of cooks you hired

(5) a. [The number of cooks you hired] is three.
b. I hired [the number of cooks you hired].

For practical purposes, we will in the following focus on quantity DPs with *number*. This choice allows us to steer clear of a layer of complexity that plays no role in our argument, viz. the possible underspecification of the dimension of measurement. Like most quantity nouns, *amount* can invoke a range of different dimensions. In (2a), the unit noun *grams* in the predicate *be 50 grams* sets for (1) the dimension to weight. But *be 50 grams* could be replaced felicitously with predicates like *be half a cup* or *be ten*, illustrating that (1) permits other dimensions, including volume and cardinality. For quantity DPs with *number*, in contrast, the quantity noun itself fixes the relevant dimension, viz. to cardinality. While not essential, this limitation is convenient, as focusing on cases with *number* will simplify our discussion.

2. Rich amounts as sets

Under the rich amount strategy, quantity DPs denote rich amounts. What are those? In one answer, rich amounts are *sets of ordinary entities*. More specifically, *amount-uniform* sets of entities, that is, sets of entities that share the same measurement in a given dimension. Under this view, the quantity DP in (4) denotes a set of pluralities of cooks that have the same cardinality, in the sense of having the same number of atomic parts. To illustrate, consider a possible world w_1, where you hired exactly three cooks. In w_1, (4) will have the denotation in (6): the set of all pluralities of cooks in w_1 that have cardinality 3.[2]

(6) $[\![\text{the number of cooks you hired}]\!]^{w_1} = \{x\colon [\![\text{cooks}]\!]^{w_1}(x) \wedge |x| = 3\}$

The sort of denotation in (6) enables an elegant uniform account of both quantity predication and entity predication. Consider again the pair of sentences in (5), repeated in (7). As stated in (8), we will assume that in (7), the quantity DP composes with the predicate via functional application.

(7) a. [The number of cooks you hired] is three.
b. I hired [the number of cooks you hired].

(8) a. $[\![[\text{the number of cooks you hired}] \text{ is three}]\!]^{w} =$
$[\![\text{be three}]\!]^{w}([\![\text{the number of cooks you hired}]\!]^{w})$
b. $[\![\text{I hired [the number of cooks you hired]}]\!]^{w} =$
$[\![\text{hired}]\!]^{w}([\![\text{the number of cooks you hired}]\!]^{w})(\text{I})$

Now take again the particular world w_1 from above, where you hired exactly 3 cooks. The quantity predication in (7a) intuitively yields truth in such a world. Assuming (6) and (8a), this can be captured by positing for *be three* the denotation in (9), a function that applies to a set A of ordinary entities and demands that A have a member of cardinality 3. Since you *hired* three

[2]The rich amount strategy is similar to the reconstruction of degrees as equivalence classes of individuals proposed in, e.g., Klein 1980 and Bale 2006. Applied to numbers, it is also reminiscent of the view that cardinal numbers can be reconstructed in terms of sets of sets with the same cardinality, a view found in work by Frege and Russell (see e.g. Hatcher 1990; Dummett 1991). Note, however, that the rich amount strategy only makes a claim about how amounts, including numbers, are construed as semantic values for the purposes of semantic composition. Thanks to Kevin Klement for help navigating the philosophy literature.

cooks in w_1, there will exist in w_1 at least one plurality of cooks with cardinality 3, hence the set in (6) must be non-empty. Given (8a), this means that (7a) is true in w_1, as desired.

(9) $[\![\text{be three}]\!]^w(A) \Leftrightarrow \exists x[x \in A \wedge |x| = 3]$

Turning now to the entity predication in (7b), this sentence is intuitively true in w_1 just in case I hired (at least) three cooks in w_1. Given (6) and (8b), this intuition can again be captured with appeal to a suitable denotation for the predicate. Suppose that the domain of the function denoted by *hire* contains not only ordinary individuals, but also rich amounts, here sets of ordinary entities. If so, what does it mean for *hire* to relate a set A to an individual? According to (10), such a predication again yields existential truth conditions, here that the individual hired some ordinary entity that is a member of A. For (7b) in world w_1, given (8b), the resulting condition is that I hired some member of the set in (6), hence that I hired (at least) three cooks. This correctly captures intuitions about sentence (7b) in world w_1: under the assumption that you hired exactly three cooks, (7b) is intuitively true just in case I hired (at least) three cooks.[3]

(10) $[\![\text{hire}]\!]^w(A)(y) \Leftrightarrow \exists x[x \in A \wedge [\![\text{hire}]\!]^w(x)(y)]$

Extrapolating from w_1, we can now state in (11) the general denotation for the quantity DP in (4). In any possible world w, (4) denotes the set of all pluralities of cooks in w that have cardinality m, where m is the exact number of cooks that you hired in w.

(11) $[\![\text{the number of cooks you hired}]\!]^w =$
$\{x: [\![\text{cooks}]\!]^w(x) \wedge |x| = \max\{n: \exists y[[\![\text{cooks}]\!]^w(y) \wedge [\![\text{hire}]\!]^w(y)(\text{you}) \wedge |y| = n]\}\}$

The function max in (11) maps a set of cardinalities to its largest member. In (11), max applies to a set that contains a cardinality n just in case n is the cardinality of some plurality of cooks that you hired in w, and it outputs the greatest member of this set—the exact number of cooks that you hired in w. This derives (6) as a special case: having hired three cooks in w_1, you hired in w_1 cook pluralities of cardinalities 1, 2, and 3, and the greatest of these cardinalities is 3.

In concert with the entries for *be three* and *hire* in (9) and (10), the denotation in (11) moreover supports the intuitively correct general truth conditions for (7a) and (7b). (7a) is predicted true in w just in case max returns the cardinality 3 in (11), hence just in case you hired exactly three cooks in w. And (7b) comes out true in w just in case I hired a plurality of n cooks in w, where n is the exact number of cooks that you hired in w. This amounts to the condition that I hired (at least) as many cooks in w as you did.

Apart from supporting intuitively adequate truth conditions for the sentences in (7), the denotation in (11) lends itself to a syntactically parsimonious DP internal composition. To show this, it will be useful to restate the entry in (11) as in (12).[4]

[3] In Scontras (2017), equivalences like (10) are due to "derived kind predication", a composition principle adapted from Chierchia (1998), who in turn builds on Carlson (1977). We instead portray such equivalencies as being guaranteed by predicates' lexical meaning. We do so for expositional convenience only. The arguments made below are independent of how exactly equivalencies like (10) are derived.

[4] In (12), max applies to a set of number-uniform sets, rather than cardinalities, and references an ordering of such sets, where a set A counts as greater than a set B in virtue of the members of A having a greater cardinality than the members of B. Under this assumption, (12) is equivalent to (11). To illustrate, consider again w_1, where you hired exactly three cooks. When $w = w_1$, max applies to a set containing three sets, viz. for each cardinality $n \in \{1, 2, 3\}$, the set of cook pluralities of cardinality n. Among those three sets, the set of cook pluralities of cardinality 3

(12) $[\![\text{the number of cooks you hired}]\!]^w =$
$\max(\{\{x\colon [\![\text{cooks}]\!]^w(x) \wedge |x| = n\}\colon \exists y[[\![\text{cooks}]\!]^w(y) \wedge [\![\text{hired}]\!]^w(y)(\text{you}) \wedge |y| = n]\})$

Suppose now that (4) has the syntactic structure sketched in (13). We can then take the definite article *the* to denote the maximality operator max. Also, as stated in (14), the NP *number of cooks that you hired* can be taken to denote that set that max applies to in (12), so that *the* and the NP can compose via functional application.

(13) $[_{DP}$ the $[_{NP}$ $[_{NP}$ $[_{N}$ number] of cooks] $[_{CP}$ wh [you hired t]]]]

(14) $[\![\text{number of cooks you hired}]\!]^w =$
$\{\{x\colon [\![\text{cooks}]\!]^w(x) \wedge |x| = n\}\colon \exists y[[\![\text{cooks}]\!]^w(y) \wedge [\![\text{hired}]\!]^w(y)(\text{you}) \wedge |y| = n]\}$

With regard to the compositional derivation of the NP denotation, a natural possibility is that the NP *number of cooks* and the relative clause *you hired* also denote sets of sets, and that the two combine intersectively. Consider the denotations for the NP and the relative clause in (15).

(15) a. $[\![[_{NP}$ $[_{N}$ number] of cooks$]]\!]^w = \{A\colon \exists n[A = \{x\colon [\![\text{cooks}]\!]^w(x) \wedge |x| = n\}]\}$
b. $[\![[_{CP}$ wh [you hired t] $]]\!]^w = \{A\colon \exists y[y \in A \wedge [\![\text{hired}]\!]^w(y)(\text{you})]\}$

We can show that the intersection of the two sets in (15) yields the set in (14). First we attend to (15a). For any w, the family of sets in (15a) comprises all sets of number-uniform cook pluralities in w. In a rendition that more closely adheres to the notation in (14), this family of sets can also be described as in (16).

(16) $\{\{x\colon [\![\text{cooks}]\!]^w(x) \wedge |x| = n\}\colon n \text{ is a cardinality}\}$

Turning to the relative clause, (15b) equates its denotation in w with the family of sets which contain some element that you hired in w. Now, what does it take for a set S of pluralities to be in the intersection of the sets in (15a) and (15b)? By (15a), for some cardinality n, S must be the set of all cook pluralities in w of cardinality n; and moreover, by (15b), you must have hired in w one of S's members, that is, you must have hired in w a cook plurality of cardinality n. This transparently restates the membership condition for the NP denotation in (14). So we have succeeded in deriving this denotation from those in (15) through intersective composition.

To complete the compositional analysis of the quantity DP in (4), we observe that the equalities in (15) can be made to fall out from unexceptional assumptions about composition internal to the NP *number of cooks* and the relative clause *you hired*. (15a) is a straightforward consequence of the lexical entry for *number* in (17a), which assumes that its denotation applies to the set given by the entity nominal's extension, here the set of pluralities given by *cooks*. With regard to (15b), note that the entry for *hire* in (10) above in particular guarantees the equivalence in (17b). With this in mind, suppose that the variable that serves as the argument of *hire* in (15b) ranges over sets of pluralities. The abstraction triggered by the relative operator will then derive a set of sets of pluralities. In fact, given (17b), it will derive the intended target in (15b).

(17) a. $[\![\text{number}]\!]^w = \lambda B.\ \{A\colon \exists n[A = \{x\colon x \in B \wedge |x| = n\}]\}$
b. $\exists y[y \in A \wedge [\![\text{hired}]\!]^w(y)(\text{you})] \Leftrightarrow [\![\text{hired}]\!]^w(A)(\text{you})$

is greatest. So this is the set that max will output in (12) for $w = w_1$, deriving the special case in (6).

We conclude that for the data examined so far, the rich amount strategy as developed in the set solution has a certain utility. Construing rich amounts as amount-uniform sets of entities, it supports a natural account of the observation that quantity DPs can saturate both quantity predicates like *be three* and entity predicates like *hire*. Also, there is also a natural compositional path to the intended amount-uniform sets as the denotations of quantity DPs.

In this section, we largely traced the steps of Scontras (2017). While he does not spell out a denotation for quantity predicates, almost all the central assumptions we made are essentially his, setting aside inconsequential matters of notation and technical execution. We deviate from Scontras (2017) in one notable respect, though: Scontras does not construe rich amounts as sets of entities, but as *nominalized properties of entities*. While nominalization is irrelevant for the arguments to be presented below, the choice between sets of entities and properties of entities, the latter understood as functions from possible worlds to sets of entities, is important, and will be shown to lead to a dilemma. In the next section, we continue laying the groundwork for making this point, by reworking the analysis stated above, treating rich amounts as properties of entities.

3. Rich amounts as properties

The property solution construes rich amounts as properties of ordinary entities, understood as functions from possible worlds to sets of entities. With properties of entities taking the place of sets of entities, other assumptions made in the last section must be adjusted accordingly. But despite these adjustments, for the cases analyzed so far, the compositional derivation of meanings remains parallel to what we saw in the previous section.

We begin again by illustrating the proposal with reference to the particular world w_1 where you hired exactly three cooks. In w_1, the quantity DP in (4), repeated in (18), denotes the property of being three cooks, explicated as a function from worlds to sets of ordinary entities that maps any world w to the set of all cook pluralities in w that have cardinality 3.

(18) the number of cooks you hired

(19) $[\![\text{the number of cooks you hired}]\!]^{w_1} = \lambda v.\ \{x\colon [\![\text{cooks}]\!]^v(x) \wedge |x| = 3\}$

Generalizing from (19), the denotation of the quantity DP in (18) can be equated with the property of being n cooks, where n is the exact number of cooks that you hired in w. This can be stated as in (20), which minimally revises (11) in the last section. Note that for $w = w_1$, max in (20) will again output the cardinality 3, which derives the special case in (19), as intended.

(20) $[\![\text{the number of cooks you hired}]\!]^w =$
$\lambda v.\ \{x\colon [\![\text{cooks}]\!]^v(x) \wedge |x| = \max\{n\colon \exists y[[\![\text{cooks}]\!]^w(y) \wedge [\![\text{hire}]\!]^w(y)(\text{you}) \wedge |y| = n]\}\}$

Consider now again the quantity predication sentence in (7a) and the entity predication sentence in (7b), both repeated in (21). For these sentences, the denotation for the quantity DP in (20) can enter into a composition that yields the same truth conditions as those derived under the set solution in the last section. To achieve this result, it is sufficient to suitably adjust the entries for *be three* and *hire* stated above, in (9) and (10), respectively, as in (22).

(21) a. [The number of cooks you hired] is three.
b. I hired [the number of cooks you hired].

(22) a. $[\![\text{be three}]\!]^w(\alpha) \Leftrightarrow \exists x[x \in \alpha(w) \wedge |x| = 3]$
b. $[\![\text{hire}]\!]^w(\alpha)(y) \Leftrightarrow \exists x[x \in \alpha(w) \wedge [\![\text{hire}]\!]^w(x)(y)]$

According to these entries, the denotation of both predicates in a world w apply to a property α to yield truth conditions that quantify existentially over the set of pluralities that α outputs for w. In the composition for the sentences in (21), this set coincides with the set A referenced in the entries in (9) and (10) above.[5] Since the entries in (22) do not otherwise differ from those in (9) and (10) above, we can be sure that (20) and the entries in (22) correctly reproduce the truth conditions for the sentences in (21) that were derived under the set solution.

Moreover, the property denotation in (20) can be derived compositionally in a way that minimally revises the composition detailed for the corresponding set denotation in (12). To see that, we begin with the observation that, paralleling the reformulation of (11) as (12) in the last section, the denotation for (18) in (20) can be rewritten as in (23).[6]

(23) $[\![\text{the number of cooks you hired}]\!]^w =$
$\max(\{\lambda v.\ \{x: [\![\text{cooks}]\!]^v(x) \wedge |x| = n\}: \exists y[[\![\text{cooks}]\!]^w(y) \wedge [\![\text{hired}]\!]^w(y)(\text{you}) \wedge |y| = n]\})$

Suppose now again that (18) has the structure in (13), repeated in (24). We can continue to assume that the definite article denotes the maximality operator max. Correspondingly, as stated in (25), we can assume that in (23), it is the denotation in w of the NP *number of cooks that you hired* that provides the argument of max.

(24) $[_{DP}$ the $[_{NP}$ $[_{NP}$ $[_{N}$ number] of cooks] $[_{CP}$ wh [you hired t]]]]

(25) $[\![\text{number of cooks you hired}]\!]^w =$
$\{\lambda v.\ \{x: [\![\text{cooks}]\!]^v(x) \wedge |x| = n\}: \exists y[[\![\text{cooks}]\!]^w(y) \wedge [\![\text{hired}]\!]^w(y)(\text{you}) \wedge |y| = n]\}$

Furthermore, the denotation in (25) can be derived compositionally under natural assumptions, recapitulating steps taken in the last section with suitable adjustments. For the NP *number of cooks* and the relative clause *you hired*, we can now assume the denotations in (26a) and (26b):

(26) a. $[\![[_{NP}$ $[_{N}$ number] of cooks$]]\!]^w = \{\alpha: \exists n[\alpha = \lambda v.\ \{x: [\![\text{cooks}]\!]^v(x) \wedge |x| = n\}]\}$
b. $[\![[_{CP}$ wh [you hired t] $]]\!]^w = \{\alpha: \exists y[y \in \alpha(w) \wedge [\![\text{hired}]\!]^w(y)(\text{you})]\}$

According to (26a), we now take *number of cooks* to denote a family of number-uniform properties, viz. a family that contains for any cardinality n, the property of being n cooks. More in line with the notation in (25), this set could also be described as in (27).

[5]To illustrate, consider again the world w_1 where you hired exactly three cooks. In composing a truth value in w_1 for (21a) and (21b), A in (9) and (10) was equated with the set of all cook pluralities in w_1 of cardinality 3. Given (19), $\alpha(w_1)$ amounts to the very same set.

[6]This restatement again requires an adjusted understanding of max. This operator is now based on an ordering of number-uniform *properties*, that is, properties that for some given cardinality n, map any input world to a set of pluralities of cardinality n. We assume that for cardinalities m and n, the property of being m cooks counts as greater than the property of being n cooks in virtue of m being greater than n. The operator max in (23) is then to be understood as mapping a set of properties to a member that is greatest relative to this ordering.

(27) $\{\lambda v.\ \{x\colon [\![\text{cooks}]\!]^v(x) \wedge |x| = n\}\colon n \text{ is a cardinality}\}$

As for the relative clause *you hired*, (26b) equates its denotation in a world w with the family of all properties α such that in w you hired a member of the set α(w). What does it take for a property to be in the intersection of the two sets in (26)? By (26a), for some cardinality n, the property must be the property of being n cooks; and by (26b), you must have hired one of the members that the property determines for w, that is, you must have hired a cook plurality in w of cardinality n. Since this amounts to the membership condition for the set of properties in (25), we have succeeded in deriving (25) through intersective composition.

Finally, the denotations in (26) are themselves subject to unexceptional compositional derivations. The denotation in (26a) can be derived by assigning *number* the entry in (28a). According to this entry for *number*, its denotation applies to the property given by the entity nominal's intension, here the intension of *cooks*. As for (26b), the entry for *hire* in (22b) guarantees the particular equivalence in (28b). Given this equivalence, (26b) falls out compositionally if relativization is assumed to leave a trace ranging over properties, and therefore to also result in abstraction over properties.

(28) a. $[\![\text{number}]\!]^w = \lambda\beta.\ \{\alpha\colon \exists n[\alpha = \lambda v.\ \{x\colon x \in \beta(v) \wedge |x| = n\}]\}$

b. $\exists y[y \in \alpha(w) \wedge [\![\text{hired}]\!]^w(y)(\text{you})] \Leftrightarrow [\![\text{hired}]\!]^w(\alpha)(\text{you})$

This completes our introduction of two possible elaborations of the rich amount strategy—the set solution and the property solution. We have seen that both solutions can capture the limited inventory of examples that we have focused on so far. But we should now ask how each of these solution fares when evaluated against a broader set of data. As announced before, we will see that the choice between the two solutions leads to a dilemma. Section 4 will discuss the predicted interpretation of quantity DPs where the quantity noun appears without a relative clause or other modifier. We will see that such cases behave as expected under the set solution, whereas the property solution faces a threat of undergeneration. While this result may favor the set solution, the findings in Section 5 seem to remove the set solution from contention, by identifying an undergeneration problem for this solution when applied to quantity DPs that contain a relative clause with an intensional verb.

4. Bare quantity DPs: the property solution and undergeneration

Our discussion has so far focused on quantity DPs that contain an NP with a relative clause modifier. However, as the cases in (29) illustrate, quantity DPs need not feature such a relative clause or other NP modifier.

(29) a. the amount of nuts

b. the number of cooks

Like their modified cousins, *bare* quantity DPs can participate in quantity predication, as illustrated in (30).[7]

[7]In philosophy, interest in bare quantity DPs that describe numbers can be traced back to Frege's writings (e.g., Frege 1884: §57). Frege's work triggered discussion of bare quantity DPs with *number* in English, with a focus on quantity predication in cases like *The number of planets is eight* (see, e.g., Moltmann 2013).

(30) a. [The amount of nuts] is 50 grams.
b. [The number of cooks] is three.

To be fully felicitous, sentences such as those in (30) often require contexts of utterance that raise to salience a proper subset of the entity noun's extension: the sentences in (30) are most naturally understood as reporting on the weight of a contextually salient portion of nuts or the cardinality of a contextually salient plurality of cooks. This is expectedly required to allow for such sentences to be judged true in realistic circumstances, since no plausible scenario will allow for the totality of all nuts in the world to weigh 50g or the totality of cooks in the world to have the cardinality 3. As far as we can see, this tacit domain restriction does not play a role in our arguments below.

Apart from the expected pragmatic condition on the use of bare quantity DPs, bare quantity DPs are subject to a further restriction: when saturating entity predicates, as in (31), they invariably result in deviant sentences. This deviance does not seem to merely reflect a need for domain restriction or other contextual support. The problem, it seems, is not just that felicitous uses of the sentences in (31) require contexts that are hard to imagine out of the blue. Rather, the oddness of those sentences appears to be robustly intuited regardless of context.[8]

(31) a. # I ate [the amount of nuts].
b. # I hired [the number of cooks].

We will now evaluate how the set solution and the property solution apply to bare quantity DPs, focusing as before on DPs with *number* for exposition. We begin with the property solution. Without further additions, the property solution predicts bare quantity DPs to be deviant with both quantity and entity predicates. To see that this is the case, let us consider the expected syntactic structure for the quantity DP in (29b), sketched in (32). As it is developed in Section 3, the property solution assigns to the NP *number of cooks* the denotation in (33).

(32) $[_{DP}$ the $[_{NP}$ $[_{N}$ number] of cooks]]
(33) $[\![\text{number of cooks}]\!]^w = \{\lambda v.\ \{x: [\![\text{cooks}]\!]^v(x) \wedge |x| = n\} : n \text{ is a cardinality}\}$

For any world w, the NP denotation is the same set of number-uniform properties: the set of properties that contains for any cardinality n, the property of being n cooks. Evidently, for any two distinct cardinalities m and n, the property of being m cooks and the property of being n cooks are distinct. Therefore, since the set of cardinalities is infinite, so is the set of properties in (33). Given the assumed cardinality-based ordering of the properties in this set (see footnote 4), this means that none of its members counts as maximal. As a consequence, the denotation in (33) cannot be in the domain of the maximality operator max, as this operator cannot map (33) to any output. Since the property solution takes max to serve as the denotation of the definite article, this means that the structure in (32) turns out to be uninterpretable.

[8]Aligned with our data in (31), Scontras (2017) notes the oddness of (ia). He suggests that this oddness can be attributed to the maximizing semantics of the definite article and the concomitant need for domain restriction. However, this suggestion misses the fact that bare quantity DPs are routinely felicitous as arguments of quantity predicates. Paralleling the contrast between (31) and (30), (ia) clearly contrasts with, say, (ib). So accommodation of the requisite domain restriction is not in general hard enough to yield judgments of oddness. Given this, appeal to the need for domain restriction is insufficient to derive the oddness of cases like those in (ia) or (31).

(i) a. #John bought the amount of apples.
b. The amount of apples is 10 kilograms.

What emerges is that according to the property solution, bare quantity DPs, in virtue of being uninterpretable, should not be usable felicitously in any syntactic frame, regardless of whether they saturate a quantity predicate or entity predicate. This correctly predicts the oddness of the entity predication cases, but at the cost of wrongly excluding the quantity predication cases. Therefore, leaving the acceptability of quantity predication with bare quantity DPs unexplained, then, the property solution faces a threat of undergeneration.

Are there ways of meeting this challenge within the limits of a property solution, revising certain negotiable assumptions adopted in Section 3? We will postpone addressing this issue until Section 6. Instead, let us now turn to the set solution detailed on Section 2. We will see that the set solution can capture bare quantity DPs in quantity predication. To illustrate, (34) shows the denotation that the set solution assigns to the NP in (32).

(34) $[\![\text{number of cooks}]\!]^w = \{\{x\colon [\![\text{cooks}]\!]^w(x) \wedge |x| = n\}\colon n \text{ is a cardinality}\}$

Unlike the NP denotation under the property solution in (33), the denotation in (34) is world dependent. For any realistic possible world w with only a finite number of cooks, the set of number-uniform sets in (34) is finite as well. Specifically, for a world where the set of all cooks has cardinality n, the set in (34) will have n+1 members. To illustrate, consider again world w_1 with exactly three cooks, say c_1, c_2 and c_3. For $w = w_1$, the set in (34) will contain the singleton set containing the plurality consisting of all those three cooks, in (35a), the set containing all smaller pluralities consisting of any two atomic parts of that plurality, in (35b), and the set containing all three atomic cooks, in (35c). In addition, (34) will of course contain the set of all cook pluralities with cardinality 4, and likewise for any cardinality greater than 4. Since there are no cook pluralities of cardinality greater than 3 in w_1, all of these sets coincide with the empty set, in (35d).

(35) a. $\{ c_1 + c_2 + c_3 \}$
b. $\{ c_1 + c_2, c_2 + c_3, c_1 + c_3 \}$
c. $\{ c_1, c_2, c_3 \}$
d. $\varnothing$

Turning to the quantity DP in (32) as a whole, the set solution assigns to it the denotation in (36), the number-uniform set of pluralities that the maximality operator max outputs for (34).

(36) $[\![\text{the number of cooks}]\!]^w = \max(\{\{x\colon [\![\text{cooks}]\!]^w(x) \wedge |x| = n\}\colon n \text{ is a cardinality}\})$

To illustrate, let us again consider the case where $w = w_1$, for which (34) is the four-membered set whose elements are listed in (35). Relative to the cardinality-based ordering of number-uniform sets appealed to in Section 2, (35a) clearly counts as greater than both (35b) and (35c). But how does (35a) relate to the empty set in (35d)? Note that the empty set did not appear in the argument of max in the cases studied in Section 2, so this question did not arise there. However, elaborating on what we stated in Section 2, it seems natural enough to assume that every non-empty amount-uniform set of pluralities counts as greater than the empty set. If so, then for $w = w_1$, the singleton set (35a) is the greatest member of (34), and hence it is this singleton set that max will output in (36). Generalizing from this, we see that for any world w, the DP denotation in (36) is the singleton set that contains the plurality of *all cooks* in w.

Consider now again the entry for the quantity predicate *be three* assumed in Section 2, repeated in (37). According to (37), this predicate denotes the function that applies to a set of pluralities and returns truth just in case that set contains a plurality of cardinality 3.

(37) $[\![\text{be three}]\!]^w(A) \Leftrightarrow \exists x[x \in A \wedge |x| = 3]$

With reference to (37), we can now analyze the quantity predication sentence in (30b). Given (36), (37) ensures that this sentence is predicted to be true in w just in case the plurality of all cooks in w has cardinality 3. In other words, the set solution predicts (30b) to convey that there are exactly three cooks. This is intuitively correct, and in particular correctly renders (30b) true in w_1. We conclude, then, that the set solution succeeds in capturing quantity predication with bare quantity DPs.

What about the deviance of bare quantity DPs with entity predicates, as in (31b)? Does the set solution provide a reason for this deviance? Initially, it does not seem to, as the sentence is expected to be interpretable. Consider again the entry for *hire* assumed in Section 2, repeated in (38) from (10).

(38) $[\![\text{hire}]\!]^w(A)(y) \Leftrightarrow \exists x[x \in A \wedge [\![\text{hire}]\!]^w(x)(y)]$

According to this entry, the denotation of *hire* in w maps a set to truth just in case you hired some member of this set in w. Given this, (31b) is predicted to be true in w_1 just in case you hired the plurality in (35a). More generally, the sentence is predicted to be true in a world w just in case you hired in w the plurality of all cooks in w.[9]

To be sure, these truth conditions do not by themselves shed light on the deviance of (31b). In fact, it is not hard to find sentences that intuitively have those truth conditions, and yet are not judged deviant. Most obviously, the relevant meaning is judged to be expressed by sentence (39), which of course can be fully felicitous.

(39) I hired [the cooks].

However, we could speculate that it is actually the very existence of sentences like (39) that contributes to the oddness of (31b). Sentence (31b) might be deviant in virtue of expressing the same truth conditions that (39) expresses while being more complex than (39) in terms of syntactic structure. In other words, sentence (31b) might be odd in virtue of being *blocked*. More generally, we could speculate that entity predication with bare quantity DPs is blocked by equivalent entity prediction with syntactically simpler DPs, DPs that are simpler in virtue of lacking a quantity nominal like *number* or *amount*. If this speculation turned out correct, the set solution would not only capture the truth conditions of quantity predication sentences with bare quantity DPs like those in (30), but would at the same time derive the oddness of entity predication sentences with bare quantity DPs, like those in (31).[10]

[9]We reported in footnote 8 that Scontras (2017) attributes the oddness of the entity predication sentence in (i) to a failure of domain restriction. We now add that, more specifically, he suggests that "in the absence of context, which could establish a salient restriction on the domain, [(i)] asserts that John bought some apples that measure the maximal degree, that is, he bought the totality of apples." Even though Scontras portrays this as a prediction of his version of the property solution (which construes rich amounts as nominalized amount-uniform properties) it is actually a prediction of the set solution. Like the version discussed in Section 3, Scontras' version of the property solution predicts that *the amount of apples* fails to denote.

(i) #John bought the amount of apples.

[10]To be sure, to defend this proposal in earnest, one would have to explain why the quantity predication in (30b), repeated in (i), is not likewise blocked by the sentence in (ii). Such an explanation could perhaps capitalize on the observation reported in, e.g., Buccola and Spector (2016: fn. 9), that sentences of the form in (i) are not in general fully acceptable, and depending on their content, can come close to being outright unacceptable. Buccola and Spector report that for them (ii) is "only marginally natural", and that *The books on that table are three* (which

Hence, the behaviour of bare quantity DPs can potentially adjudicate between the set and property construal. Even though Scontras (2017) advanced a version of the property solution, only the set solution immediately captures the behaviour of bare quantity DPs in both quantity predication and entity predication. However, we will in the next section introduce the second horn of the dilemma announced at the outset. We will identify a problem that we think closes the door to the set solution as a proper elaboration of the rich amount strategy. In Section 6, this result will then lead us to take a second look at the property solution.

5. *De dicto* readings: the set solution and undergeneration

In this section, we will identify a challenge to the set solution presented in Section 2. To set the stage, we will first revisit the basic data that we focused on there. Consider again the quantity DP in (40) and the sentence in (41), once again repeated from (18) and (21a).

(40) the number of cooks you hired

(41) [The number of cooks you hired] is three.

We would now like to draw attention to the type of inference in (42), which features as its premise the quantity predication sentence in (41).

(42) [The number of cooks you hired] is three
There exist (at least) three cooks

Intuitively, this inference is valid, as (41) intuitively entails the existence of three cooks. This is in fact unsurprising under the set solution. We showed that, under this analysis, (41) is true just in case you hired exactly three cooks. Given these truth conditions, the inference is straightforwardly predicted to be valid. However, we would like to point out that the inference is predicted to be valid even without referencing those truth conditions in full. Specifically, given that the conclusion in (42) does not reference the content of the relative clause in the quantity DP, we can show that validity is expected regardless of the relative clause's content. More precisely, this holds as long as the relative clause is interpreted as restrictive, so that the set denoted by the NP after modification is a subset of the NP without the modifier. To prepare our case against the set solution, it will be useful to now spell out this point in some more detail.

To begin, recall that Section 2 assigned to (40) the interpreted syntactic structure sketched in (43), repeated from (13). The denotation given to the NP *number of cooks* contained in this structure, a family of sets, is repeated in (44) from (34). Also, recall again that Section 2 assigned the predicate *be three* the denotation in (45), repeated from (9).

(43) $[_{DP}$ the $[_{NP}$ $[_{NP}$ $[_{N}$ number] of cooks] $[_{CP}$ wh [you hired t]]]]

(44) $[\![\text{number of cooks}]\!]^w = \{\{x\colon [\![\text{cooks}]\!]^w(x) \wedge |x| = n\}\colon n \text{ is a cardinality}\}$

they mark as ??) is worse.
(i) [The number of cooks] is three.
(ii) The cooks are three.
For the moment, we will not scrutinize the blocking idea any further. However, we will return to the issue in Section 6, where we will see data that shed doubt on its viability.

(45) $[\![\text{be three}]\!]^w(A) \Leftrightarrow \exists x[x \in A \wedge |x| = 3]$

Let us now attend to the denotation of (43) as whole. In Section 2, the relative clause modifier was assumed to compose intersectively, hence restrictively. So modification by the relative clause in (43) yields an NP that in w denotes a subset of the set in (44). Further, the definite DP as a whole was taken to denote a member of the set denoted by NP. These assumptions ensure that the denotation of (43) in a world w will be a member of the family of sets in (44), hence will be a set of number-uniform cook pluralities in w. Therefore, given the existential meaning for *be three* in (45), the truth of (41) in w requires that the denotation of (43), hence the set of cook pluralities in w, contain a member with cardinality 3. It follows that there are at least three cooks in w, capturing the validity of the inference (42).

As announced above, the deduction just presented, while assuming that the modifying relative clause composes restrictively, does not otherwise make reference to the content of the relative clause. Hence the validity of inferences of the form in (42) is predicted regardless of the relative clause's content. We will now see, however, that this prediction is incorrect.

The quantity DP in (46) is like our running example (40) in that it features a modifying relative clause. The new feature in (46) is that relativization is from an intensional context, viz. from a dependent clause that serves as the complement of *want* (cf. Moltmann 2013). In some ways, the quantity DP in (46) is unexceptional. As illustrated in (47), (46) is like its simpler cousin (40) in that it can saturate both quantity predicates like *be three* and entity predicates like *hire*.

(46) the number of cooks you want to hire

(47) a. [The number of cooks you want to hire] is three.
b. I hired [the number of cooks you want to hire].

However, the quantity predication sentence (47a) differs from its counterpart in (41) with regard to intuitions about the inference in (48), parallel to (42). While (42) is unequivocally valid, the same is not true for (48), where sentence (47a) serves as the premise.

(48) [The number of cooks you want to hire] is three

There exist (at least) three cooks

Intuititively, the validity of (48) depends on how its premise, sentence (47a), is understood. In one possible reading, call it *de re*, (47a) entails the existence of a particular plurality of three actual cooks that you want to hire. Under this reading of the premise, the inference in (48) is valid. However, setting this *de re* reading aside, (47a) also permits a reading, call it *de dicto*, which does not come with any implications about actual cooks, hence renders (48) invalid. To confirm the existence of such a reading, it may help to imagine replacing *cooks* in (47a) with, say, *vampires*. Aligned with our claim about (48), it is clear that the resulting variant of (47a) could well be considered true by someone who at the same time adheres to the sensible view that there are no actual vampires at all, let alone three.

Sentence (47a) seems to inherit the ambiguity just described from an ambiguity of the quantity DP in (46). Intuitively, this quantity DP itself can be read as *de re* or as *de dicto*. What we just saw is that the *de dicto* reading is not captured by the set solution detailed in Section 2.

Stepping back, though, we should ask whether it is possible to derive such readings by revising

the assumptions in Section 2 while preserving the construal of rich amounts as sets of entities. Such a revised account would posit that the denotation of (46) in a world w is a set of pluralities of ordinary entities, but *not* a set of pluralities of *cooks* in w, and, hence, it is not drawn from the family of sets in (44). One attempt to pursue this option might posit that the denotation of (46) is instead a member of the family of sets in (49).

(49) $\{\{x: |x| = n\}: n \text{ is a cardinality}\}$

The non-empty sets in the family of sets in (49) partitions the set of *all pluralities* of ordinary entities, including both cooks and non-cooks. Hence the denotation of (46) would be, for some cardinality n, the set of all pluralities of that cardinality. The immediate benefit of this revision would be that, given the entry in (45), (47a) would no longer be predicated to entail that there exist at least three cooks, but merely that there exist three individuals. This would accommodate the intuition that (48) need not be valid.

However, the proposal that (46) denotes a member of (49) is not in fact a viable way of capturing intuitions about (48). One question is how such a denotation would arise compositionally. In particular, it is unclear on what grounds the denotation of the quantity DP in (46) might wind up not making any reference to the meaning of *cooks*. But we see a more decisive objection to the proposal that (46) denotes a member of (49). This proposal has unwanted consequences for the inference in (50).

(50) [The number of cooks you want to hire] is three
I hired [the number of cooks you want to hire]

I hired (at least) three cooks

The inference in (50) is intuited to be unambiguously valid. Given the denotations for *be three* in (45) and *hire* in (51), this should not be so if the quantity DP in (46) could denote a member of (49). If (46) had such a denotation, then the two premises in (50) would be *not* predicted to entail that there are three *cooks*. They should merely support the weaker conclusion that there are at least three *individuals* (that the speaker hired), who may or may not be actual cooks.

(51) $[\![\text{hire}]\!]^w(A)(y) \quad \Leftrightarrow \quad \exists x[x \in A \wedge [\![\text{hire}]\!]^w(x)(y)]$

We in fact do not see a principled development of the set solution that would reconcile intuitions about the inference in (48) with those about the inference in (50). We therefore conclude that quantity DPs with intensional relative clauses seem beyond the reach of the set solution.

So we now see in full the dilemma for the rich amount strategy that we announced at the outset. The option of construing rich amounts as sets is precluded by *de dicto* readings. At the same time, construing rich amounts as properties leads to an undergeneration challenge with bare quantity DPs. How is this dilemma to be resolved? While we will not attempt a comprehensive and final answer to this question in this paper, we will briefly discuss one avenue of resolution, viz. the possibility of amending the property solution so as to fit all the data we have seen. We will propose in the next section that such an amendment can be devised, but that it requires stipulations that would remain to be derived from more principled and independently motivated assumptions.

6. Tailoring the property solution?

Having seen that the set solution fails to deliver *de dicto* readings, we now add that such readings can be accommodated under a property solution. For reasons of space, we will demonstrate this here in a somewhat compressed format. Consider again the quantity DP with *want* in (46), repeated here as (52). Given assumptions stated in Section 3, (52) is expected to allow for a denotation that, for any world w, can be stated as in (53).

(52) the number of cooks you want to hire

(53) $[\![\text{the number of cooks you want to hire}]\!]^w =$
$\lambda v.\ \{x: [\![\text{cooks}]\!]^v(x) \wedge |x| = \max\{n: \forall u[u \in \text{Acc}_w \rightarrow$
$\exists y[[\![\text{cooks}]\!]^u(y) \wedge [\![\text{hired}]\!]^u(y)(\text{you}) \wedge |y| = n]]\}$

Encoding content contributed by *want*, Acc in (53) maps any world w to the set of all your desire worlds in w, the worlds where what you want in w is realized. According to (53), the denotation of (52) in w is then the property of being m cooks, where m is the greatest cardinality n such that you hire (at least) n cooks in all of your desire worlds in w.

With this in mind, we now return to the quantity predication sentence in (47a), repeated here as (54). We noted that in the reading of this sentence that we are interested in, its *de dicto* reading, the sentence does not intuitively entail that there exist three cooks.

(54) [The number of cooks you want to hire] is three.

Now, we *would* derive this unwanted existence inference if we insisted on the entry for *be three* assumed in Section 3, repeated in (55a) from (22a). This is so because the truth conditions derived would still wind up quantifying existentially over a set of pluralities of cooks *in the world of evaluation w*. However, the unwanted existence inference can be eliminated with a suitable revision of the entry for *be three*. Specifically, the inference is removed if the condition "$x \in \alpha(w)$" in (55a) is replaced with the weaker condition "$\exists v[x \in \alpha(v)]$", as in (55b).

(55) a. $[\![\text{be three}]\!]^w(\alpha) \Leftrightarrow \exists x[x \in \alpha(w) \wedge |x| = 3]$
b. $[\![\text{be three}]\!]^w(\alpha) \Leftrightarrow \exists x[\exists v[x \in \alpha(v)] \wedge |x| = 3]$

Given this replacement, the condition for truth in (55b) does not impose any condition on w specifically, and so allows for its input property to map w to the empty set. As a consequence, as desired, the resulting meaning for (54) will no longer entail that there are cooks, let alone three. At the same time, for an input property that is amount-uniform, this condition requires that this property be one that is based on cardinality 3. For (54), assuming (53), this amounts to the condition that the quantity DP denote the property of being three cooks. Hence, (54) is now predicted to have a reading that is true in w just in case the largest cardinality n such that you hire (at least) n cooks in all of your desire worlds in w is 3. We take it that these truth conditions correctly capture the *de dicto* reading of sentence (54).

Notably, replacing (55a) with (55b) does not have adverse effects for the analysis of quantity prediction in basic cases like (56), which repeats (41). The denotation that Section 3 derived for the quantity DP in (56) is repeated from (20) in (57). What does it take for (57) to map a given world v to a set that contains a plurality of cardinality 3? It must be the case that *in world*

w you hired exactly three cooks. Hence (56) is still predicted to entail that there are (at least) three cooks in w, so that the intuitive validity if the inference (42) continues to be captured.

(56) [The number of cooks you hired] is three.

(57) $[\![\text{the number of cooks you hired}]\!]^w =$
$\lambda v.\ \{x: [\![\text{cooks}]\!]^v(x) \wedge |x| = \max\{n: \exists z[[\![\text{cooks}]\!]^w(z) \wedge [\![\text{hire}]\!]^w(z)(\text{you}) \wedge |z| = n]\}\}$

Having seen that the property solution can accommodate *de dicto* readings, let us now revisit the undergeneration challenge for this approach from bare quantity DPs that we identified in Section 4. Consider again the bare quantity DP in (58), which repeats (29b). The expected denotation for the NP *number of cooks* under the property solution in Section 4 is repeated from (33) in (59). We noted in Section 4 that the set of properties in (59) lacks a greatest element, so that (58) is predicted to be uninterpretable. And we noted that this is problematic, since a quantity predication sentence like (60), repeated from (30b), is actually judged to be felicitous.

(58) the number of cooks

(59) $[\![\text{number of cooks}]\!]^w = \{\lambda v.\ \{x: [\![\text{cooks}]\!]^v(x) \wedge |x| = n\}: n \text{ is a cardinality}\}$

(60) [The number of cooks] is three.

We now acknowledge that, while this observation presents a challenge to the property solution as detailed in Section 4, it does not by itself exclude an implementation of the rich amounts strategy that construes rich amounts as properties. As one possibility, consider a conceivable denotation for (58) that can be stated as in (61).

(61) $[\![\text{the number of cooks}]\!]^w =$
$\max(\{\lambda v.\ \{x: [\![\text{cooks}]\!]^v(x) \wedge |x| = n\}: \exists x[[\![\text{cooks}]\!]^w(x) \wedge |x| = n]\})$

In (61), the argument of max is a set of properties which, for a given world w, includes the property of being n cooks only if there are (at least) n cooks in w, hence if the property maps w to a non-empty set. As long as the number of cooks in w is finite, this set *does* have a greatest element for max to output, and sentence (60) is correctly predicted to be true in w just in case there are exactly three cooks in w.

One question that remains is how the denotation in (61) might be derived compositionally. In an answer that sticks close to the assumptions in Section 3, the argument of max in (61) is the denotation of the NP sister of the definite article. In turn, that answer leads to the question of how the NP denotation could be derived compositionally. Again staying close to Section 3, one answer posits a covert predicate Δ, which, as stated in (62), denotes in a world w the set of all properties that map w to a non-empty set. Suppose that this covert predicate modifies the NP *number of cooks*. As stated in (63), given (59), intersective composition will then have the intended effect, deriving the argument of max in (61).

(62) $[\![\Delta]\!]^w = \{\alpha: \exists y[y \in \alpha(w)]\}$

(63) $[\![[_{NP}\ [_{NP}\ [_N \text{ number}]\ \text{of cooks}]\ \Delta]]\!]^w =$
$\{\lambda v.\ \{x: [\![\text{cooks}]\!]^v(x) \wedge |x| = n\}: \exists x[[\![\text{cooks}]\!]^w(x) \wedge |x| = n]\}$

What we just outlined is a possible resolution of the undergeneration challenge identified for the property solution in Section 3. Of course, this resolution relies on a premise that would remain to be motivated, viz. the assumption that a silent predicate like Δ is indeed made available by grammar. The proposal furthermore raises questions about the distribution of Δ. If modification by Δ were obligatory, then the intended *de dicto* reading for (54) above could no longer be derived, as the resulting truth conditions would carry as an unwanted additional entailment the entailment there are three cooks. In fact, since (54) does not seem to even *permit* a *de dicto* reading with such an additional existence entailment, modification by Δ in (54) would need not be somehow excluded.

Further questions about the distribution of Δ arise from the central observation reported in Section 4 that while bare quantity DPs permit quantity prediction, they do not permit entity predication. Consider again the deviant sentence in (64), which repeats (31b). As noted in Section 4, this deviance could be derived with reference to the NP denotation in (59), which would render (64) uninterpretable. However, such a derivation of the deviance of (64) requires that in this sentence, the NP *number of cooks* resists modification by Δ.

(64) # I hired [the number of cooks].

As long as it is assumed that the quantity predication sentence (56) permits modification by Δ in the quantity DP, it seems implausible that the presence of Δ in the same quantity DP in (64) is excluded for syntactic reasons. However, there is another possibility, already entertained in Section 4 in our evaluation of the set solution. On a parse of (64) with Δ modifying NP, the sentence would convey that I hired all the cooks. Given this, it is conceivable that such a parse is blocked by the equivalent and less complex sentence in (65), which repeats (39).

(65) I hired [the cooks].

However, this proposal is once again called into question by further data. An overt relative clause like *that there are* is expected to permit a meaning much like the meaning of Δ in (62). Therefore, given the hypothesis that modification by Δ in (64) is subject to blocking, we should expect the same to hold for the overt relative clause *that there are*. However, this prediction does not seem to be borne out. In clear contrast to (64), (66) seems to be felicitous, no less so than the other quantity DPs with relative clauses that we have presented in this paper.

(66) I hired [the number of cooks [that there are]].

In sum, the success of an analysis of bare quantity DPs that relies on a covert modifier like Δ depends on the availability of a satisfactory account of this predicate's distribution. Stepping back, to show that the property solution is viable in some form or other, it remains to be shown how this approach can capture the distribution of bare quantity DPs, reconciling the deviance of such DPs in entity predication with their felicitous uses in quantity predication, while at the same time accommodating quantity DPs with *de dicto* readings.

7. Conclusion

We have explored the prospects of the rich amount strategy as an analysis of quantity DPs. We found that this approach faces a dilemma, which arises from quantity DPs with *de dicto*

readings and bare quantity DPs. *De dicto* readings exclude a set construal of rich amounts, but bare quantity DPs introduce challenge for a property construal that remains to be resolved. We suggest that possible resolutions should be evaluated by comparison with an alternative approach to quantity DPs proposed in Alonso-Ovalle and Schwarz 2023, an approach where quantity predication and entity predication arise from different structures of DP, and the amount that enter semantic composition are the type of abstract *lean* quantities proposed in the natural sciences, rather than rich amounts.

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Protagonist-Mediated Perspective[1]

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Abstract. There are two main competing analyses of Free Indirect Discourse: bicontextual accounts, which posit two separate context parameters (Schlenker, 2004; Eckardt, 2014; Reboul et al., 2016), and quotation accounts (Maier, 2015, 2016, 2017b). In this paper, we show that the bicontextual approach is not powerful enough to explain the range of perspective-taking behavior in Free Indirect Discourse. We highlight overlooked data on how grammatically perspectival expressions like *come* are interpreted in Free Indirect Discourse, showing that these perspectival expressions can be anchored to any perspective that is accessible to the protagonist. To account for this data, the bicontextual account requires a significant enrichment: two separate assignment functions in addition to two context parameters. Formalizing quotation using a *store update model*, we argue that modifying the bicontextual account in this way makes the two competing accounts strikingly similar to each other.

Keywords: perspective, Free Indirect Discourse, context shift, quotation.

1. Introduction

Free Indirect Discourse (FID) is a mixed perspective environment: some elements are evaluated relative to the narrator's perspective, and others are evaluated relative to the perspective of a protagonist, or prominent character. Much of the existing work on the linguistics of FID focuses on accounting for its tense and person features (Doron, 1991; Schlenker, 2004; Sharvit, 2008; Egetenmeyer, 2020). Despite the fact that FID is a perspectival phenomenon, relatively little attention has been paid to how perspectival expressions are interpreted in FID.

Existing work agrees, for the most part, on the empirical facts about perspectival expressions in FID: they are interpreted relative to the protagonist (Doron, 1991; Reboul et al., 2016; Hinterwimmer, 2019). But perspectival expressions constitute a diverse class, encompassing epithets, expressives, predicates of personal taste, and deictic motion verbs. These various classes of expressions may encode perspective in their semantics in different ways. Whether current theories of FID predict protagonist-oriented readings depends on how each expression's reference to perspective is grammatically encoded.

In this paper, we explore the interpretation of perspectival expressions in FID in more depth. We show that perspectival expressions are subject to a looser restriction in FID than previously proposed. Rather than being obligatorily protagonist-oriented, their perspectival orientation is protagonist-mediated: they can only refer relative to perspectives accessible in the protagonist's (real or imagined) discourse context.

Throughout this paper, we use the perspectival motion verb *come* as an example perspectival expression. As we will argue, certain properties of perspectival motion verbs make them partic-

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ularly useful diagnostics: they are anaphoric (Barlew, 2015, 2017; Anderson, 2021), rather than indexical, and, due to a quirk of their lexical semantics, they receive non-speaker orientations fairly easily in ordinary discourse.

We probe the interpretation of *come* in FID contexts drawn from various literary sources, and present evidence that *come* can be anchored to some non-protagonist perspectives, including addressees of the protagonist and attitude holders. To explain these findings, we put forward a view of perspectival expressions in FID as obligatorily protagonist-mediated, rather than protagonist-oriented. We show that this falls out naturally from a quotation-based account of FID (Maier, 2015, 2016, 2017b), but can also be explained under a significantly enriched version of the bicontextual treatment (Schlenker, 2004; Eckardt, 2014; Reboul et al., 2016).

To aid comparison between the quotation-based account and the modified bicontextual account, we borrow a formalism from programming languages: store updates. We formalize the quotational account at a finer-grained level using a store update model of the discourse context to illustrate how the bicontextual account, once enriched to account for protagonist-mediated perspective, becomes very similar to the quotational account.

2. Free Indirect Discourse

Free Indirect Discourse is a mixed perspective discourse style. Certain linguistic expressions are interpreted with respect to the protagonist's perspective, while others are interpreted with respect to the narrator's perspective. This makes it different from both indirect speech, in which the content of a speaker's utterance is conveyed, but their wording is paraphrased by the speech reporter (1a), and from quotation, in which the speaker's utterance is conveyed through a faithful reporting of their words (1b).

(1) Mary: Later, I will go to the store.
   a. Mary said that she was going to go to the store later.
   b. Mary said, "Later, I will go to the store."

In Free Indirect Discourse, by contrast, the content and style of the protagonist's utterance is preserved, but not their exact wording. In (2), the speech report reflects Mary's voice, but third-person pronouns are used, and the tense/aspect of the verb differs from both the quoted and indirect versions.

(2) Later she would go to the store, Mary said.

Although FID originally emerged as a topic of interest in literary studies, its linguistic properties pose interesting challenges for theories of context-sensitivity and perspective. A number of competing analyses of the semantics of FID have emerged. In this section, we review the empirical properties of FID.

There is some debate over how to define FID on the basis of linguistic properties, rather than stylistic criteria, such as the authors who use it or the genres in which it appears. Fleischman (1990) lays out a three-part definition of FID as a kind of narration where (1) the features of direct speech (exclamatives, fragments, hesitations, etc) are reported (2) in the manner of indirect speech, (i.e. with third-person pronouns and shifted tense) (3) without the normal

structure of a speech report, such as quotation marks or embedding verbs.

However, subsequent work has highlighted the existence of multiple kinds of narration that meet these criteria, such as Viewpoint Shifting (Hinterwimmer, 2017) and Protagonist Projection (Holton, 1997; Stokke, 2013; Abrusán, 2021).[2]

We adopt four criteria for what constitutes FID: narrator-oriented tense and person, protagonist-oriented temporal adverbials, and non-embeddability. Previous work has also used perspectival expressions as a FID marker. However, since our goal is to revisit the assumptions that have been made about perspectival expressions, we defer their behavior to Section 4.

Narrator-oriented tense In FID, tense reports the temporal perspective of the narrator. In (3), the day being described is in the narrator's past, but the protagonist's future. The verb is past tense, indicating that tense is narrator-oriented.

(3) Tomorrow was Monday, Monday, the beginning of another school week! (Lawrence, 1920)

Protagonist-oriented temporal adverbials A striking feature of FID is the apparent conflict between tense and temporal adverbials. Future-oriented temporal adverbials can co-occur with the past tense, as in (3) above. This arises because tense is anchored to the narrator's *now*, but temporal adverbials refer relative to the *now* of the protagonist.

Narrator-oriented person The interpretation of person pronouns is a topic of some debate in work on FID. There is general consensus that the person features of pronouns are narrator-oriented: first person pronouns refer to the narrator, and the protagonist is generally referred to in the third person (Banfield, 1982; Schlenker, 2004; Maier, 2017a).[3] The protagonist may also be referred to with first-person pronouns if they are the same individual as the narrator (Schlenker, 2004), as in (4a). More rarely, the protagonist may be referred to in the second person (Fludernik, 1995; Maier, 2017b), as in (4b), where the last sentence is a FID report of Lotte's thought.

(4) a. The door slammed shut and I was standing outside the flat. What an idiot I had been! I had left the keys inside. (Eckardt, 2014)
b. I told Lotte about your good health. She smiled. You had obviously finally stopped smoking! Eckardt (2014)

The interpretation of gender features is more contentious. Doron (1991); Schlenker (1999, 2004) argue that gender features, like tense, are interpreted relative to the narrator's perspective. However, Sharvit (2008) provides examples that demonstrate that this is not always the case: the protagonist's beliefs about the gender of individuals also plays a role. Maier (2015, 2017b); Reboul et al. (2016); Delfitto et al. (2016) concur with Sharvit (2008)'s data, arguing that the

[2]Other terms in the literature include *substitutionary perception* (Fehr, 1938), *non-reflective/unreflective perception* (Banfield, 1982), *represented consciousness* (Brinton, 1980), and *narrated perception* (Fludernik, 1995).
[3]Banfield (1982) and some subsequent authors (Reboul et al., 2016) have claimed that first-person pronouns are only licit in FID when the narrator is the addressee of the protagonist. See Schlenker (2004) and Maier (2017a) for counter-examples.

gender features of pronouns are protagonist-oriented, while the person features are narrator-oriented.

Because this debate is ongoing, we rely only on person as an indicator of FID.

Matrix scope FID is a root-level phenomena: it always takes matrix scope. Doron (1991) shows that although FID passages can be followed by speech or attitude report parentheticals (5a), they cannot be embedded (5b).

(5) a. Tomorrow was Monday, Ursula thought.
b. *Ursula thought that tomorrow was Monday.

Furthermore, the attitude verbs that appear in these parentheticals are not limited to those that take CP complements (6), providing further evidence that they should not be treated as marking ordinary speech reports (Reinhart, 1983).

(6) What department did she want? Elizabeth interrupted. (Woolf, 1925: cited in Reinhart 1983)

Having spelled out the characteristics that we will use to identify FID, we turn to the interpretation of perspectival expressions.

3. Perspectival motion verbs

In this paper, we focus on the interpretation of one class of perspectival expressions: perspectival motion verbs like *come*. In this section, we illustrate the properties of these verbs and explain why they are a particularly useful diagnostic for understanding who can serve as the anchor for perspectival expressions in FID.

3.1. Anchoring

Perspectival motion verbs describe motion relative to the location of a perspective-holder. The verb *come* describes motion towards the perspective-holder, while the verb *go* describes motion away (Fillmore, 1966). In (7a), *come* can be used because the motion is to the location of the listener, who can serve as the perspective-holder. In (7b), on the other hand, there is no discourse-prominent individual in New York to serve as the perspective-holder, so *come* is infelicitous.

(7) *Context: Abby and Beth are talking to each other in Boston.*
a. Abby: I'm coming/#going to see you right now.
b. Abby: I'm #coming/going to New York right now.

The most common perspective-holder for *come* is the speaker, as is typical for perspectival expressions (Fillmore, 1966; Kuno and Kaburaki, 1977; Lasersohn, 2005; Potts, 2005, 2007; Harris and Potts, 2009). However, other perspective-holders can also anchor *come*. In (7a), the perspective-holder is the listener. In (8), *come* is anchored to an attitude-holder, Rishi's brother, who is the subject of *hope*.

(8) *Context: Rishi and Kate are talking in Boston. Rishi's brother lives in New York.*
Rishi: My brother is hoping that I'll come to New York soon.

In ordinary conversation, the perspective-holder of *come* is not fixed. It can be any sufficiently discourse-prominent individual (Anderson, 2021). This sets *come* apart from other perspectival expressions such expressives, epithets, and predicates of personal taste, which exhibit much more limited ability to anchor to non-speaker perspectives (Harris and Potts, 2009; Harris, 2012; Kaiser, 2015; Kaiser and Lee, 2017).

3.2. Anchoring relations

The examples above make use of one kind of **anchoring relation** between the perspective-holder and the motion path: the perspective-holder is located at the destination of motion, at either event-time or utterance-time. However, English *come* allows two other anchoring relations. First, it can be used to describe motion towards a home-base of the perspective-holder (Fillmore, 1966). For instance, since Sherlock Holmes is habitually associated with 22B Baker Street, Moriarty's motion towards Baker Street can be described using *come* in (9), even though Holmes and his addressee are not in London (and will not be there at event-time).

(9) *Context: Holmes and Watson are on the Cornish coast.*
Holmes: I instructed Mrs. Hudson to visit her cousin in the country, to protect her in case Moriarty comes to call at Baker Street in our absence.

Second, English *come* allows an accompaniment anchoring relation: it can be used to describe motion alongside the perspective-holder (Fillmore, 1966). This is shown in (10).

(10) Holmes: Watson, you are coming with me to Cornwall this weekend.

There is no perspective-holder at the destination of motion (Cornwall) at either event or utterance time, but the use of *come* is still felicitous.

It is important to note that under any analysis, the lexical semantics of *come* exclude its subject from serving as the perspective-holder if the event time motion towards perspective-holder anchoring relation is used. This is because the same person cannot both be in motion towards a location and already located there. This makes it particularly easy to set up non-speaker anchoring for *come*: if the speaker is the subject of *come* in an event time anchoring context, they cannot serve as the perspective-holder.

3.3. The semantics of perspectival motion verbs

Several competing analyses of the semantics of perspectival motion verbs have been proposed. Some previous work analyzes its perspectival component as indexical (Taylor, 1988; Oshima, 2006a, b; Sudo, 2018). In this view, the context parameter contains an additional field for a perspective-holder or set of perspective-holders.

More recent work has convincingly demonstrated that *come* is sensitive to discourse factors that do not affect indexicals (Barlew, 2017; Charnavel, 2018; Anderson, 2021). For instance,

in (11), the perspective-holder for *come* is first the listener, then the speaker. In (12), the perspective-holder co-varies with the quantifier.

(11) John will come to your house before he comes here. (Fillmore, 1966)

(12) Every mother believes that her wayward child is coming to Christmas dinner. (Barlew, 2015)

These examples argue in favor of analyses in which *come* is anaphoric to a discourse-given perspective, since indexicals do not shift under quantification. Anderson (2021) also presents examples where *come* shifts between perspective-holders within a clause, such as in (13).

(13) *Context: Nick and Carolyn are siblings. Nick lives in Texas, Carolyn lives in Massachusetts, and their parents live in Washington. Nick is in Texas talking to his friend.*
Nick: Carolyn says that our mom will come to Texas during bluebonnet season and come to Northampton during asparagus season.

We adopt a perspective-anaphoric treatment following Barlew (2017). In this treatment, *come* is anaphoric to a prominent perspective in the Common Ground, as shown in (14a).

(14) a. **Lexical semantics for *come***:
$[\![\text{come}]\!]^{w,g} = \lambda x.\lambda e.\text{MOVE}(e) \wedge \text{DEST}(e,x) \wedge x = \text{LOC}(g(p))$, where p is a perspective-holder, w is a possible world, and g is an assignment function.

In this account, p is a variable that is resolved anaphorically to a perspective-holder in the Common Ground by the assignment function.

We now return to FID and lay out the empirical evidence about how perspectival motion verbs behave in this environment.

4. Perspectival expressions in Free Indirect Discourse

Previous work has assumed that perspectival expressions in FID are obligatorily fixed to the perspective of the FID protagonist (Banfield, 1982; Schlenker, 1999, 2004). In this section, we revisit this assumption through the lens of the perspectival motion verb *come*, which, in ordinary speech, allows any discourse-prominent individual to serve as the perspective-holder. We present new data showing that in addition to the protagonist, there are several other kinds of acceptable perspectival anchors for *come* in FID.

4.1. Protagonists

Previous work on FID has assumed that perspectival expressions are obligatorily protagonist-oriented. Although we will show below that this is not always the case for perspectival motion verbs, it is common.

The protagonist can anchor *come* when they are located at the destination of motion at either utterance time or event time. Example (15) is a case of event-time protagonist anchoring.

(15) Harriet had begun to be sensible of his talking to her much more than he had been used to do, and of his having indeed quite a different manner towards her; a manner of kindness and sweetness!–Latterly she had been more and more aware of it. When they had been all walking together, he had so often come and walked by her, and talked so very delightfully!–He seemed to want to be acquainted with her. (Austen, 1816)

In this passage from *Emma*, the protagonist, Harriet, is currently located at Hartfield, but is reporting a motion event that occurred when she was at Donwell Abbey. Notice that the destination of motion, and therefore, the perspective, actually co-varies with the quantifier in this example: the destination of motion is wherever Harriet is at each moment.

Example (16) shows an instance of utterance-time protagonist anchoring. The perspective-holder is the protagonist, Elena, who is at Tuscany at utterance time, but was not at event time.

(16) Elena watched the cypress-tufted hills of Tuscany give way to the valley of the Arno. [...] Thirty years ago, in a different lifetime she had come here with Jeff, before they were married. And five years before that, by herself, when she had studied and taught in Europe. Those were vacations, pleasure trips, adventures. This was a pilgrimage, a quest. (Davies, 2008)

Example (17) illustrates either event-time anchoring or a homebase anchoring relation; in either case, the perspective-holder is the protagonist, Anne Elliot, who lives at Camden Place and is reflecting on a party that will be held there as she walks around Bath.

(17) Anne could do no more; but her heart prophesied some mischance to damp the perfection of her felicity. It could not be very lasting, however. Even if he did not come to Camden Place himself, it would be in her power to send an intelligible sentence by Captain Harville. (Austen, 1818)

These examples illustrate what is already well-known: the protagonist of FID can serve as the perspective-holder for *come*.

4.2. Addressees and speakers

Although many uses of *come* in FID are protagonist-oriented, not all are. There are many instances where *come* is oriented to the addressee of the protagonist, as in (18) below. In (18), the FID passage reports Lady Bruton's perspective, but *come* is anchored to Richard's perspective (the destination is his home).

(18) Richard turned to Lady Bruton, with his hat in his hand, and said, "We shall see you at our party to-night?" whereupon Lady Bruton resumed the magnificence which letter-writing had shattered. She might come; or she might not come. Clarissa had wonderful energy. Parties terrified Lady Bruton. But then, she was getting old. (Woolf, 1925)

Examples (19a) and (19b) show that the accompaniment relation is also available with addressee perspective-holders. In (19a), the FID protagonist is Lily, but the perspective-holder is Mr. Bankes, who has invited her to walk with him. This is an accompaniment relation because Lily will be in motion alongside Mr. Bankes, rather than in motion towards his location. In

(19b), the protagonist is Mrs. Ramsay, who is expressing the wish to accompany her addressees (Minta, Prue, and Paul) to the beach.

(19) a. So, Lily thought, it was probably an excuse of his for moving, for getting out of earshot, that made Mr. Bankes almost immediately say something about its being chilly and suggested taking a stroll. She would come, yes. (Woolf, 1927)

b. Instantly, for no reason at all, Mrs. Ramsay became like a girl of twenty, full of gaiety. A mood of revelry suddenly took possession of her. Of course they must go; of course they must go, she cried, laughing; and running down the last three or four steps quickly, she began turning from one to the other and laughing and drawing Minta's wrap round her and saying she only wished she could come too, and would they be very late, and had any of them got a watch? (Woolf, 1927)

These examples show that the protagonist's addressees can anchor *come* with various anchoring relations.

We note that in these examples, the protagonist is the subject of the motion verb; one might argue that addressees are licensed only when the protagonist's perspective is unavailable to license *come*. But this will not do, since the motion event could always be described in a way consistent with the protagonist's perspective, if another verb is used instead. If perspectival motion verbs were obligatorily protagonist-oriented in FID, we would expect the passages above to use *go* instead of *come*.

4.3. Attitude holders

Perspectival motion verbs in FID environments can also be anchored to attitude holders. For instance, (20a) contains two motion descriptions, both describing a trip from Mansfield, where Mrs. Norris is located, to Portsmouth, where Mrs. Price is located.

(20) a. [Mrs. Norris] proclaimed her thoughts. She must say that she had more than half a mind to go with the young people; it would be such an indulgence to her; she had not seen her poor dear sister Price for more than twenty years; and it would be a help to the young people in their journey to have her older head to manage for them; and she could not help thinking her poor dear sister Price would feel it very unkind of her not to come by such an opportunity. (Austen, 1814)

The first description uses *go*; presumably, Mrs. Norris is the perspective-holder and *come* is not licensed because her own motion is being described. The second motion description, which occurs inside an attitude report, uses *come*; it must be anchored to the perspective of Mrs. Price, the attitude holder, since Mrs. Norris is not a valid perspective-holder at utterance time (when she is in Mansfield) or event time (when she is in motion).

Example (21) shows another example of anchoring to an attitude holder. Emma, the protagonist, is at Hartfield, but the destination of motion is Abbey Mill Farm, the home of the Martins. Thus, the perspective-holder anchoring *come* must be the Martins, who issued the invitation.

(21) Emma, to dissipate some of the distress it occasioned, judged it best for [Harriet] to return Elizabeth Martin's visit. How that visit was to be acknowledged–what would be

> necessary– and what might be safest, had been a point of some doubtful consideration. Absolute neglect of the mother and sisters, when invited to come, would be ingratitude. It must not be: and yet the danger of a renewal of the acquaintance! (Austen, 1816)

We note that *come* is embedded here within a non-finite clause, an environment that usually does not allow indexical shift (Deal, 2020; Sundaresan, 2020); this is additional evidence that perspective shift for motion verbs is a grammatically distinct phenomenon.

Indeed, perspectival motion verbs can be anchored to attitude holders even when they are not syntactically embedded within the attitude report. In (22), the second instance of *come* is anchored to the speaker of the direct speech report that precedes it (Minta). The protagonist is Mrs. Ramsay, who is inside the house observing her guests through a window.

(22) There was some quality which she herself had not, some lustre, some richness, which attracted him, amused him, led him to make favourites of girls like Minta. They might cut his hair from him, plait him watch-chains, or interrupt him at his work, hailing him (she heard them), "Come along, Mr. Ramsay; it's our turn to beat them now," and out he came to play tennis. (Woolf, 1927)

These examples demonstrate that several kinds of attitude holders can anchor perspectival motion verbs even within FID. However, we note that in all the cases shown above, the attitude report is one that is re-reported by the protagonist within the FID passage.

4.4. Co-variation

There are also some rare cases of *come* co-varying in quantificational contexts within FID. Example (23) is one such case: here, the perspective-holder of *come* co-varies with the individuals that Clarissa wants to please. The destination of motion is each of their locations.

(23) How much she wanted it–that people should look pleased as she came in, Clarissa thought and turned and walked back towards Bond Street, annoyed, because it was silly to have other reasons for doing things. Much rather would she have been one of those people like Richard who did things for themselves. (Woolf, 1925)

This is a particularly valuable example because it is not a context that quantifies over speech or thought, which could introduce covert structure involving manipulation of context parameters.

4.5. The narrator is excluded

So far we have shown that other discourse-prominent individuals beyond the protagonist can anchor perspectival motion verbs in FID. Are there any potential perspective-holders who are excluded?

A key property of the perspective-holders in the examples we have shown is that they are *accessible* to the protagonist. The protagonist is aware of them, either as an addressee (18)-(19a), the subject of an attitude report that the protagonist is relaying (20a)-(22), or as an individual quantified over in a hypothetical context that the protagonist is mulling (23).

However, there is one key individual who cannot serve a perspective-holder within FID: the narrator of the FID passage. This is shown by the infelicity of *come* in (24a) below.

(24) a. Twelve years ago I had sat in my dreary London apartment, dreaming of Southern Italy, and now I was here. Oh how lovely it would be there! To feel the sun and taste the food! If only I could one day earn enough to go/#come there! So I had sighed then.

The narrator and the protagonist are the same individual, but have different utterance-time locations. Although the narrator is in Italy at utterance-time, *come* cannot be felicitously used to describe the protagonist's motion there. The narrator's perspective seems to be unavailable to anchor perspectival expressions within the FID passage.

This is striking because the narrator is discourse-prominent: nothing in the semantics of *come* seems to rule out (24a). In fact, *come* can be anchored to the narrator in a non-FID paraphrase, as in (25a):

(25) a. Twelve years ago I sat in my dreary London apartment, dreaming of Southern Italy, and now I was here. I'd thought it would be lovely to be there and feel and taste the food. I hoped for so long to earn enough to come here.

This suggests that the infelicity springs from violating some FID-specific condition, rather than from the semantics of *come*.

4.6. Summary

We have presented new data showing that *come* allows a wider range of perspectival anchoring than has been previously assumed for perspectival expressions in FID. We find that many non-protagonist individuals can serve as perspectival anchors, including addressees of the protagonist and subjects of attitude reports recounted by the protagonist. However, the licensing of *come* is still more restricted than in ordinary discourse: although the narrator is discourse-prominent, they cannot serve as the perspectival anchor for *come*.

5. Mediated perspective

Based on the evidence presented above, we propose that FID constrains the set of available perspectival anchors for *come* to individuals whose perspectives are accessible to the protagonist. We call this **Mediated Perspective**.

(26) Mediated Perspective: in FID, perspectival expressions can only be anchored to perspectives that are available to the protagonist in the protagonist's discourse context.

Both the bicontextual and quotational accounts treat FID as involving two utterance contexts: the narrator's matrix context and the protagonist's embedded speech or thought context. The accounts differ, however, in how they model these contexts.

Mediated Perspective stipulates that the set of licit perspective-holders comes only from the

embedded speech or thought context of the protagonist. This has ramifications for the structure that must be assumed in modeling the two contexts: the protagonist's context must be tracked in a form that preserves the set of accessible perspectives. In this section, we discuss what this means for these two competing theories of FID.

5.1. Bicontextual analysis

One main family of accounts of FID is the *bicontextual* analysis. The bicontextual analysis proposes that FID passages are evaluated with respect to two context parameters simultaneously. Tense and person features are controlled by the matrix context, while all other indexicals are controlled by the protagonist's speech or thought context (Schlenker, 2004; Eckardt, 2014; Reboul et al., 2016). We focus on Eckardt (2021)'s version of this account.

The central proposal is that in indirect speech, two context parameters are at play: the matrix context parameter C, which tracks the context of reporting speech event, and an embedded context parameter d, which tracks the reported context. In a FID context, these are respectively referred to as the narrator's and protagonist's contexts.

In this account, the lexical entry for each expression determines which context parameter it refers relative to. Some always refer relative to the matrix context C, such as tense features, while others can refer relative to the embedded context d, such as temporal adverbials.

A rigid indexical is an indexical that remains fixed to the matrix context even in an embedded context. For instance, when the English indexical *I* is used in a speech report, it refers relative to C and picks out the narrator, even if it occurs in the embedded clause. In (27a), both occurrences of *I* refer to Kate; although the second occurs within the embedded clause, it cannot be interpreted as referring to Smita, who is the speaker of the embedded context.

(27) a. Kate: I heard Smita say that I was tall.

Other expressions can refer relative to the embedded context of utterance. Eckardt (2021)'s example is *thank heavens*. When *thank heavens* is used in an unembedded context, as in (28a) it refers relative to the speaker; when it is used in the embedded context in (28b), it expresses that Anna, rather than the matrix speaker, is thankful.

(28) a. Thank heavens she was rich.
b. Thank heavens she was rich, Anna said.

Eckardt (2021) posits that *thank you* always refers to an embedded context, if available, and expresses that the internal speaker (protagonist) is thankful (29a).

(29) a. $[\![\text{ thank heavens }]\!] = \lambda p.\lambda w.\text{RELIEF}(sp(v_c), time(v_c), p, w)$
"added to any proposition p, states that the internal speaker is relieved about p" (Eckardt, 2021).

The interpretation in (28b) is straightforward under this treatment: the internal context variable v_c can be resolved to d, the embedded context of Anna's speech. In (28a), there is only one context parameter available (C); consequently, all context variables are resolved to it. This leads v_c to be instantiated with C, attributing relief to the speaker within C, who is the narrator.

Critically, the ability to shift some but not all expressions within Free Indirect Discourse rests on analyzing certain expressions as rigid indexicals, and others as shiftable. Rigid indexicals are unaffected by the embedded context; shiftable indexicals refer relative to an embedded context when it exists (as in FID).

Note that Eckardt (2021)'s account allows for quantification over contexts, which would lead shiftable indexicals to co-vary with the quantifier in some kinds of quantification, as in (30a):

(30) a. Every teacher$_i$ confirmed that luckily, her$_i$ students were reading a book. (Eckardt, 2021)

Here, each teacher serves as the speaker for a confirmation report, introducing an embedded context for every teacher. The expressive *luckily* then refers relative to each of these individual embedded contexts.

The final piece of Eckardt (2021)'s bicontextual account is the linking between the matrix and embedded contexts: she posits that matrix clauses of indirect speech reports serve to describe the embedded utterance context. This provides a temporal link between the matrix and embedded context.

A key feature of the bicontextual accounts is the reliance on context parameters to explain protagonist- versus narrator-oriented expressions in FID. A clear prediction is that only indexical expressions, more specifically, shiftable indexicals, should be affected by the presence of an embedded context, because it is this class of expressions that take their referent from the context parameter directly. Other classes of context-sensitive expressions, like anaphoric expressions, pick up their referent from the discourse context via the assignment function. Thus, their interpretation would not be affect by the presence of an embedded context parameter.

5.1.1. Mediated Perspective in the bicontextual account

The bicontextual account therefore makes a clear prediction about *come*: because it is anaphoric, its interpretation should not be changed within FID contexts. The set of available perspectives is determined by the discourse-prominence of various perspectives, not by the context parameter. Therefore, the presence of an embedded context parameter should have no effect on the licensing of *come*. As we have seen, however, *come* does behave differently in FID: even though the narrator is discourse-prominent, they cannot serve as the perspective-holder for *come*.

In order to capture Mediated Perspective, the bicontextual account would need a way to track which perspectives are accessible to the protagonist. The existing bicontextual account, however, tracks only the context parameter of the protagonist.

We are not the first to point out that FID affects expressions beyond indexicals. In fact, Schlenker (2004) points out that FID comes with a requirement that all content other than tense and person is read *de dicto* according to the protagonist. He achieves this for indexicals via the bicontextual approach. But anaphoric expressions will require something else, since they are sensitive to the discourse-prominence of individuals in the Common Ground, not the context parameter.

Similarly, Reboul et al. (2016); Delfitto et al. (2016) propose that FID is subject to a Maximize Shifting constraint, which requires all elements to shift to the protagonist's perspective when possible. However, if we interpret this constraint as governing anaphoric elements in addition to indexicals, it is too strong: it predicts obligatory protagonist-oriented readings of *come*, ruling out the other perspective-holders that we discussed in Section 4.

5.1.2. A modified bicontextual account

One solution would be to enrich the bicontextual account with access to the discourse context. In our modified bicontextual account, we posit two Common Grounds in addition to two context parameters in FID.

The matrix Common Ground perspective ranking determines who can serve as the protagonist for FID (as explored by Hinterwimmer (2019); Bimpikou (2020); Abrusán et al. (2021)), while the protagonist's Common Ground determines who can serve as a perspective-holder for expressions within the FID passage. The relationship between the two discourse contexts is asymmetrical. FID passages serve to update the protagonist's Common Ground as well as the matrix Common Ground, since the narrator is recounting the FID content in their own discourse context. Matrix utterances, on the other hand, only update the matrix Common Ground: the protagonist does not have access to the narrator's commentary.

This approach ensures that only protagonist-accessible perspectives are selected: perspectival expressions within FID refer relative to the protagonist's Common Ground. The embedded Common Ground does not contain the narrator, since the protagonist is unaware of them. This effectively rules out the narrator as a potential perspective-holder for *come* (and other perspectival expressions, both indexical and anaphoric), while allowing *come* to be anchored to any protagonist-accessible perspective.

5.2. Quotation analysis

A main competing account of FID pursues a quotation-based account. Maier analyzes FID using quotation and unquotation operations (Maier, 2015, 2016, 2017b), positing that the narrator is reporting the protagonist's (real or imagined) speech verbatim, but with certain elements selectively **unquoted**. Unquotation is a device for pausing verbatim quoting that is commonly used in journalistic reporting, as in (31) below.

(31) Sarah said she would have to "do it [herself] after all."

Here, the originally first-person reflexive has been unquoted so that it matches its antecedent.

Maier proposes that FID is quoted speech or thought of the protagonist, with tense and the person features unquoted by the narrator. In his analysis, the FID example in (5a) could be represented using the square brackets of unquotation as follows:

(32) a. Tomorrow [was] Monday, Lily thought.

All content outside of the brackets is interpreted as the protagonist's direct thought, while the

brackets represent the narrator's paraphrasing of the tense of the verb.

Maier argues that FID has a verbatim faithfulness requirement: the words used to report the protagonist's speech or thought are in their register, not that of the narrator. This falls out naturally under a quotational analysis, since, other than the unquoted tense and person features of pronouns, everything else within a FID passage represents the protagonist's own words.

Maier (2015) uses a two-dimensional analysis of quotation in which quotes have both a use and mention component (Geurts and Maier, 2005). The mixed quotation in (33) contributes two components of meaning: the assertion that Ann used the literal words "not mah cup o' tea" to refer to a property, and the assertion that she meant that property to apply to the music.

(33) Ann said that this music was "not mah cup o' tea." (Maier, 2015)

Formally, the use component is a property variable that ranges over semantic objects of the type corresponding to the syntactic category of the quoted material. A quotation operator takes a string of letters/phonemes and returns an expression referring to that string, represented with the corner brackets ⌜ ⌝. The truth-conditions for (33) are shown in (34).

(34) Ann used ⌜not mah cup o' tea⌝ to refer to property $P\wedge$ Ann said that this music was P.

Unquotation is used to substitute a linguistic expression of the narrator's for one within the quote. A quotation containing an unquotation is interpreted as a function that expects an argument of the type of the unquoted material. To demonstrate how quotation and unquotation work together in FID, consider the FID passage in (35).

(35) Mary was packing her bags. Tomorrow was her last day. Oh how happy she would be to finally walk out of here. To leave this godforsaken place once and for all. (Maier, 2017b)

We represent quotation with corner brackets and unquotation with square brackets. In the quotational analysis, (35) would have a quotation operator scoping over the last two sentences, with unquotation operators unquoting tense and pronouns, as shown in (36).

(36) Mary was packing her bags. ⌜ Tomorrow [was] [her] last day. Oh how happy [she] [would be] to finally walk out of here. To leave this godforsaken place once and for all.⌝

The truth-conditions of the first FID sentence are shown in (37).[4]

(37) [[Tomorrow was her last day]] = Mary uses ⌜ Tomorrow ... ... last day⌝ to refer to $P\wedge$ Mary thought P(was)(her).

[4]We have followed Maier (2015)'s semantics rather than Maier (2017b), which requires more notational overhead. In the later presentation, the semantics for (37) are:
[["Tomorrow [was] [her] last day"]] = $\exists e[\textsc{think}(e)\wedge\textsc{agent}(e)=x\wedge\textsc{time}(e)<\textsc{now}\wedge$
$\exists e'\sqsubset e, e''\sqsubset e[\textsc{form}(e)=\ulcorner\text{Tomorrow}\urcorner^\frown\textsc{form}(e')^\frown\textsc{form}(e'')^\frown\ulcorner\text{last day}\urcorner\wedge{}^\vee\textsc{content}(e')=||was||\wedge$
${}^\vee\textsc{content}(e'')=||her||]]$ where $^\frown$ denotes the concatenation of strings, and $^\vee$ is an operator that returns the extension of an intensional expression.

5.2.1. Mediated Perspective and the quotational account

In quotation-based accounts, FID passages are taken to be verbatim-faithful to the protagonist's thought or speech, except for select elements that are **unquoted** by the narrator (Maier, 2015, 2016, 2017b). This account naturally captures protagonist-mediated perspective, since perspectival expressions are predicted to be reported exactly how the protagonist used them.

However, our data does force the scope of the unquoting operator to be very narrow. In (36), we placed brackets around the entire verb, indicating that the entire verb was unquoted. However, in examples with *come*, like (38), this will not work: the perspectival anchoring of the verb must be quoted, while the tense and aspect of the verb must be unquoted.

(38) [She] [would come], yes. (Woolf, 1927)

Thus, in order to account for Mediated Perspective, the quotational account must allow unquoting at the featural level, as Maier (2015) proposes to explain Sharvit (2008)'s cases of pronouns with narrator-oriented number and protagonist-oriented gender marking.

5.3. Alternative Accounts of FID

More recently, Charnavel (2023) has proposed an alternative analysis of FID drawing on Sharvit (2008)'s indirect discourse approach to FID. Charnavel (2023) argues that FID is indirect discourse in the scope of a logophoric operator.

(39) $[[log\text{-}FID]]^{c,g}(w)(p)(t)(x) = 1$ iff for all world-time-individual-assignment quadruples $< w', t', x', g' >$ compatible with x's mental state in w at t (where x' is the individual in w' that x self-identifies as), $p(w')(t')(x')(g') = 1$. (Charnavel, 2023)

This explains why FID can contain exempt anaphors if they refer to the protagonist, as in (40), and also why anti-logophoric elements are blocked within FID.

(40) [pro$_i$ log-FID [That was one of the bonds between Sally and himself$_i$.]] (Charnavel, 2023)

Charnavel (2023)'s proposal neatly captures one aspect of the Mediated Perspective descriptive generalization: the logophoric pronoun would block *come* from referring relative to the narrator, since Charnavel (2020) shows that when *come* co-occurs with exempt anaphors, they must refer relative to the same perspective-holder:

(41) [Le fils de Claire]$_i$ mérite que le temps permette à son$_i$ propre fils de venir à Lyon.
'[Claire's son]$_i$ deserves the fact that the weather allows his$_i$ own son to come to Lyon.'
Inference: Claire's son is located in (or associated with) Lyon. (Charnavel, 2020)

However, the logophoric account of FID fails to account for the second aspect of Mediated Perspective for exactly this same reason: it predicts that *come* should be obligatorily protagonist-oriented in FID, since the anaphoric reference of *come* is predicted to be bound by the protagonist-referring logophoric pronoun.

To fully account for Mediated Perspective, the examples of non-protagonist-oriented uses of

come would need to be explained, for instance, by positing an intervening logophoric binding context. While this would be plausible for many of the attitude-holder cases, it is harder to accept in addressee-oriented cases such as (18), repeated as (42) below:

(42) Richard turned to Lady Bruton, with his hat in his hand, and said, "We shall see you at our party to-night?" whereupon Lady Bruton resumed the magnificence which letter-writing had shattered. She might come; or she might not come. Clarissa had wonderful energy. Parties terrified Lady Bruton. But then, she was getting old. (Woolf, 1925)

In this example, there is very little linguistic structure surrounding *come* that could support an intervening addressee-oriented logophoric binding context.

6. Shifting Discourse Contexts

We have presented evidence that perspectival motion verbs in FID are subject to Mediated Perspective: they can be anchored only to perspectives accessible to the protagonist. We have shown that this descriptive generalization is captured by quotation accounts of FID (Maier, 2015, 2016, 2017b), but argued that it presents challenges for competing accounts of FID, particularly, the bicontextual approach.

Bicontextual accounts posit two context parameters to explain why some elements in FID are protagonist-oriented and others are narrator-oriented. Since *come* is not indexical, it should not be affected by an additional context parameter. As we have shown, however, *come* does behave differently in FID compared to ordinary discourse: the narrator, though discourse-prominent, cannot serve as the perspective-holder. A stipulation that perspectival items are always protagonist-oriented (such as Schlenker (2004)'s de dicto requirement or Reboul et al. (2016); Delfitto et al. (2016)'s Maximize Shifting requirement) would be too strict, since *come* can be anchored to addressees and attitude holders in the protagonist's discourse context.

Above we suggested a way to salvage the bicontextual account by using two discourse contexts in addition to two context parameters. In this section, we present a formalization of this modified bicontextual account alongside the quotational account, in a common framework.

6.1. A store update treatment of assignment functions

The protagonist-mediated behavior of *come* in FID shows that FID affects anaphoric reference as well as indexical reference. One way to achieve this is to propose that there are two discourse contexts as well as two context parameters at play. We posit separate assignment functions for the protagonist and narrator, with an asymmetrical relationship: the narrator's assignment function can refer to entities tracked in the protagonist's Common Ground, but not vice versa.

We model this by adopting a *store update* model of assignment functions. We introduce an operator similar to the context shift operator posited in work on shifty indexicals (Schlenker, 2003; Anand and Nevins, 2004; Deal, 2017), but operating on assignment functions. To achieve the asymmetric relationship between the narrator and protagonist Common Grounds, we will need two versions of the operator: one to shift to the protagonist's discourse context (SWAP),

and one to shift and merge back to the narrator's (MERGE).

(43) a. $[[\text{SWAP}]] = \lambda(\langle c_1, g_1\rangle, \langle c_2, g_2\rangle).(\langle c_2, g_2\rangle, \langle c_1, g_1\rangle)$
b. $[[\text{MERGE}]] = \lambda(\langle c_1, g_1\rangle, \langle c_2, g_2\rangle).(\langle c_2, g_2 \oplus g_1\rangle, \langle c_1, g_1\rangle)$

SWAP takes two discourse contexts and switches between them, shifting between both context parameters and assignment functions. MERGE also switches between discourse contexts, but additionally, the discourse context it produces includes a merged assignment function: all assignments in g_2 are added to g_1. Alpha-renaming is used to avoid conflicts. By default, the interpretation function uses the first context in the tuple to evaluate all expressions.

A FID passage begins with a SWAP operation, moving the discourse context from that of the narrator to the protagonist, and ends with a MERGE operation, which merges any discourse referents introduced into the narrator's assignment function before changing back to the discourse context of the narrator. This achieves a general protagonist-oriented interpretation of FID. However, in FID, some elements remain fixed to the narrator's perspective: tense and person features. We propose that these features are wrapped within a MERGE and SWAP operator pair. An example is shown in (44).

(44) [[Her husband was coming tomorrow.]]$^{<C,G,c,g>}$
a. [SWAP MERGE her SWAP husband MERGE was SWAP coming tomorrow MERGE]

Our treatment makes predictions about the interpretation of discourse referents in FID beyond perspectival anchoring. In the analysis we sketch, discourse referents introduced within the FID passage should be available in the matrix discourse context, since the embedded assignment function is merged into the matrix assignment function. However, the protagonist should not be able to refer to discourse referents introduced by the narrator unless they are also available in the embedded discourse context.

This prediction seems to be borne out. In (45a), Peter Wimsey is introduced within the embedded discourse context in the italicized FID passage. He can then referred to pronominally in the matrix context, as in the continuation in (45b). This shows that discourse referents introduced by the protagonist can be referred to by the narrator.

(45) a. For a long moment, Harriet simply could not believe her eyes. *Peter Wimsey. Peter, of all people. Peter, who was supposed to be in Warsaw, planted placidly in the High as though he had grown there from the beginning.* (Sayers, 1935)
b. Wrapping up his conversation with the Master of Balliol, he turned to face her.

In example (46), by contrast, the italicized exclamation can only be interpreted from the narrator's matrix perspective, not as a continuation of the previous FID passage.

(46) Anna looked pale and worried. How I longed to know what she was thinking! Many years later I discovered that her brother had stolen a large portion of her father's funds around that time. *What a scoundrel he was!*

The store update model therefore accounts for the asymmetrical nature of reference in FID: the narrator's discourse context tracks the protagonist's discourse, but not the other way around. Mediated Perspective is one consequence of this asymmetry: within FID, *come* can only be licensed by perspectives prominent within the protagonist's discourse context.

The store update model thus captures Mediated Perspective in FID. One challenge, however, lies in the fact that tense is narrator-oriented, while the perspectival anchoring conditions on *come* are evaluated relative to the protagonist's discourse context. As in Maier's quotational account, we will need to allow SWAP and MERGE to operate at a fine-grained level: the SWAP back to the protagonist's perspective must come after tense is evaluated, but before the perspectival anchoring conditions on *come* are evaluated. We leave this syntactico-semantic interface puzzle for future work.

6.2. Unifying Approaches to FID

The store update model sketched above is one way of implementing an enriched bicontextual account. Rather than lexically specifying each expression to refer either to the matrix discourse context or the embedded discourse context, we have introduced operators that shift between pairs of context parameters and assignment functions. This provides access to two discourse contexts through the two assignment functions: the narrator's and the protagonist's. Our account is inspired by the context shift operators proposed for indexical shift, but provides a mechanism for switching back again to the matrix context.

Notice that the store update model looks similar to the quotational account of FID, in which interpretation is controlled by the use of quotation and unquotation operators. Another way to look at the store update model is as a formalization of quote and unquote: SWAP begins a quotation, while MERGE provides a way to unquote and return to the matrix discourse context.

The store update model therefore draws together the quotation and bicontextual accounts of FID: to account for the mediated behavior of perspectival motion verbs demonstrated above, both must involve manipulating assignment functions.

7. Misleading Quotation

The store update formalization of quotation also makes predictions about quotation outside of FID. In a quote, the matrix speaker reports an utterance from a prior context. Both the context parameter and the assignment function within a quote are those of the original speech context. After the quote, the quoter can refer back to entities introduced within the quote.

In (47), the quotation introduces Valerie Saintclair into both the embedded and matrix discourse contexts. The quoter can then refer pronominally to her outside of the quotation.

(47) Mrs. Oglander$_i$ said, "I had never seen Valerie Saintclair$_j$ before that fatal night." But she$_i$ was in fact her$_j$ mother!

Although the quoter can refer to discourse entities introduced by the quotee, the quotee cannot refer to discourse entities outside of the quote, unless they are also available within the embedded discourse context. Example (48) can only be felicitously uttered if Valerie Saintclair was in the original discourse context being quoted.

(48) Even though Valerie Saintclair$_i$ was in fact her$_j$ daughter, Mrs. Oglander$_j$ said, "I had never seen her$_i$ before that fatal night."

Otherwise, this would be misquotation: it would lead to the false belief that Mrs. Oglander had asserted that it was Valerie Saintclair who was unknown to her, rather than whoever Mrs. Oglander was really speaking about. The formalization we have sketched thus provides a way of predicting when quotations are and are not felicitous.

Although we model quotation as a shift back to the original speech context, discourse participants do not usually have direct access to the original context (they may not have been present). In these cases, quotation must involve a reconstruction of the original context, using both the existing Common Ground (especially in the case of mixed quotation) and world knowledge.

If the reconstructed context differs from the original context in a way that changes the interpretation of the quote, the quotation is infelicitous: the listener will be unable to interpretation, or will interpret it misleadingly. Consider the two ways of quoting (49) in (50).

Example (50a) is misleading because, in the absence of explicit information about the original speech location, the addressee borrows the location from matrix speech context to resolve the indexical *here*. By contrast, (50b) first updates the matrix discourse context with information about the quotee's utterance location. This allows the addressee to reconstruct the embedded context and correctly solve the referent of *here*.

(49) *Context: Sally Ride is being interviewed at NASA.*
Sally Ride: I did not come here to make history.

(50) *Context: Lisa Meedan is giving a speech about Sally Ride at Swarthmore.*
a. Lisa Meedan: Sally Ride said, "I did not come here to make history."
b. Lisa Meedan: Sally Ride said at NASA, "I did not come here to make history."

This approach echoes Eckardt (2014)'s proposal for FID, in which underspecified fields in the embedded context parameter are determined via anaphoric reference to the matrix context parameter. Thus, the store update model of quotation we have sketched could also be used to formalize the notion of misquotation.

8. Conclusion

We have presented new data about the interpretation of perspectival expressions in FID. Although perspectival expressions are commonly protagonist-oriented, we show that one perspectival expression, the motion verb *come*, can be anchored to other discourse-prominent individuals. However, its behavior is more restricted in FID than in ordinary discourse: although the narrator is discourse-prominent, they cannot serve as the perspective-holder for *come*.

We posit that *come* can only be anchored to perspectives accessible to the FID protagonist, a descriptive generalization we call Mediated Perspective. We show that this pattern of behavior is compatible with quotational accounts of FID, but is not easily captured by alternatives like the bicontextual approach.

We propose enriching the bicontextual account with two assignment functions in addition to two context parameters. We sketch a formalization using store updates, and show that in this framework, the bicontextual and quotational accounts become very similar. We also discuss

predictions that the store update model makes for reference in FID and in quotation more broadly.

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Inherently context-sensitive gradable adjectives[1]

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Abstract. In most analyses of languages that are argued to have degrees as semantic primitives (e.g. Cresswell, 1976; von Stechow, 1984), gradable adjectives (GAs) receive context-independent denotations. When evaluativity (i.e., norm-relatedness) arises, it is added to the meaning of GAs by a covert operator (e.g., *pos* in Cresswell 1976, von Stechow 1984; EVAL in Rett 2007, 2008) or a pragmatic process (Rett 2014). In this paper, I argue that Japanese takes the opposite route to evaluativity: Japanese GAs are inherently context-dependent, and evaluativity arises by default. Empirical evidence comes from 1) obligatory differential readings of measure phrases (MPs) occurring with positive forms of GAs and 2) evaluativity of equatives and degree questions involving GAs. In fact, cross-linguistically, the two phenomena, the unavailability of absolute MP readings occurring with a GA and evaluativity of that GA in equatives and degree questions, are observed to be related (Bierwisch, 1989; Winter, 2005; Krasikova, 2009; Sassoon, 2011; Breakstone, 2012; Bochnak, 2013), which motivated proposals that (some) relative GAs in English are inherently context-dependent (Sassoon, 2011; Breakstone, 2012). I demonstrate that all relative GAs in Japanese exhibit this link and motivate their inherently context-dependent denotations.

Keywords: evaluativity, measure phrases, degree semantics, Japanese

1. Introduction

Evaluativity (i.e., norm-relatedness (Bierwisch, 1989)) is an inference that a given degree exceeds the contextual standard. In analyses of languages that are argued to have degrees as primitives, i.e., Beck et al.'s (2009) + Degree Semantics Parameter languages,[2] gradable adjectives(GAs) receive context-independent denotations, and when evaluativity arises in positive constructions, equatives, and degree questions, it is contributed by a covert morpheme such as *pos* (Cresswell, 1976; von Stechow, 1984) and EVAL (Rett, 2007, 2008) (see Section 2.1) or derived pragmatically (Rett, 2014).

However, there is another analytical option, which is to say that (some) relative GAs[3] are inherently context-dependent. In fact, this line of approach has been pursued even for English (Breakstone, 2012; Sassoon, 2011), in light of the observation that relative GAs that disallow absolute MPs to occur with their positive forms (1a) are consistently evaluative in degree questions and equatives (1b) (Bierwisch, 1989; Winter, 2005; Krasikova, 2009; Sassoon, 2011; Breakstone, 2012; Bochnak, 2013).

(1) a. *3 feet short

b. #How short is the giant? #He's as short as Goliath. (Breakstone, 2012: 114 (5c))

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[2]See Bochnak et al. (2020) for arguments against such a binary view.

[3]See Rotstein and Winter (2004) and Kennedy and McNally (2005) for classes of GAs. Relative GAs refer to GAs whose standards are context-dependent (Kennedy and McNally, 2005).

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Breakstone (2012) summarizes this link as Bierwisch's observation (2): if a GA does not allow an MP to occur with its positive form, that GA is evaluative in equatives and degree questions.

(2) Bierwisch's observation (adapted from Breakstone, 2012: 114 (4))
*MP Adjective in Positive form ⇒ Adjective is evaluative in equatives and questions.

A similar link between MP compatibility and evaluativity is observed in Japanese. In fact, all relative GAs in Japanese[4] disallow absolute MPs to occur with their positive forms (3), and all of them are evaluative in equatives (4) and degree questions.

(3) *Context: Out of the blue*
#Biru A-wa 10m taka-i.
Building A-TOP 10m tall-NPST
intended: 'Building A is 10m tall.'

(4) Biru A-wa Biru B izyoo-ni
Building A-TOP Building B izyoo-ni
taka-i
big-NPST
'Building A is as tall as Building B.'
→ Building A and B are tall.

Based on these data, I will argue that all relative GAs in Japanese are inherently context-dependent. The idea of inherent context dependency in Japanese relative GAs has been proposed by Oda (2008), who builds on a suggestion in Beck et al. (2004). However, Oda's (2008) analysis does not connect the MP readings with evaluativity in equatives and degree questions (see Section 3.4). By identifying inherent context dependency of relative GAs as the unified source of the MP interpretations and wider distribution of evaluativity in Japanese, I connect the Japanese facts to the cross-linguistic literature on evaluavitity. In turn, my analysis sheds light on a novel analytical option for MP interpretations in English (Section 5.2).

2. Previous approaches to evaluativity

This section reviews sources of evaluativity identified in the previous literature. I focus on semantic approaches to evaluativity arising with relative GAs since they are the most relevant for the current purpose (See Rett (2014) for an analysis of evaluativity as an implicature).

2.1. Adding evaluativity

The standard denotations of relative GAs in degreeful languages like English are context-independent. An example of a relational denotation of a GA is given in (5). Constructions with relative GAs are thus expected to be non-evaluative by default, and evaluativity is added by some other means. For example, the evaluativity entailment in positive constructions (6) is attributed to the covert morpheme *pos* (7a) (Cresswell, 1976; von Stechow, 1984; Kennedy and McNally, 2005).

[4]Most of the literature on degree semantics in Japanese, including this paper, focuses on canonical adjectives (*kēyōshi*). I set aside another class called nominal adjectives (Nishiyama, 1999) (*kēyōdōshi*). Oshima et al. (2019) surveyed 200 canonical adjectives and nominal adjectives, respectively, and concluded that neither have a strong tendency to be absolute (i.e., minimum and/or maximum standard) predicates.

(5) $[\![\text{tall}]\!] = \lambda d.\ \lambda x.\ \text{Tall}(x) \geq d$ (6) Kim is tall.

(7) a. $[\![\text{pos}]\!] = \lambda G_{det}.\ \lambda x.\ \exists d[\text{standard}(d)(G)(C) \ \&\ G(d)(x)]$ (K&M, 2005:350 (13))
b. $[\![(6)]\!] = [\![\text{pos}]\!]([\![\text{tall}]\!])(\text{Kim}) = 1$ iff $\exists d[\text{standard}(d)([\![\text{tall}]\!])(C) \ \&\ \text{Tall}(\text{Kim}) \geq d]$

Rett (2007, 2008) points out that while *pos* contributes two things, evaluativity and existential closure over the degree argument of a GA, the former arises in constructions that do not require the latter, including in equatives and degree questions. She proposes to replace *pos* with another covert element EVAL, which only contributes evaluativity (8).

(8) $[\![\text{EVAL}_i]\!] = \lambda D_{dt}.\ \lambda d.\ D(d) \ \&\ d > s_i$ (Rett, 2007: 231 (9))

Occurrence of EVAL is unrestricted, so every degree construction has denotations with and without EVAL by default. However, EVAL is sometimes obligatory due to triviality or markedness. Evaluativity as a result of triviality is observed in positive constructions (9a). The non-evaluative denotations of positive constructions are trivial (9b), and therefore only the evaluative readings are allowed (9c).

(9) a. Amy is tall.
b. *Without EVAL: $\exists d[\text{Tall}(\text{Amy},d)]$
c. With EVAL: $\exists d[\text{Tall}(\text{Amy},d) \ \&\ d > s_{tall}]$ (Rett, 2007: 219 (27))

Evaluativity as a consequence of markedness is observed in equatives and degree questions involving a negative antonym GA. For example, without EVAL, the equative in (11a) is in mutual entailment with its positive counterpart (10a).[5] Being marked with respect to the positive counterpart, equatives with negative antonym GAs receive an obligatory evaluative reading involving EVAL (11c).

(10) a. Amy is as tall as Betty. (Rett, 2007: 217 (18))
b. Without EVAL: $\{d_1\text{: Tall}(a,d_1)\} = \{d_2\text{:Tall}(b,d_2)\}$
c. With EVAL: $\{d_1\text{: Tall}(a,d_1) \ \&\ d_1 > s_{tall}\} = \{d_2\text{:Tall}(b,d_2) \ \&\ d_2 > s_{tall}\}$

(11) a. Amy is as short as Betty. (Rett, 2007: 217 (19))
b. *Without EVAL: $\{d_1\text{: Short}(a,d_1)\} = \{d_2\text{:Short}(b,d_2)\}$
c. With EVAL: $\{d_1\text{: Short}(a,d_1) \ \&\ d_1 > s_{short}\} = \{d_2\text{:Short}(b,d_2) \ \&\ d_2 > s_{short}\}$

2.2. Bierwisch's (1989) observation and inherent context dependency

Recall from Section 1 that evaluativity of equatives and degree questions constructed with a given GA is linked to that GA's incompatibility with absolute MPs (Bierwisch, 1989; Winter, 2005; Krasikova, 2009; Sassoon, 2011; Breakstone, 2012; Bochnak, 2013), as summarized by Breakstone (2012) in (2). As Sassoon (2011) points out, in addition to negative antonym GAs (1) following the pattern in (2), there are also many antonym pairs in which both positive (12) and negative members exhibit the same pattern.

[5]This mutual entailment only holds between the 'exactly' readings and not the 'at least' readings of equatives. Rett (2007) argues that the 'exactly' reading is the denotation of an equative. Rett (2014), on the other hand, takes the 'at least' reading to be the semantic denotation and argues that the 'exactly' reading results from strengthening due to a pragmatic competition with a comparative.

(12) a. *20°warm b. ?How warm is the ice-cream?
c. ?This ice-cream is as warm as that one. (Sassoon, 2011: 532 (6),(9))

Proposals to account for Bierwisch's observation (2) tend to attribute evaluativity to the denotations of GAs themselves. I will review two such proposals for English.

2.2.1. Sassoon (2011)

Sassoon (2011) argues that Rett's EVAL account, which relies on pragmatic competition between positive and negative members of antonym pairs, cannot capture the cases in which both members are evaluative. Sassoon (2011) proposes that what MP-incompatible, evaluative GAs have in common regardless of their polarity is that their zero is relative. In contrast, MP-compatible GAs like *tall* are associated with scales with an absolute zero, or ratio scales. She argues that according to measurement theory, only ratio scales license absolute MPs. A property P's zero is absolute iff it is index-independent (13a) and corresponds to absence of the given property (13b), and relative otherwise, where the set of indices W_c represents the context set (Stalnaker, 1978).

(13) a. $\forall w_1,w_2 \in W_c[\text{Zero}(P, w_1)=\text{Zero}(P, w_2)]$ (adapted from Sassoon, 2011: 537 (18))
b. $\forall w \in W_c[\forall x \notin \text{Zero}(P, w) \rightarrow f(P, w)(x)>0]$ where $\text{Zero}(P,w) = \{x \in D_e: f(P, w)(x)=0\}$

According to Sassoon (2011), a relative zero need not but can equal the norm, i.e., the contextual standard of the kind specified by *pos*. When it does, the GA resembles minimum-standard GAs (Kennedy and McNally, 2005) in that a degree is considered to exceed the contextual standard merely by being on the scale, giving rise to evaluativity in equatives and degree questions as well as comparatives. One remaining question is what factors influence whether a relative zero does or does not equal the contextual standard, both empirically and analytically.

2.2.2. Inherently evaluative adjective denotation

Also aiming to account for Bierwisch's (1989) observation (2), Breakstone (2012) takes the idea of context-dependent GAs one step further and claims that all GAs are inherently evaluative.

(14) a. $[\![\text{tall}]\!]^c = \lambda d.\ \lambda x.\ \text{Height}(x) \geq d\ \&\ d>\text{standard}_c$
b. $[\![\text{short}]\!]^c = \lambda d.\ \lambda x.\ \text{Height}(x) \leq d\ \&\ d < \text{standard}_c$ (Breakstone, 2012: 116 (13))

In a sense, his proposal is a mirror image of Rett (2007, 2008). Lack of evaluativity is derived by an 'anti-evaluative' morpheme called the 'Standard Shifting Morpheme' (SSM) (15).

(15) $[\![\text{SSM Adj}]\!]^c = [\![\text{Adj}]\!]^{c_0}$ where context $c_0 \equiv c$, except that $\text{standard}_{c0}(\text{Adj})=0$ (tentative)
(Breakstone, 2012: 117 (14a))

This SSM is prohibited when its application would lead to triviality, trivial falsity, or contradiction.[6] For example, SSM cannot apply to positive forms because the result would be trivial.

[6]In addition, for positive but MP-incompatible relative GAs like *warm*, Breakstone (2012) speculates that they have an independent ban on SSM.

However, he eventually relaxes the denotation of SSM to allow the standard to be a salient degree (16).

(16) $[\![\text{SSM}_d\ \text{Adj}]\!]^c = [\![\text{Adj}]\!]^{c_d}$ where context $c_d \equiv c$, except that
$\text{standard}_{cd}(\text{Adj}) = d$: a salient degree (Breakstone, 2012: 121 (28))

This is necessary in order to account for the lack of evaluativity in comparatives with a negative antonym GA like *short*. For example, in (17)[7], the denotation without the SSM would be evaluative contrary to the empirical fact (17a), and the denotation with the SSM shifting the standard to absolute zero (15) would be contradiction (17b). The desired interpretation is derived by shifting the contextual standard to the salient degree contributed by the *than* clause (16), in this case Mary's height (17c).

(17) John is shorter than Mary. (Breakstone, 2012: 122 (32))

a. $\{d' | \text{height(J)} \leq d' \ \&\ d' < \text{std}_c\} \setminus \{d'' | \text{height(M)} \leq d'' \ \&\ d'' < \text{std}_c\} \neq \varnothing$

b. $\{d' | \text{height(J)} \leq d' \ \&\ d' < 0\} \setminus \{d'' | \text{height(M)} \leq d'' \ \&\ d'' < 0\} \neq \varnothing$

c. $\{d' | \text{height(J)} \leq d' \ \&\ d' < \text{height(M)}\} \setminus \{d'' | \text{height(M)} \leq d'' \ \&\ d'' < \text{height(M)}\} \neq \varnothing$

To explain why negative antonym GAs like *short* do not allow an MP to occur with their positive forms, he assumes that MPs have a precondition against vagueness (18).

(18) MP denotation $[\![\text{n units}]\!] = \lambda D_{dt}$. D is not vague. $|D| \geq n$
(Breakstone, 2012: 118 (20))
D is not vague if D is a total function on the domain of degrees, *Deg*

Even with this precondition against vagueness, with the relaxed definition of SSM in (16), Breakstone's system seems to wrongly predict that differential readings should be available for some instances of MPs occurring with positive forms of MP-compatible GAs like *tall*. This is because a salient degree is not always vague: in (19), SSM should be able to shift the standard to the height of 10m, which is salient in the context.

(19) *Context: Building B is 10m 50cm tall.* Building A is 10m tall. #Building B is 50cm tall.

Breakstone's underlying assumption seems to be that the 'salient degree' picked out by SSM can only be the absolute zero or the standard of comparison overtly contributed by a *than* phrase. However, it is not clear to me what definition of saliency can include these two cases and exclude a degree specified in the immediately preceding clause (19). In fact, in Japanese, making a degree salient in the preceding sentence licenses an otherwise anomalous *MP Adjective* sequence (3) to have a differential MP interpretation (20).

(20) *Context: As in (19)*
Biru A-wa 10m-da. Biru B-wa 50cm taka-i.
Building A-TOP 10m-COP Building B-TOP 50cm tall-NPST
'Building A is 10 m tall. Building B is 50cm taller.'

This suggests that, while seemingly unsuccessful for English, inherently context-dependent denotations of GAs may be the right approach for Japanese. While strictly speaking the gen-

[7] I have simplified Breakstone's analysis of comparatives. He assumes that the comparative morpheme *-er* takes, in addition to two predicates of degrees corresponding to the associate's and the standard's degrees, a variable over a generalized quantifier over degrees, which is existentially closed in the absence of an MP.

eralization in (2) does not hold in Japanese because *MP Adjective* sequences are not entirely ungrammatical, a slightly modified version in (21) captures the Japanese facts.

(21) Modified Bierwisch's observation
If *MP Adjective* in the positive form does not have an absolute MP reading, that adjective is evaluative in equatives and degree questions.

I will argue below that inherently context-dependent denotations of GAs straightforwardly capture both MP interpretations and distribution of evaluativity in Japanese.

3. Obligatory differential MP interpretation

3.1. Data

Japanese GAs uniformly disallow absolute interpretations of MPs (3 repeated as 22) (Snyder et al., 1995; Beck et al., 2004; Oda, 2008). This pattern is shared with languages such as Russian (Krasikova, 2009) and Spanish (Bosque 1999 cited in Schwarzschild, 2005).

(22) #Biru A-wa 10m taka-i
Building A-TOP 10m tall-NPST
intended: 'Building A is 10m tall.'

Where Japanese differs from other languages that disallow absolute MP interpretations is that, if there is a salient, precise degree to serve as the standard, *MP Adj* receives a differential interpretation rather than being ungrammatical (20 repeated as 23).

(23) *Context: Building B is 10m 50cm tall.*
Biru A-wa 10m-da. Biru B-wa 50cm taka-i.
Building A-TOP 10m-COP Building B-TOP 50cm tall-NPST
'Building A is 10 m tall. Building B is 50cm taller.'

3.2. Previous accounts

This section discusses previous approaches to the obligatory differential MP readings in Japanese (Hayashishita, 2007, 2009; Kubota, 2011; Sawada and Grano, 2011). What they have in common is that they maintain context-independent denotations of GAs and introduce the standard degree responsible for differential readings by a covert morpheme.

3.2.1. Hayashishita (2007, 2009): Differential *pos*

Hayashishita (2007, 2009) proposes that the *pos* morpheme in (24) is responsible for the differential MP readings. While he presents it as a variant of the *pos* morpheme proposed for positive constructions in English (7a), Hayashishita's version is inherently differential; in (24), d_2 corresponds to the gap between x's degree of G-ness and the standard degree.

(24) Hayashishita's *pos* morpheme
$[\![pos]\!] = \lambda d_2.\lambda G_{det}.\lambda x.\exists d_1[\text{standard}(d_1)(d_2)(G)(C) \wedge G(d_1)(x)]$
where standard$(d_1)(d_2)(G)(C)$ iff d_1 exceeds the standard of G-ness by d_2, given the comparison class C (Hayashishita, 2007: 96 (64))

Hayashishita uses his differential *pos* morpheme to account for evaluativity of equatives and degree questions (see Section 4.1) as well. While the analytical move to attribute differential MP interpretations and evaluativity to the same source is shared with my proposal, attributing them to *pos* in (24) faces issues that do not arise in my account. Both the denotation and distribution of Hayashishita's *pos* deviate from the original proposal for the English counterpart (von Stechow, 1984; Kennedy and McNally, 2005): the standard *pos* morpheme only contributes evaluativity and existential closure over degrees, and it only occurs in the absence of MPs and degree operators. Hayashishita leaves open the question of whether his version of *pos* works for English.

3.2.2. Kubota (2011), Sawada and Grano (2011): MPs requiring a lower bound

Unlike Hayashishita (2007, 2009), for Kubota (2011) and Sawada and Grano (2011), requirements of MPs themselves trigger their differential interpretations. The general idea shared between the two proposals is that an MP requires the denotation it combines with to denote a measure function[8] with a lower bound and that (coerced) comparatives are derived minimum-standard adjectives. I will review the implementation by Kubota (2011).[9]

Kubota (2011) argues that MPs are accompanied by a null degree head δ (25). The function stnd is shared with his denotation of *pos*, and it returns a contextually salient degree in the absence of an overt standard phrase (See Section 5.1 for further discussion on the nature of stnd). In (26a), repeated from (20), stnd would return the height of Building A.

(25) $[\![\delta]\!] = \lambda g_{ed}.\ \lambda d.\ \lambda x.\ g(x) - \text{stnd}(g) \geq d$ (Kubota, 2011: 8 (20))

(26) a. *Context: Building B is 10m 50cm tall.*
Biru A-wa 10m-da. Biru B-wa 50cm taka-i.
Building A-TOP 10m-COP Building B-TOP 50cm tall-NPST
'Building A is 10 m tall. Building B is 50cm taller.'

b. $[\![$ (26a) $]\!]$ = tall(Building B) - stnd(tall) $\geq$ 50 cm
(modelled on Kubota, 2011: 8 (22a))

By attributing differential readings of MPs to the requirements of a covert element that only occurs in presence of an MP (Kubota, 2011; Sawada and Grano, 2011), one must give up on unifying differential MP interpretations with evaluativity in equatives and degree questions, which do not allow modification by MPs. In fact, Kubota (2012) attributes the latter to overt functional elements in these constructions (see Section 4.2).

[8]Both Kubota (2011) and Sawada and Grano (2011) assume that GAs denote measure functions.
[9]For Sawada and Grano (2011), the requirement for a minimum standard is encoded in a covert Meas head (Svenonius and Kennedy, 2006), and in the absence of an overt standard phrase, a covert coercion operator is inserted below Meas to add a contextually salient degree as the minimum standard.

3.3. Analysis of obligatory differential MPs

I propose that all relative GAs in Japanese are inherently context-dependent (28): they take an extra argument d′, which is to be filled by the denotation of an accompanying covert degree variable that picks out a salient degree through assignment (28b).[10]

(28) a. $[\![$ taka- 'tall' $]\!]^{g,w} = \lambda d'.\ \lambda d.\ \lambda x.\ \textsc{tall}(x)(w) \geq d > d'$

b. $[\![\ d_{d,3}\ ]\!]^{g,w} = g(3)$

I take MPs to denote generalized quantifiers over degrees, or 'predicates of gaps' (Schwarzschild, 2005), and propose the denotations exemplified in (29). The use of the function CM as opposed to directly predicating D of 50cm reflects the idea that degrees do not necessarily correspond to units of measurements (e.g. Schwarzschild, 2020). Note also that the use of MIN(D) in the denotation achieves the same effect as Breakstone's (2012) precondition against vagueness (18) and Kubota's (2011) and Sawada and Grano's (2011) requirement for having a minimum standard, as MIN(D) would be undefined if D does not have a precise minimum element.

(29) $[\![50\text{cm}]\!]^{g,w} = \lambda D_{dt}.\ \textsc{cm}(|D|) \geq 50$ where $|D| = \textsc{max}(D) - \textsc{min}(D)$

Ignoring the contribution of the non-past tense, the meaning of (20), repeated as (30a), is derived in (30), where the MP is base-generated as a sister of the GA but QR-ed due to type mismatch. The final denotation (30e) says that the function CM returns the number 50 when it takes the set of degrees d that Building B is tall to and that is greater than the contextually salient degree g(3). In this case, g(3) corresponds to the height of the Building A, 10m, which was made salient in the previous sentence. g(3) must not be vague because it will correspond to MIN(D), which rules out a reading in which Building B is 50cm taller than, e.g., the presumed average height of buildings when it has not been made precise in the discourse.

(30) a. *Context: Building B is 10m 50cm tall.*
Biru A-wa 10m-da. Biru B-wa 50cm taka-i.
Building A-TOP 10m-COP Building B-TOP 50cm tall-NPST
'Building A is 10 m tall. Building B is 50cm taller.'

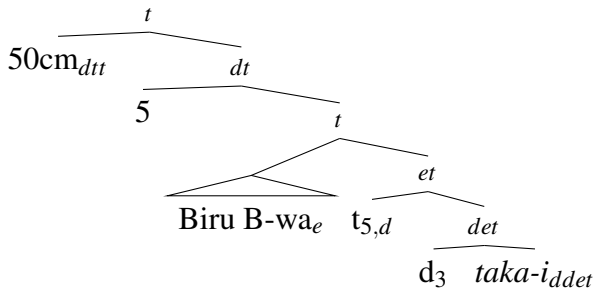
b. $[\![\ d_3$ taka-i $]\!]^{g,w} = \lambda d.\ \lambda x.\ \textsc{tall}(x)(w) \geq d > g(3)$

c. $[\![\ t_{5,d}\ d_3$ taka-i $]\!]^{g,w} = \lambda x.\ \textsc{tall}(x)(w) \geq g(5) > g(3)$

d. $[\![$ Biru B-wa $t_{5,d}\ d_3$ taka-i $]\!]^{g,w} = 1$ iff $\textsc{tall}(\text{Building B})(w) \geq g(5) > g(3)$

e. $[\![$ 50cm 5 Biru B-wa $t_{5,d}\ d_3$ taka-i $]\!]^{g,w} = 1$ iff $\textsc{cm}(|\lambda d.\ \textsc{tall}(\text{Building B})(w) \geq d > g(3)|) \geq 50$

[10] Strictly speaking, the context dependency comes not from the denotation in (28a) but from the accompanying pronoun (28b), which fills the first degree argument of (28a). I have chosen this implementation over a perhaps more straightforwardly contextually-dependent GA denotation in (27) because, as I demonstrate below, the standard degree corresponding to g(3) can be bound by two overt lexical items.
(27) $[\![$ taka-$_3$ 'tall' $]\!]^{g,w} = \lambda d.\ \lambda x.\ \textsc{tall}(x)(w) \geq d > g(3)$



In (30a), the standard of comparison can be made overt with a post-position, *yori*, as in (31).

(31) Biru B-wa Biru A yori 50cm taka-i
Building B-TOP Building A yori 50cm tall-NPST
'Building B is 50cm taller than Building A.'

I assume that *yori* comes with an index over measure functions, which picks out a salient measure function via assignment (32)[11](Hayashishita, 2009; Hohaus, 2015; Oda, 2020); in (31), it would be the measure function for height. In addition, the covert degree variable d_3 is bound by a lambda, and this argument slot is filled by the denotation of the *yori* phrase. The denotation of (31) in (33e) ends up being identical to (30e) because HEIGHT(Building A)(w) in (33e) is the denotation of g(3) in (30e).

(32) $[\![\text{yori}_{1,ed}]\!]^{g,w} = \lambda x.\ g(1,ed)(x)$ (based on Hohaus, 2015: 157 (339))

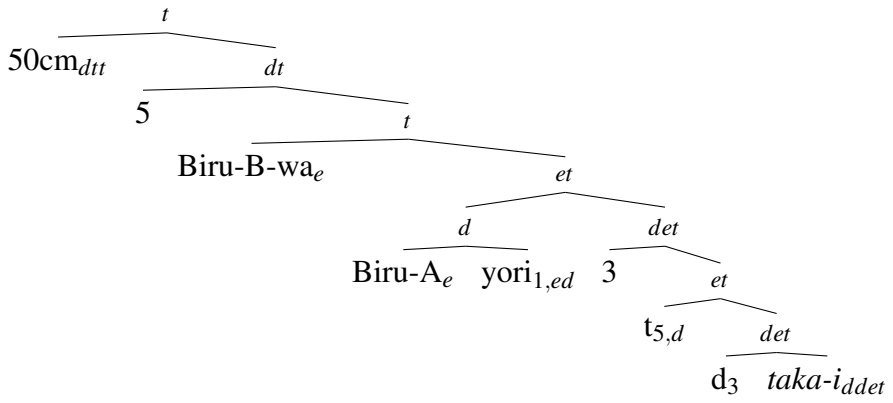
(33) a. $[\![3\ t_{5,d}\ d_3\ \text{taka-i}]\!]^{g,w} = \lambda d.\ \lambda x.\ \text{TALL}(x)(w) \geq g(5) > d$

b. $[\![\text{Biru A yori}]\!]^{g,w} = g(1,ed)(\text{Building A}) = \text{HEIGHT}(\text{Building A})(w)$

c. $[\![\text{Biru A yori } 3\ t_{5,d}\ d_3\ \text{taka-i}]\!]^{g,w} = \lambda x.\ \text{TALL}(x)(w) \geq g(5) > \text{HEIGHT}(\text{Building A})(w)$

d. $[\![5 \text{ Biru B-wa Biru A yori } 3\ t_{5,d}\ d_3\ \text{taka-i}]\!]^{g,w} = \lambda d.\ \text{TALL}(\text{Building B})(w) \geq d > \text{HEIGHT}(\text{Building A})(w)$

e. $[\![50\text{cm } 5 \text{ Biru B-wa Biru A yori } 3\ t_{5,d}\ d_3\ \text{taka-i}]\!]^{g,w} = 1$ iff $\text{CM}(|\lambda d.\ \text{TALL}(\text{Building B})(w) \geq d > \text{HEIGHT}(\text{Building A})(w)|) \geq 50$



[11]I assume, following Sudo (2015), that a seemingly clausal complement of *yori* is a relative clause.

3.4. Comparison with Oda (2008)

My proposal is not the first proposal for context-dependent, inherently differential denotations of GAs in Japanese. Such an idea has been put forth by Oda (2008), who adopts the denotation suggested by Beck et al. (2004) in (34a), where the degree argument d′ corresponds to the difference between the absolute degree of x and the contextual standard c. Taking MPs to denote a degree, she argues that (34a) correctly derives the differential MP reading of a sentence analogous to (30a), as in (34b).

(34) a. $[\![\textit{takai}]\!] = \lambda d'.\ \lambda x.\ \max(\lambda d.\text{tall}(d)(x)) = c + d'$ (Beck et al., 2004: 342 (e.n.15(ib)))

b. $[\![\text{(30a)}]\!]^{g,w} = 1$ iff $\max(\lambda d.\text{tall}(d)(\text{Building B})) = c + 50\text{cm}$

However, there is one significant difference between my proposal and Oda's (2008) denotation in (34a), which reflects her claim that Japanese does not allow abstraction over degrees, i.e., it has the negative setting for Beck et al.'s (2004) Degree Abstraction Parameter. Subsequent works have identified evidence for abstraction over degrees in Japanese (e.g. Shimoyama, 2012; Sudo, 2015). One such piece of evidence is scope ambiguity in sentences with a differential MP and a modal. The original example in English (35) comes from Heim (2000), who attributes the ambiguity to scope interactions between the modal and the comparative operator *-er*.

(35) a. (This draft is 10 pages.) The paper is required to be exactly 5 pages longer than that.

b. 'Exact' reading $\forall w \in \text{Acc}: \max\{d: \text{long}_w(p,d)\} = 15\text{pp}$

c. 'Minimum' reading $\max\{d: \forall w \in \text{Acc}: \text{long}_w(p,d)\} = 15\text{pp}$

(adapted from Heim, 2000: 48 (28))

The same ambiguity is replicated with a modal *hitsuyoo-ga a-ru* in Japanese (36).

(36) Ronbun-wa shitagaki yori tyoodo 5 peeji nagai hitsuyoo-ga a-ru
paper-TOP draft than exactly 5 page long need-NOM exist-NPST

'The paper needs to be exactly 5 pages longer than the draft.'

(adapted from Sudo, 2015: 45 (109))

My denotations of GAs predict this scope ambiguity, which depends on the landing site of the MP with respect to the modal, similarly to Beck's (2012) proposal for English.

(37) a. 'Exact' reading ∀>MP
$[\![$[tyoodo 5pp 7 Ronbun-wa shitagaki yori$_1$ 3 $t_{7,d}$ d_3 naga-i] hitsuyoo-ga ar-u$]\!]^{g,w} = 1$
iff $\forall w'[w' \in \text{DEON}(w) \rightarrow \text{PAGE}(|\lambda d.\ \text{Long}(\text{paper})(w') \geq d > \text{LENGTH}(\text{draft})(w')|)=5]$

b. 'Minimum' reading MP>∀
$[\![$tyoodo 5pp 7 [Ronbun-wa shitagaki yori$_1$ 3 $t_{7,d}$ d_3 naga-i hitsuyoo-ga ar-u$]\!]^{g,w} = 1$
iff $\text{PAGE}(|\lambda d.\ \forall w'[w' \in \text{DEON}(w) \rightarrow \text{LONG}(\text{paper})(w') \geq d > \text{LENGTH}(\text{draft})(w')]|) = 5$

Another consequence of the inability to abstract over degrees in Oda (2008)'s proposal is that it does not seem to extend to equatives and degree questions, which involve abstraction over degrees (Beck et al., 2009). Therefore, the inherent context sensitivity in Oda's denotation cannot be characterized as the source of the wider distribution of evaluativity (See Section 4.1),[12] in contrast to my proposal (see Section 4.4).

[12]In Oda (2015) she allows abstraction over degrees and attributes evaluativity of *izyoo* equatives to a version of

4. Evaluativity

4.1. Wider distribution of evaluativity with GAs

Japanese shows much wider distribution of evaluativity than English. Equative-like[13] constructions involving a GA and a particle *izyoo* ('$\geq$') (38) or *kurai* ('$\approx$') (39) are always evaluative in Japanese, regardless of whether the GA is a positive (a) or negative (b) member of a polar antonym pair (Hayashishita, 2007, 2017; Kubota, 2012; Oda, 2015).

(38) a. Biru A-wa Biru B izyoo-ni taka-i
Building A-TOP Building B izyoo-DAT tall-NPST
'Building A is as tall as Building B.' → Building A and B are tall.

b. Biru A-wa Biru B izyoo-ni hiku-i
Building A-TOP Building B izyoo-DAT short-NPST
'Building A is as short as Building B.' → Building A and B are short.

(39) a. Biru A-wa Biru B kurai taka-i
Building A-TOP Building B kurai tall-NPST
'Building A is about as tall as Building B.' → Building A and B are tall.

b. Biru A-wa Biru B kurai hiku-i
Building A-TOP Building B kurai short-NPST
'Building A is about as short as Building B.' → Building A and B are short.

Degree questions (41) constructed with *kurai* are also evaluative even with the positive member of an antonym pair.[14]

(41) Biru A-wa dono kurai taka-i no?
Building A-TOP which kurai tall-NPST Q
'How tall is Building A?' → Building A is tall.

4.2. Previous analysis: Kubota (2012)

Kubota (2012) accounts for the data in Section 4.1 by encoding evaluativity in the morphemes *izyooni* and *kurai* (42). This strategy is partially motivated by the need to reflect his observation that the evaluativity inference is presupposed for the standard of equatives but not for the associate (see Kubota, 2012: 37–8).

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pos.

[13]While I will refer to constructions like (38)-(39) as equatives from now on, their semantics differs from that of equatives in English. In addition to being evaluative, they lack an 'exactly' reading; in fact, both Hayashishita (2007) and Kubota (2012) would describe (38)-(39) as comparatives. I suspect that *izyoo* equatives lack the strengthened, 'exactly' readings because being evaluative, they do not enter a Quantity competition with comparatives (see e.g., Rett, 2014).

[14]The patterns I discuss in Section 4.1 and 4.3 hold for degree demonstratives as well (40).

(40) Biru A-wa kono kurai taka-i
Building A-TOP this kurai taka-NPST
'Building A is about this tall.' → Building A is tall.

(42) $[\![\text{kurai}]\!] = \lambda x.\ \lambda g_{ed}.\ \lambda y.\ g(y) \approx g(x)$ <u>defined if $g(x) \geq \text{stnd}(g)$</u>
(adapted from Kubota, 2012: 42 (14))

Kubota's proposal predicts that any construction with *izyoo* and *kurai* would be evaluative by default. I will demonstrate that this is a wrong prediction.

4.3. Lack of evaluativity with GNs

Contrary to the prediction of Kubota's denotations of *izyoo* and *kurai*, once we replace the positive GAs in (38a), (39a), and (41) with morphologically related gradable nominals (GNs), the evaluativity inference is no longer available (45)-(46).[15]

(44) Biru A-wa Biru B izyoo-no taka-sa-da
Building A-TOP Building B izyoo-GEN big-N-COP
'Building A is as tall as Building B.' $\not\rightarrow$ Building B is tall.

(45) Biru A-wa Biru B kurai-no taka-sa-da
Building A-TOP Building B kurai-GEN big-N-COP
'Building A is as tall as Building B.' $\not\rightarrow$ Building B is tall.

(46) Biru A-wa dono kurai-no taka-sa-na-no?
Building A-TOP which kurai-GEN big-N-COP-Q
'How tall is Building A?' $\not\rightarrow$ Building A is tall.

The lack of evaluativity in corresponding constructions with GNs shows that the source of evaluativity in equatives and degree questions with GAs cannot be *izyoo* and *kurai*. I propose that instead, what gives rise to evaluativity is the inherent context dependency of GAs, which is not shared with GNs.

4.4. Analysis of evaluativity

My inherently context-sensitive denotations of GAs account for the evaluative inference in equatives and degree questions formed with GAs. To account for the lack of such inference in corresponding constructions formed with GNs, I propose that the nominalizer *-sa* is one of the two morphemes that can bind the variable over a contextually salient degree accompanying a GA, the other being the standard marker *yori* (see Section 3.3). Recall the denotation of the GA *taka-* 'tall' (47), repeated from (28).

(47) a. $[\![\text{ taka- 'tall' }]\!]^{g,w} = \lambda d'.\ \lambda d.\ \lambda x.\ \text{TALL}(x)(w) \geq d > d'$
b. $[\![\ d_{d,3}\ ]\!]^{g,w} = g(3)$

[15] Similarly, in his 2007 paper, Hayashishita presents examples like (43) as evidence that the evaluativity cannot be attributed to *izyoo* and *kurai*. Notice the lack of evaluativity and occurrence of the optional GN, *nagasa*.
(43) John-wa 10m gurai-no (nagasa-no) turizao-o katta.
John-TOP 10m kurai-GEN length-GEN fishing.rod-ACC bought
'John bought a fishing rod that is 10m long.' (Hayashishita, 2007: 105 (96))

Izyoo and *kurai* have the denotations in (48) and (49), respectively. Use of the MAX operator for the standard of comparison but not the associate is to capture the asymmetry that evaluativity is only presupposed for the former (Kubota, 2012).

(48) $[\![izyoo]\!]^{g,w} = \lambda x.\ \lambda P_{det}.\ \lambda y.\ \lambda d.\ P(d)(y)=1 \ \&\ d \geq \text{MAX}[\lambda d'.P(d')(x)=1]$

(49) $[\![kurai]\!]^{g,w} = \lambda x.\ \lambda Q_{det}.\ \lambda y.\ \lambda d.\ Q(d)(y)=1 \ \&\ d \approx \text{MAX}[\lambda d'.Q(d')(x)=1]$

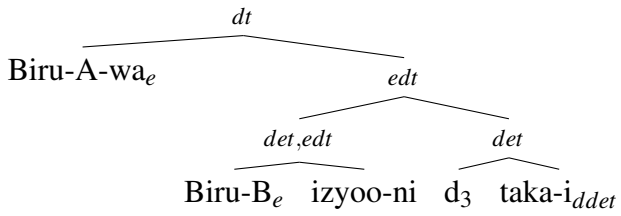
The denotation of the adjectival equative in (38a), repeated in (50a), is derived as in (50), where existential closure over degrees takes place as the last step.[16]

(50) a. Biru A-wa Biru B izyoo-ni taka-i
Building A-TOP Building B izyoo-DAT taka-NPST
'Building A is as tall as Building B.' → Building A and B are tall.

b. $[\![$Biru B izyoo-ni$]\!]^{g,w} = \lambda P_{det}.\ \lambda y.\ \lambda d.\ P(d)(y)=1 \ \&\ d \geq \text{MAX}[\lambda d'.P(d')($Building B$)=1]$

c. $[\![$Biru B izyoo-ni d_3 taka-i$]\!]^{g,w} = \lambda y.\ \lambda d.\ \text{TALL}(y)(w) \geq d > g(3) \ \&\ d \geq \text{MAX}[\lambda d'.\ \text{TALL}($Building B$)(w) \geq d' > g(3)]$

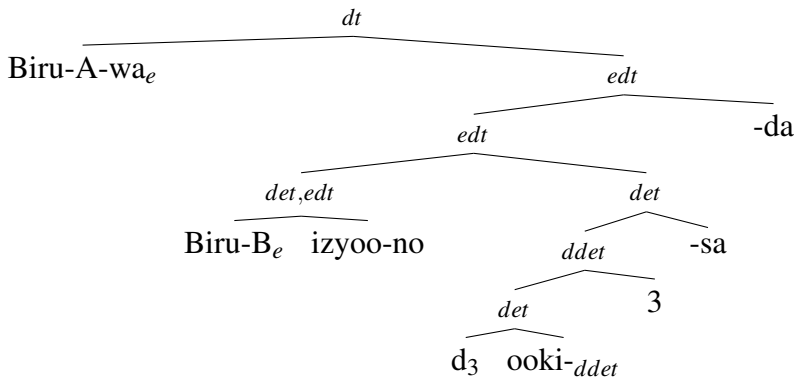
d. $[\![$Building A-wa Biru Bo izyoo-ni d_3 taka-i$]\!]^{g,w} = 1$ iff $\exists d.$ TALL(Building A)(w) $\geq$ $d > g(3)$ & $d \geq$ MAX[$\lambda d'$.TALL(Building B)(w) $\geq d' > g(3)$]



In contrast, the nominal equative in (44) is not evaluative because the nominalizer *-sa* (51) binds the degree variable accompanying the GA and plugs in the absolute zero degree.

(51) $[\![$-sa$]\!]^{g,w} = \lambda P_{ddet}.\ \lambda d.\ \lambda x.\ P(0)(d)(x)=1$

(52) $[\![(44)]\!]^{g,w} = 1$ iff $\exists d.$ TALL(Building A)(w) $\geq d > 0$ & $d \geq$ MAX[$\lambda d'$.TALL(Building B)(w) $\geq d' > 0$]



[16]The reason for not existially closing the degree argument in the denotations of *izyoo* and *kurai* is that, it seems that the degree argument of *x izyoo/kurai no Adj-sa* is sometimes manipulated further (see (56) in Section 4.5).

4.5. Evaluativity with GNs

There are two cases in which constructions with GNs are evaluative. One case is when the GN is a negative member of an antonym pair, as in the equative in (53). It may be that markedness competition with the positive counterpart is responsible for evaluativity of this type (Rett, 2014). I leave open the question of how antonymity should be modelled in my framework.

(53) Hana-wa Taro kurai-no chiisa-sa-da
Hana-TOP Taro kurai-GEN small-N-COP
'Hana is about as short as Taro.' → Taro and Hanako are short.

The other instance of evaluativity in GN constructions involves the verbal ending *ar-u*. Watanabe (2013) observes that in (54), the *ar-u* ending is evaluative (54b), while the *de-ar-u* ending is neutral (54a). He analyzes the syntactic structures of the two constructions as in (55), where the sole semantic difference is that there is *pos* in (54b) but not in (54a).

(54) a. Kono biru-wa taka-sa-ga 20m de-ar-u.
this building-TOP tall-N-NOM 20m de-ar-NPST
'This building is 20m tall.' (adapted from Watanabe, 2013: 281 (51))

b. Kono biru-wa taka-sa-ga 20m ar-u.
this building-TOP tall-N-NOM 20m ar-NPST
'This building is 20m tall.' → The building is tall.
(adapted from Watanabe, 2013: 281 (50))

(55) a. (54a) [TP [vP [PredP [DP ...]Pred de]v ar]T u]

b. (54b) [TP [vP [PredP [DegP ... Deg pos]Pred ∅]v ar]T u]
(based on Watanabe, 2013: 274 (31–32), 282 (55))

These constructions bear similarities to the GN constructions discussed in Section 4.3. In fact, the *-da* ending in (44-45), which I glossed as a copula, is a contraction of *de-ar-u* (Nakayama 1998 cited in Nishiyama, 1999; Urushibara, 1994), and it can be replaced by *ar-u*, giving rise to evaluativity (56 building on 44).

(56) Biru A-wa Biru B izyoo-no taka-sa-ga ar-u
Building A-TOP Building B izyoo-GEN big-N-NOM ar-NPST
'Building A is as tall as Building B.' → Building A is tall.

This raises a question of whether (56) involves *pos* as well. However, there are reasons to believe that the source of evaluativity in (54b) and (56) is not *pos*. First, there is a semantic difference between (54a) and (54b) other than evaluativity. The former has the 'exactly 20m' reading, and the latter has the 'greater than 20m' reading; if the building is 30m tall, the former is false, but the latter is true. Second, Watanabe (2013) argues that *pos* can only specify a vague standard, which predicts that evaluativity should always be felt in *ar-u* constructions. However, evaluativity is not felt in *MP ar-u* constructions analogous to (54b) if there is a precise and salient degree (57); a contrastive topic marker *-wa* is attached to the MP (58); or a standard phrase is added (59), suggesting that the standards of *ar-u* constructions are not always vague.

(57) *Context: You have to be at least 120cm to ride the roller coaster.*
Hana-wa shinchoo-ga 125cm ar-u kara no-rer-u
Hana-TOP height-NOM 125cm ar-NPST because ride-can-NPST
'Hana is 125cm tall, so she can ride (the roller coaster).' $\nrightarrow$ Hana is tall.

(58) Hana-wa chiisa-i. Shinchoo-ga 120cm-wa ar-u kedo 130cm-wa
Hana-TOP small-NPST height-NOM 120cm-TOP ar-NPST but 130cm-TOP
na-i
NEG-NPST
'Hana is short. Her height is greater than 120cm but less than 130cm.' $\nrightarrow$ Hana is tall.

(59) Kono biru-wa ano biru yori taka-sa-ga ar-u
this building-TOP that building yori tall-N-NOM ar-NPST
'This building is taller than that building.' $\nrightarrow$ 'This building' is tall.
(based on Watanabe, 2013: 292 (85a))[17]

It may be that the verbal element *ar-* is not the same between *ar-u* (54b) and *de ar-u* (54a), as *ar-* is highly homophonous, also being a main verb meaning 'to exist' and a resulatative marker (Martin, 2003). If that is the case, one possibility is that *ar-* in *ar-u* contributes evaluativity by taking a covert degree variable similar to the one accompanying GAs and adds to the predicate it combines with the reading that the relevant degree exceeds the degree picked out by the variable. Using the variable instead of *pos* allows it to pick a salient degree other than the vague contextual standard (57, 58) (see Section 5.1) and to be bound by *yori* (59), just like the variable accompanying a GA in regular comparatives (see Section 3.3).

5. Remaining issues and implications

5.1. Flexible nature of context sensitivity

Before concluding, this section elaborates on remaining issues and implications. One question that my analysis raises concerns the nature of the free degree variable accompanying GAs. In order to characterize context sensitivity of GAs as the unified source of both obligatory differential MP interpretations and evaluativity of equatives and degree questions, it is crucial that this free variable picks out 'contextually salient' degrees of slightly different nature in the two cases. For differential MP interpretations, it picks out a precise degree that has been made salient, linguistically or non-linguistically. For evaluativity, the variable picks out a vague contextual standard of the kind picked out by the *pos* morpheme in English (Cresswell, 1976; von Stechow, 1984; Kennedy and McNally, 2005), such as the presumed average degree of entities that are the same kind as the associate. An implicit assumption in my account is that the latter option is the default. This accounts for the evaluativity inferences in equatives and degree questions, as well as positive forms without MPs.

Deviation from this default is usually (though not always; see (65)) triggered by an overt ele-

[17] Watanabe (2013) presents a version with a differential MP and marks it as '?'. Without the MP, the version in (59) seems perfectly fine, which suffices for my purpose of illustrating non-vague standards in *ar-u* constructions.

ment. For example, as argued in Section 3.3, when there is an MP, the need for MIN(D) to be defined rules out the vague contextual standard as the value of the free variable. Another construction in which empirical facts require similar non-default assignment is a *hoo* comparative (Matsui and Kubota, 2012) without an overt standard. As Matsui and Kubota (2012) point out, *hoo* comparatives differ from regular comparatives in that they are uttered most naturally as an answer to a *which* question (60). While Matsui and Kubota (2012) focus on cases with an overt standard marked with *yori*, (60) is perfectly felicitous without one, and its interpretation is non-evaluative just like regular comparatives.

(60) *Context: "Which is taller, Building A or B?"*
Biru A-no-hoo-ga (Biru B yori) taka-i
Building A-GEN-hoo-NOM (Building B yori) tall-NPST
'Building A is taller (than Building B).' (based on Matsui and Kubota, 2012: (15a,16a))

Following Matsui and Kubota (2012)'s analysis of *hoo* (62) as adding a presupposition that the cardinality of comparison class C that x belongs to is two, my analysis predicts the denotation of (60) without the *yori* phrase in (64), assuming that in the absence of an MP, a covert existential operator (63) undergoes QR.[18]

(62) $[\![\text{hoo}_C]\!]^{g,w} = \lambda \text{x: x} \in \text{C \& |C|=2. x}$ (Matsui and Kubota, 2012: 7 (17))

(63) $[\![\exists]\!]^{g,w} = \lambda \text{D}_{dt}. \exists \text{d}[\text{D(d)=1}]$

(64) $[\![$ (60) without the *yori* phrase $]\!]^{g,w} = 1$ iff $\exists \text{d}[\text{TALL(Building A)(w)} \geq \text{d} > \text{g(3)}]$
defined iff Building A $\in$ C & |C|=2

In order to not derive evaluativity, the degree assigned to the free variable g(3) must be a salient degree that Building A exceeds but Building B doesn't; the most plausible candidate is the height of Building B. If my account is on the right track, there may be a principle for when the assignment deviates from the default and picks out a salient degree other than the contextual standard.

To be clear, this issue is not specific to my account, and it is quite likely that the empirical picture requires this flexibility. Kubota (2011) explicitly remarks on this issue in his account of differential MP interpretations in Japanese. He uses the function stnd, which takes the denotation of a GA and returns a salient degree along the relevant dimension, in both his denotation of *pos* in positive constructions and the denotation of δ, which appears with MPs (see Section 3.2.2). Therefore, stnd must be able to return a vague contextual standard in the former and a precise, salient degree in the latter. Kubota (2011) remarks that this is the right approach to Japanese because it seems that stnd can pick out a precise degree in positive constructions as well (65). In (65), the output of stnd, or in my account, the value assigned to the free degree variable, is 10m, not e.g., the presumed average length of wires.

[18] While this is somewhat ad-hoc, it is in line with Rett's (2007; 2008; 2014) argument that the two contributions of *pos*, namely existential closure over degrees and evaluativity, should be separated. An overt MP is licensed in the same position as well (61).
(61) Biru A-no-hoo-ga (Biru B yori) 50cm taka-i
Building A-GEN-hoo-NOM (Building B yori) 50cm tall-NPST
'Building A is 50cm taller (than Building B).'

(65) *Context: A needs a wire that is exactly 10m for making a high-precision antenna. B hands A a wire. A measures it with a high-precision ruler, and it is 10m 2mm.*
Kore-wa naga-i-kara dame-da! (adapted from Kubota, 2011: 9 (23))
this-TOP long-NPST-because useless-COP
'This one won't work since it's too long!' (lit. 'This one won't work since it's long!')

5.2. MP interpretations in English

Positive forms of GAs in Japanese give rise to differential interpretations when combined with an MP. This differs from positive but MP-incompatible relative GAs in English (e.g., *warm*). As Bierwisch (1989) points out for *short*, if one attempts to interpret an otherwise ungrammatical *MP Adjective* sequence, the resulting interpretation is not a differential reading but an absolute reading with an evaluativity inference. This reading is brought out in (66).

(66) *Context: How is the pool's temperature?* It's so warm. It's (about) 35 °C warm.

If GAs like *warm* have denotations analogous to GAs in Japanese (67), the reading in (66) can be derived by assuming that, unlike in Japanese, MPs in English denote a degree (68). In (68), the temperature of the pool is no less than 35 °C, which is in turn greater than the contextual standard, g(3). Unlike in Japanese, where g(3) would correspond to MIN(D) of an MP and therefore must be precise, in English, g(3) can continue to refer to the vague contextual standard, which results in evaluativity.

(67) a. $[\![\text{warm}]\!]^{g,w} = \lambda d'.\ \lambda d.\ \lambda x.\ \text{WARM}(x)(w) \geq d > d'$
b. $[\![d_{d,3}]\!]^{g,w} = g(3)$

(68) $[\![(66)]\!]^{g,w} = 1$ iff $\text{WARM}(\text{the pool})(w) \geq 35\ °C > g(3)$

If this is the right approach, then the difference in MP interpretations between Japanese GAs and positive but MP-incompatible relative GAs in English may correspond to a parametric difference in whether MPs denote generalized quantifiers over degrees (Schwarzschild, 2005) or simply denote a degree. Of course, a question still remains as to why the reading in (68), which was only brought out by establishing evaluativity in the previous sentence, is not more easily available in English.

6. Conclusion

I have demonstrated that Japanese relative GAs uniformly exhibit the cross-linguistically observed link between incompatibility with absolute MPs and evaluativity, summarized in (21) (Bierwisch, 1989; Winter, 2005; Krasikova, 2009; Sassoon, 2011; Breakstone, 2012; Bochnak, 2013). While assuming inherently context-dependent denotations of all relative GAs in English (Breakstone, 2012) wrongly predicts differential MP readings to be available for MPs occurring with positive forms of GAs in the presence of a salient precise degree, these readings are exactly the right predictions for Japanese. I proposed that both MP readings and distribution of evaluativity in Japanese are explained by inherently context-dependent denotations of all relative GAs. My proposal predicts that context dependency is the default unless the free

degree variable responsible for context dependency is bound by overt lexical items, namely a standard marker *yori* and a nominalizer *-sa*. Japanese provides a clear picture of what inherent context dependency in degreeful languages would look like, and, as I suggested in Section 5.2, provides a hint for the semantics of idiosyncratic (Schwarzschild, 2005) classes of positive but MP-incompatible relative GAs in other languages.

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(Past) temporal reference in an aspect prominent language[1]

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Abstract. Akan (Kwa, Niger-Congo) deploys three different temporal markers to express pastness: the final vowel lengthening of the verb (LEN), the prefix *a-*, and the particle *ná*. Building on novel fieldwork data, we propose a pronominal analysis for *ná*, viewed as a non-present tense. For *LEN*, we develop a hybrid tense-aspect analysis, with its (past) tense lacking existential closure. By contrast, *a-* denotes a hybrid perfect with a quantificational tense semantics and an underspecified resultative aspect semantics.

Keywords: tense, aspect, Akan.

1. Introduction

This paper provides an in-depth study of how temporal anteriority is encoded in Akan, with a focus on how temporal and event variables enter semantic composition via tense-aspectual markers. At the core of this investigation are three morphemes that convey 'pastness': the sentence particle *ná*, the suffix *LEN* and the prefix *a*. While both *ná* and *LEN* exhibit referential interpretations, these come with a different aspectual profile: imperfective for *ná*, perfective for *LEN*. By contrast, the prefix *a* appears to give rise primarily to resultative readings.

(1) a. **ná** Kofi (re-)di akokɔ.
NA Kofi PROG-eat chicken
With PROG: 'Kofi was eating chicken.'
Without PROG: 'Kofi used to eat chicken.'
b. Kofi di-**ì** akokɔ.
Kofi eat-**LEN** chicken.
'Kofi ate chicken.'
c. Ama **a**-di akokɔ.
Ama **a**-eat chicken
'Ama has eaten chicken.'

Its distribution has led several scholars to characterize *LEN* as a perfective/completive aspect (Osam, 2003, 2008; Lecavelier, 2022), as a past tense (Dolphyne, 1987; Duah and Savić, 2020) or as a hybrid past perfective form (Boadi, 2008). In comparison, *ná* and *a* have only received some sketchy treatment in the literature.

In the remainder of the paper, we will tackle the following questions:

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(i) How does Akan manipulate reference and eventuality times?

(ii) Do tense forms in Akan require a pronominal, quantificational or hybrid analysis?

The paper is structured as follows: In the next section, we offer a concise overview of previous accounts, pointing to a lack of consensus on the status of the three markers and a severe underassessment of their semantic properties. Section 3 presents novel data illustrating the range of interpretations available for each marker. These empirical findings provide the foundation for the formal analysis outlined in section 4. Specifically, we propose that both *ná* and *LEN* denote pronominal tenses. While *ná* functions as a distal deictic tense excluding the utterance time, *LEN* operates as a relative past tense. Beside a different temporal restriction, they further diverge from an aspectual viewpoint: *ná* pairs exclusively with stative/habitual aspect operators, whereas *LEN* additionally spells out a perfective projection. In contrast, *a* allows for a broader range of interpretations, including experiential, resultative and universal readings. We contend that its underlying semantic representation involves an extended now perfect, further combining with either a resultative or a stative viewpoint aspect. Crucially, interpretations arising from resultative viewpoint are semantically underspecified and vary based on the QuD, thus leading to either an experiential or a resultative interpretation. Finally, section 5 concludes with a comprehensive summary of the key findings.

2. Background

In Dolphyne (1987)'s seminal work, the two affixes *a* and *LEN* are classified as perfect aspect and past tense, respectively, with no further characterization. Along the same lines, Duah and Savić (2020) views *LEN* as an aspectually neutral past tense, while *a* locates the event time before the reference time, akin to Reichenbach (1947)'s perfect. Current relevance is first explicitly stated as a meaning component of *a* in Boadi (2008) and Osam (2008). However, the two authors disagree on *LEN*'s status: while Boadi views it as a past tense (with perfective uses), Osam argues that the suffix denotes a completive (or perfective) aspect that depicts the eventuality as a whole. The latter has broader implications for Osam's theory, where Akan is regarded as an aspect-prominent language lacking the canonical tense opposition between present and past. This is replaced by the opposition between future (the prefix *bɛ*) and non-future tense, that is the null form ∅. By contrast, unmarked clauses are treated as present-tensed in Duah and Savić (2020) and Boadi (2008). Boadi further assumes that stative and habitual aspect are expressed through silent morphology. Their position differs from the one taken by Dolphyne (1987), who argues the null form only carries aspectual information. Finally, the particle *ná* has received less attention and has been often simply glossed as a clausal determiner. Boadi (2008) notes that *ná* is lexically ambiguous between a future- and a past-oriented form, whose homophony is regarded as merely coincidental. In contrast to Boadi's view, Osam characterizes *ná* as an imperfective temporal marker, without any specific mention of a temporal restriction. A summary of the these accounts is given in Table 1.

This literature overview, though not exhaustive, brings to light a lack of consensus regarding the semantic status of the three anteriority markers as well as the null form in Akan languages. While these proposals share a common understanding that the prefix *a* denotes a perfect aspect, they do not offer a comprehensive characterization of all its uses. This point is particularly cru-

cial, given recent research indicating that what is commonly referred to as “the perfect" cross-linguistically does not represent a universally distinct category (Chen et al., 2021; Bertrand et al., 2022). Even less clear is the status of *LEN*, which has been defined as a perfective aspect or a past tense. Lastly, we have observed that disagreement also exists concerning the temporal orientation of both unmarked and *ná*-marked clauses. Against this backdrop, the next section offers a more fine-grained empirical investigation of temporality in Akan.

	Null form	***a***	**LEN**	***ná***
Dolphyne (1987)	{HAB, STAT}	PERF	PAST	n/a
Boadi (2008)	{PRES, HAB, STAT}	Res. PERF[2]	(PFV) PAST	PAST/FUT
Osam (2008)	non-future	Res. PERF	PFV	(IPFV) TM [3]
D & S (2020)[4]	PRES	Exp. PERF	PAST	CD

Table 1: Summary: Previous accounts on temporal markers in Akan

3. Data: semantic properties

The data presented in this paper[5] follow the guidelines for semantic fieldwork illustrated in Matthewson (2004). Almost all the data were elicited using acceptability judgment tasks, whereby speakers were asked to judge whether a sentence was true in a given context. The diagnostics we developed draw from recent semantic fieldwork research on past tense and perfect forms (Chen et al., 2021; Bertrand et al., 2022). More specifically, Bertrand et al. (2022) identify four different kinds of *perfect*: a past perfective, a resultative perfect, an experiential perfect and a hybrid form encompassing both resultative and experiential uses.

(i) Referential readings: TAM forms are felicitous in referential contexts if they locate an eventuality at a contextually given time, much like pronouns do.

(2) Context (stative predicate): Last week, you visited Afiba. Since she had gotten the flu, you couldn’t stay long. Today, one of your friends asks you about Afiba. You tell them why you had to cut your visit short:

a. Afiba yare-**è**.
Afiba sick-**LEN**
‘Afiba was/got sick.’

b. #Afiba **a-**yare.
Afiba **a-**sick
‘Afiba has been sick.’

c. **Ná** Afiba yare.
NA Afiba sick
‘Afiba was sick.’

LEN and *ná* are both acceptable in referential contexts as opposed to *a*, with one important caveat: while with *ná* Afiba’s state is merely depicted at the moment of the visit, speakers

[2]The types of perfect labelled here go back to the classification found in Bertrand et al. (2022): we will come back to this point later.
[3]Temporal Marker, with no temporal restriction.
[4]Duah and Savić (2020).
[5]The data presented here are the result of fieldwork elicitation from March 2022 to November 2023 with five native speakers of the Asante Twi dialect of Akan.

view the sick-state modified with *LEN* as likely to have ceased by the utterance time. Note that *ná*-marked sentences with eventive predicates are rejected in past episodic scenarios, as the resulting interpretation is obligatorily habitual.

(3) Context (eventive predicate): Yesterday, there was salmon and beef at the canteen, but Kofi picked salmon. Today, one of your friends asks you about Kofi's choice. You answer:
   a. Kofi di-**ì** salmon.
      Kofi eat-**LEN** salmon
      'Kofi ate salmon.'
   b. #Kofi **a**-di salmon.
      Kofi **a**-eat salmon
      'Kofi has eaten salmon.'
   c. #**Ná** Kofi di salmon.
      NA Kofi eat salmon
      'Kofi used to eat salmon.'

(ii) Experiential readings: Experiential readings are associated with indefinite temporal intervals and are, therefore, compatible with eventualities that occurred at least once before.

(4) Context (stative predicate): One of your friends tells you that they are quite envious of Afiba, who always seems to be in great health and energetic. However, you think that this is quite exaggerated: in fact, even Afiba was sick at some point in the past...
   a. #Afiba yare-**è** (da).
      Afiba sick-**LEN** ever
   b. Afiba **a**-yare (da).
      Afiba **a**-sick ever
   c. #**Ná** Afiba yare (da).
      NA Afiba sick ever
      Intended: 'Afiba was/has been sick (before).'

Compared to referential contexts, judgments are reversed: the prefix *a* is compatible with an experiential reading, whereas both *LEN* and *ná* are not.[6]

(iii) Modification by locating temporal adverbials: Modification by locating temporal adverbials (LTA) is expected to be possible only with clauses containing a referential form. This prediction is borne out.

(5) Context: Speaking of an expensive purchase made in 2016...
   a. Me-tɔ-**ɔ** / #**m'a**-tɔ aponkye aboɔden **wɔ afe 2016**.
      1SG-buy-**LEN** / **1SG.a-**buy goat expensive **at year 2016**
      Intended: 'In 2016 we bought an expensive goat.'
   b. #**Ná** me-tɔ aponkye aboɔden **wɔ afe 2016**.
      NA 1SG-buy goat expensive **at year 2016**
      Intended: 'In 2016 we bought an expensive goat.'
      Comment: It means that we used to buy expensive goats back in 2016, implying that now we only buy cheap ones.

[6]The same findings are replicated with sentences containing an eventive predicate. We do not report the data due to space constraints.

As shown in (5), only *LEN*-inflected predicates can be modified by a locating temporal adverbial[7]. When the predicate is eventive, the particle *ná* produces a habitual interpretation. However, when the predicate is stative, *ná* can be readily modified by LTAs:[8]

(6) Context: In 2010, I inherited my family's wealth after my parents died in a car accident. Unfortunately, I spent it all by 2015.
a. **Wɔ afe 2010 ná** me-yɛ sikanii.
At year 2010 NA 1SG-COP rich
'In 2010 I was rich.'

(iv) Habitual readings: As we have seen so far, when combining with eventive predicates, the particle *ná* yields a habitual interpretation. Interestingly, a number of predicates, predominantly stative in nature, display a systematic ambiguity wherein stative and habitual interpretations intertwine (cf. Boadi (2008)). In certain instances, this distinction is phonologically encoded[9], with the habitual meaning corresponding to a high tone on the verb's final syllable. Importantly, the observed ambiguity extends to *ná*-marked clauses, as the following examples illustrate:

(7) a. **(Ná)** Kofi **dà** há.
NA Kofi sleep.**STAT** here
Without ná: 'Kofi is sleeping here (right now).'
With ná: 'Kofi was sleeping here (then).'
b. **(Ná)** Kofi **dá** há.
NA Kofi sleep.**HAB** here
Without ná: 'Kofi sleeps here.'
With ná: 'Kofi used to sleep here.'

(v) Present and future reference: In the previous section, we saw that *ná* and the null form have been associated by some scholars with temporal reference not strictly confined to past (for *ná*) or present (for the null form). Concerning *ná*, we observe that future interpretations are possible (see (8)), but any reference to the present is categorically excluded (see (9)), even with stative predicates.

(8) Context: Kofi is going to an 'all you can eat' event tonight. He has barely touched any food today, as he plans to stuff himself like a bottomless pit. However, you warn him that he will most likely feel sick tomorrow.
a. **ɔkyena *(ná)** wó-yare.
tomorrow NA 2SG-sick
'You will be sick tomorrow.'

[7]Preposing the adverbial in (5) does not result in any difference.

[8]Let us note here that *ná* most naturally occurs in combination with adverbial clauses, where it correlates with the clausal determiner *nó* heading the embedded clause (see also Osam (2003); Boadi (2008); Duah and Savić (2020), among others). In these cases, the predicate of the matrix clause depicts an ongoing event and, thus, bears the progressive marker *re*, as exemplified below.

(i) ná-clauses modified by adverbial clauses
a. Ama ba-à yɛ **nó**, **ná** Kwame **re-**noa aduane.
Ama come-LEN COP **CD NA** Kwame **PROG-**cook food
'When Ama arrived, Kwame was cooking.'
b. Ama bue-è ɛpono nó **nó**, **ná** Kwame **re-**da.
Ama open-LEN door DEF **CD NA** Kwame **PROG-**sleep
'When Ama opened the door, Kwame was sleeping.'

[9]See Boadi (2008: 35) for a list of predicates with stative/non-stative alternation in Akan.

(9) Context: You look pale and your forehand is burning. I say:
a. **Seisei (*ná)** wó-yare.
now **NA** 2SG-sick
Intended: 'You are sick now.'

As for the null form, neither past nor future reference is applicable (see (8), (10) and (11)), challenging its classification as a non-future tense.

(10) Kofi wu***(-ù) nnora**.
Kofi die-**LEN** **yesterday**
lit. 'Kofi dies(/died) yesterday.'

(11) Context: I was just wondering what Kofi was up to yesterday when you stopped by...
a. ***(ná)** Kofi re-didi **nnora**.
NA Kofi PROG-eat **yesterday**.
lit. 'Kofi is(/was) eating yesterday.'

(vi) Resultative readings: A resultative interpretation obtains for eventualities whose result state holds true of the reference time (i.e., UT for matrix clauses). While for *a*, the result state of the depicted event extends to the utterance time, this is not the case for *LEN*.

(12) Context: It is cold in the room, but the window is closed. You wonder...
a. #wó nà wó **a**-bié mpoma nó anaa?
2SG FOC 2SG **A**-open window DEF Q
'Was it you that opened the window?'
$\rightsquigarrow$ *the window is open now*
b. wó nà wó bié**-è** mpoma nó anaa?
2SG FOC 2SG open**-LEN** window DEF Q
'Was it you that opened the window?'
$\not\rightsquigarrow$ *the window is open now*

Based on the data above, we can conclude that only *a*-marked predicates give rise to a resultative interpretation.[10]

(vii) Universal readings: Universal readings occur when a predicate holds from an earlier time up to the reference time (McCoard, 1978; McCawley, 1971). These usually require an overt adverbial determining the duration or the starting point of the time-span stretching until the RT (Iatridou et al., 2001; Kiparsky, 2002). Following the diagnostics developed in Dahl (2021), the data below test the availability of universal readings with duration-quantifying (e.g., *for two weeks*) and left-boundary indicating (e.g., *since 2020*) adverbials.

(13) Context: Kofi moved to the US three years ago and he still lives there.[11]
a. Kofi a-tena America mfie mmiensa.
Kofi A-live America PL.year three
'Kofi has been living in the US for three years.'

[10] One related open question pertains to whether the result state can be cancelled or is part of the asserted meaning of the sentence. Judgments are not firm and vary depending on scenarios and predicates. For this reason, we leave the issue of cancellability of the result state of *a*-marked predicates for future research.

[11] For reasons of readibility, we omit here target sentences containing *ná*. As expected, these are not compatible with a universal interpretation.

b. #Kofi tena-à America mfie mmiensa.
Kofi live-LEN America PL.year three
'Kofi lived in the US for three years.'
c. #Kofi tena America mfie mmiensa.
Kofi live America PL.year three
lit. 'Kofi lives in the US for three years.'

Following these data, only *a* displays universal readings, akin to the English present perfect. Judgments are replicated for other stative and eventive predicates.[12]

(viii) Narrative progression: TAM forms can also be deployed for narrative progression. Typically, perfective pasts are used to progress a story from an earlier point to a later one (in the past) (cf. Kamp and Rohrer (1983)). In the following, a consultant is presented with an English text to translate into Akan, using their preferred temporal markers. Predicates that temporally follow those in the immediately preceding sentence are boldfaced. By contrast, predicates that do not induce a strict narrative progression are underlined. The consultant consistently chose *LEN* to progress the story.[13] [14]

(14) *Context*: Kofi's mum is quite controlling. She wants to know every single detail in Kofi's daily routine, after he leaves for school in the morning. Kofi makes sure he won't leave out even the smallest detail!
Target text:
a. I **walked** to school. I **entered** the classroom. I **sat** at my desk, I **opened** my backpack, I **took out** the notebook. Then I <u>was hungry</u>. I **pulled out** an apple. It <u>was rotten</u>.
Translation offered:
b. Me nante **kɔ-ɔ̀** sukuu nà **mewura-à** sukuu dan nó mu. Me
1SG walk go-LEN school COORD enter-LEN school class DEF inside. 1SG
tena-à m'akonwa so na **me-bue-è** me bag mu. Me
sit-LEN 1POSS.1SG=seat on COORD 1SG-open-LEN POSS.1SG bag inside 1SG
fa-à me book nà <u>ná</u> <u>ɛkɔm</u> de me. Me **yi-ì** apple
take-LEN POSS.1SG book COORD NA hunger COP 1SG 1SG bring.out-LEN apple
nà <u>ná</u> <u>aporɔ</u>.
COORD NA rotten

(ix) Actuality entailments: Finally, one last property that has been often associated with perfective aspect (PFV) are actuality entailments (AE). As the literature has noted (Bhatt, 1999; Hacquard, 2009), PFV-marked ability modals entail the truth of their prejacent in the actual world. Crucially, the same does not follow when imperfective aspect (IPFV) is used instead. In Akan, actuality entailments only arise with *LEN* and *a*, in combination with the ability modal *tumi*. To express past ability, the particle *ná* must be used instead.

[12]However, in order to avoid ambiguity with an experiential reading, consultants strongly preferred the insertion of the proximal deictic *nie* (="this").
[13]Interestingly, *ná* was chosen instead for the only two (stative) predicates that were co-temporal to the preceding event.
[14]As a follow-up, the consultant was asked to judge a text where the boldfaced TAM forms were replaced with *a*. The text was rejected, with the following feedback: *It would only work if you're describing things as they happen at the moment, for example during a phone call.*

(15) Akua [tumi tɔ**-ɔ** / **a**-tumi a-tɔ] efie, # nanso w-a-n-tɔ.
Akua can buy**-LEN / A-**can CONS-buy house but **3SG-LEN-NEG-buy**
Intended: 'Akua was able to buy a house, but she didn't.'

(16) **Ná** Akua tumi tɔ efie, nanso w-a-n-tɔ.
NA Akua can buy house but **3SG-a-NEG-buy**
'Akua was able to buy a house, but she didn't.'

Interim summary:

	a	**LEN**	***ná***
Referential	x	✓	(stat/hab)
Experiential	✓	?x	x
Modification by LTA	x	✓	(stat/hab)
Habitual	x	x	✓
Future reference	x	x	✓
Resultative	✓	x	x
Universal	✓	x	x
Narrative progression	?	✓	x
Actuality entailment	✓	✓	x

Table 2: Summary: Semantic properties of TAnt markers

In this section, we outlined some relevant semantic properties carried by the three anteriority markers *LEN*, *a* and *ná*. From a temporal perspective, while *LEN* and *ná* are strictly compatible with referential readings, the prefix *a* may express experiential, resultative as well as universal readings. Furthermore, from an aspectual perspective, we observed that, on the one hand, *ná* is generally licensed in imperfective contexts such as stative and habitual, on the other *a* and *LEN* both give rise to actuality entailments, which indicates a perfective aspectual profile. A summary of the findings in this section is presented in table 2.[15]

3.1. Combinatorial restrictions

Before moving to the semantic analysis, as a final note, let's briefly consider the combinatorial restrictions on their co-occurrence displayed by the three markers.

The particle *ná* and the prefix *a* are often found in tandem, yielding a past perfect-like interpretation. By contrast, *LEN* is ruled out in ná-marked clauses, as given below.

(17) Context: Ama is such a great cook. She enjoys nothing more in life than baking for her friends. Last Tuesday we stopped by her place and guess what?
a. **Ná** Ama **a**-noa aduane.
NA Ama a-cook food

[15]The symbol "?x" for *LEN*'s experiential readings represents the fact that, though largely unavailable, these readings were simply dispreferred by some speakers in certain contexts.

'Ama had cooked some food.'
Comment: *By the time you got there she had already cooked (maybe in the morning or so)*.

b. *__Ná__ Ama noa-__à__ aduane.
NA Ama cook-LEN food
Intended: 'Ama had already cooked food.'

In (17), the main predicate is further shifted back in time with respect to the past time denoted by *ná*.

The marker *LEN* is not only restricted to *ná*-less clauses, but it's additionall ruled out whenever the predicate bears already tempo-aspectual marking, be it *a* or any other prefix (see (18)).[16]

(18) Complementary distribution of *LEN* with other TAM affixal morphemes:
a. Afiba (*a-)noa-à aduane.
Afiba A-cook-LEN food
b. Afiba (*re-)noa-à aduane.
Afiba PROG-cook-LEN food
c. Afiba (*bɛ-)noa-à aduane.
Afiba PROSP-cook-LEN food

In contrast to *LEN*, the particle *ná* can not only co-occur with *a*, but also with all the other affixal markers (excluding obviously *LEN*).

Building on these empirical findings, the next section develops a semantic theory for the three markers.

4. The semantics of anteriority markers

Building on the properties and the distribution detailed earlier, this section spells out the semantics of the three anteriority markers in Akan, further exploring how they contribute to the temporal interpretation of matrix clauses.

In what follows, we will argue that:
(i) Firstly, the particle *ná* denotes a distal deictic tense which excludes the utterance time as a possible temporal reference.
(ii) Secondly, the prefix *a* is a hybrid perfect aspect with meaning components that are akin to both resultative and experiential perfects.
(iii) Finally, the suffix *LEN* also involves a hybrid TAM form, in that it conflates past tense and perfective aspect.

Crucially, we will further propose that Akan unmarked predicates do not involve a covert present tense, but simply associate with either a stative or a habitual interpretation via covert aspect operators. A present interpretation, therefore, occurs only in the absence of any covert element introducing temporal reference into the composition.

[16] In fact, all TAM verb morphemes are in complementary distribution with one another.

4.1. Preliminary assumptions and the temporal interpretation of bare clauses

In the brief review in section 2, we saw that the absence of overt TAM marking in Akan languages has been associated with a present (Duah and Savić, 2020; Boadi, 2008), a non-future (Osam, 2008) or a temporally neutral (Dolphyne, 1987) interpretation. Furthermore, most accounts assume that stative/habitual meaning must also be semantically encoded in dedicated covert operators (which may or may not coincide with the covert present). Based on the data presented in section 3, the claim that bare clauses yield non-future or temporally unspecified interpretations must be rejected. In fact, past-oriented contexts strictly require overt TAM marking. As a starting hypothesis, we are going to assume the simplest option: bare clauses are tenseless and the present reference is provided by the default evaluation time, that is the utterance time.[17] Since both bare and *ná*-marked clauses are aspectually imperfective, we assume that this interpretation arises through covert STATive and HABitual oeprators.[18] Leaving habitual meaning aside, a (simplified) semantics for STAT is given in (19):

(19) $[\![\text{STAT}]\!] = \lambda p_{\langle v,t\rangle}.\lambda t_{\langle i\rangle}.\exists e[t \subseteq \tau(e) \,\&\, p(e)]$[19]

Via the semantics in (19), we derive for the sentence in (20) the truth-conditions in (20b) from the LF in (20a):

(20) Afiba yare. ('Afiba is sick.')

a. $[_{CP}$ w@ [λw_0 [t_c $[_{TP\langle i,t\rangle}$ - $[_{AspP\langle i,t\rangle}$ $[_{Asp}$ STAT] $[_{VP\langle v,t\rangle}$ λe_3 $[_{VP}$ Afiba $[_{V'}$ $\text{yare}_{w0,e3}$]]]]]]]]

b. $[\![$ (20a) $]\!] = 1$ iff $\exists e[t_c \subseteq \tau(e)$ & *sick*$(w@)(e)(A)]$
'There is an eventuality e, such that its running time surrounds the context time t_c and e is an eventuality of Afiba being sick in the actual world.'

The composition yielding the truth-conditions in (20b) produces a predicate of times at TP-level (the set of reference times that are surrounded by the running time of the given eventuality). Since no structurally higher element provides a suitable reference time (RT), the system utilizes the EvalT t_c to close off the set of reference times. A present interpretation obtains.

4.2. The semantics of ná

In the light of its referential uses, we argue that the particle *ná* should be treated as a pronominal tense. More specifically, *ná* denotes a deictic distal tense, which locates an event at a specific time that is not the utterance time. In other words, *ná* covers the semantic space left free by the unmarked form.[20] Following the pronominal analysis adopted here (see Partee (1973); Kratzer

[17] We are assuming here a system where propositions are always evaluated with respect to a world and a time of evaluation (EvalT). In matrix clauses, these always coincide with the actual world (here w@) and the utterance time (here t_c), respectively. Clearly, this need not be the case in embedded contexts.

[18] In our system, VPs introduce eventuality arguments saturated by (viewpoint) aspect. Eventualities comprise both states and events.

[19] According to the semantics formulated in (19), STAT maps a predicate of eventualities to a predicate of times, such that these hold of t if for some eventuality e, its running time surrounds t.

[20] In the interest of space, we need to gloss over the syntactic status of *ná*. We refer the reader to Kandybowicz (2015), where the particle's tense nature is defended against an adverbial one.

(1998); Heim (1994), *ná* denotes a temporal interval. This, however, is presuppositionally restricted to times that do not include the context time t_c.

(21) a. $[\![\text{ná}_7]\!]$ defined iff there is a contextually salient time g(7) $[\neg(g(7) \circ t_c)]$
b. When defined, $[\![\text{ná}_7]\!] = g(7)$

In agreement with Kandybowicz (2015), we assume that *ná* occupies the T-head position, thus leading to the following semantic representation for the given sentence.[21]

(22) **Ná** Afiba yare.
NA Afiba sick
'Afiba was/{will be} sick (then).'
a. $[_{CP}$ w@ [λw_0 [t_c $[_{TP\langle i,t\rangle}$ na_7 $[_{AspP\langle i,t\rangle}$ $[_{Asp}$ STAT] $[_{VP\langle v,t\rangle}$ λe_3 $[_{VP}$ Afiba $[_{V'}$ $yare_{w0,e3}$]]]]]]]]

To compute the meaning of the sentence, a covert aspectual operator once more needs to saturate the eventuality argument of the predicate "yare". Since the verb is stative, one logical candidate is STAT.[22] Subsequently, applying the predicate of times denoted by the AspP in (22a) to g(7) yields the following definedness conditions and truth-conditions:

(23) a. $[\![$ (22a) $]\!]$ defined iff there is a contextually salient time g(7) $[\neg(g(7) \circ t_c)]$
b. When defined, $[\![$ (22a) $]\!] = 1$ iff $\exists e[g(7) \subseteq \tau(e)$ & *sick*$(w@)(e)(A)]$ 'There is an eventuality e, such that its running time surrounds g(7) and e is an eventuality of Afiba being sick in the actual world.'

Since the reference time g(7) is only restricted to temporal intervals not including UT, the truth-conditions in (23) are compatible with both past-oriented and future-oriented scenarios.

4.3. The semantics of *LEN*

We saw in section 3 that *LEN*, on the one hand, involves properties that are characteristic of the past tense: it makes reference to (specific) times preceding the local evaluation time and it can be modified by (past-oriented) locating temporal adverbials. On the other hand, it exhibits a perfective aspectual profile in that it actualizes the depicted eventuality (under ability modals) and it is used for narrative progression.

To account for its mixed properties, we propose a hybrid semantics for *LEN*, comprising both a pronominal tense and a perfective aspect. We posit that *LEN* spells out a span comprising two projections: a past-restricted tense pronoun in T and a PFV-like operator in Asp. This analysis combines a pronominal analysis for its tense component and existential analysis for its aspectual part.[23].

Note that *LEN*'s tense component $past_{2,5}$ is a doubly indexed pronoun whose first index is free and picks out the RT, while the second index is bound by the local EvalT (that is t_c in matrix

[21] Since *ná* is not evaluated with respect to an additional temporal interval, no EvalT (i.e., t_c) projects at LF.
[22] Given a suitable HAB-operator, habitual meaning is readily computed in a similar fashion. The fact that, in the absence of a progressive marker, *ná*-marked eventive predicates can only be interpreted habitually naturally follows from the system only admitting STAT and HAB as its covert aspectual operators.
[23] For a similar proposal for Samoan, see Hohaus (2019); Bochnak et al. (2019).

clauses). These semantics allow us to derive the meaning for the sentence in (24) as follows:

(24) Afiba di-ì salmon.
Afiba eat-LEN salmon
'Afiba had salmon.'

(25) $[_{CP}$ w@ [λw$_0$ [t$_c$ [λt$_5$ $[_{TP\langle t\rangle}$ $[_T$ past$_{2,5}$] $[_{AspP\langle i,t\rangle}$ $[_{Asp}$ PFV] $[_{VP\langle v,t\rangle}$ λe$_3$ $[_{VP}$ Afiba $[_{V'}$ {di-salmon}$_{w0,e3}$]]]]]]]]]

(26) a. $[\![$ (25) $]\!]$ defined iff g(2) < t$_c$
b. $[\![$ (25) $]\!]$ = 1 iff $\exists$e[τ(e) $\subseteq$ g(2) & *eat*(w′)(e)(ιx[*salmon(x)*])(A)]
'There is an eventuality e, such that its running time is entirely included in g(2) and e is an eventuality of Afiba eating salmon in the actual world.'

Compared to the LF for the bare clause in (20a), the LF in (25) is not tense-deficient, but introduces the RT into the composition via the pronoun $past_{2,5}$. This receives a value, restricted to times preceding t$_c$, via the assignment function g.

4.4. The semantics of *a*

A satisfactory analysis for *a* should be able to capture the readings that the affixal marker can yield: resultative, experiential and universal. According to the typological classification in Bertrand et al. (2022), perfect forms that exhibit the same properties as Akan *a* are categorized as *hybrid*. Among these, we have the English Present Perfect. Semantic accounts of the English (Present) Perfect can be grouped into three different types (cf. Bhatt and Pancheva (2005)): (i) *Anteriority accounts*, adopting a Reichenbachian analysis (Klein, 1992; Reichenbach, 1947); (ii) *Extended-Now (XN) accounts*, relying on a time span interval extending backwards from the RT (Iatridou et al., 2001; McCawley, 1971; McCoard, 1978; Pancheva, 2003); (iii) *Result state accounts*, appealing to some notion of the result state being relevant/obtaining at the utterance time (Portner, 2003; Moens et al., 1988).

Abstracting away from the technical details of each individual theory, we will propose a pragmatically enriched XN-theory. According to our proposal, the universal-existential distinction is grammatically determined, whereas the contrast between resultative and experiential readings is only contextually resolved.

In line with much previous work (Iatridou et al., 2001; Pancheva, 2003; Rullmann and Matthewson, 2018), we assume that a perfect is hosted within a dedicated projection between tense and viewpoint aspect projections. A resulting structure for the aspect layer is sketched in (27).

(27) $[_{TP}$ *Tense* $[_{AspP}$ PERF/PROSP $[_{ViewP}$ PFV/IPFV [... VP ...]]]]

What is relevant for the current discussion is that the prefix *a* spells out the XN-Perfect heading the AspP. According to the XN-theory, the perfect introduces what Iatridou et al. (2001) have called the "Perfect Time Span" (PTS), that is a temporal interval delimited by the clausal tense (on its right hand) and by an overt adverbial (or else left unspecified) on its left hand. Building on Pancheva (2003: 284), we adopt the semantics for the perfect operator as formulated in (28).

(28) $[\![\text{PERF}]\!](p_{\langle i,t\rangle})(t_{\langle i\rangle}) = 1$ iff $\exists t'[\text{XN}(t',t) \,\&\, p(t')]$
With XN(t′,t) the time span stretching throughout t′ and culminating in t.

According to (28), PERF is a quantificational tense that quantifies over a temporal interval (the PTS). Since in our system VPs denotes properties of eventualities, PERF will have to further combine with a lower viewpoint aspect that closes off the eventuality variable.

4.4.1. Deriving the universal reading

We have seen that *a* can readily produce universal readings when it combines with unbounded predicates (usually statives). One example is repeated below.

(29) Kofi a-tena America firi afe 2019.
Kofi A-live America from year 2019
'Kofi has been living in the US since 2019.' (Universal)

In (29), the adverbial "firi afe 2019" provides the starting point of the PTS, while its end point coincides with the default variable t_c - lacking the sentence an overt superordinate tense (for instance, *ná*). As for its viewpoint aspect, in the current framework the only covert viewpoint aspects are STAT and HAB. Since the one arising is a stative interpretation, we assume that it's the former to feature at LF. The resulting LF is sketched in (30), with the truth-conditions computed in (31).

(30) $[_{CP}\ \text{w@}\ [\lambda w_0\ [t_c\ [.\text{TP}_{\langle i,t\rangle}$ - $[_{AspP\langle i,t\rangle}\ [_{Asp}\ \text{PERF}_{\langle it,it\rangle}]\ [_{ViewP}\ [_{ViewP\langle i,t\rangle}\ [_{View}\ \text{STAT}_{\langle vt,it\rangle}\ ]$
$[_{VP\langle v,t\rangle}\ \lambda e_3\ [_{VP}\ \text{K.}\ [_{V'}\ \{\text{tena-America}\}_{w0,e3}\ ]]]]\ [_{PP}\ \{\text{afe firi 2019}\}.\text{PP}_{\langle i,t\rangle}\ ]]]]]]]$

(31) $[\![(30)]\!] = 1$ iff $\exists t'[\text{XN}(t', t_c)$ & $\textit{Begin}(t', \textit{year}(2019))$
& $\exists e[t' \subseteq \tau(e)$ & $\textit{live}(\text{w@})(e)(\textit{in}(\text{US}))(\text{K})]$
'There is a PTS t′ extending from 2019 until t_c and there is an eventuality e, such that its running time surrounds t′ and e is an eventuality of Kofi living in the US in the actual world.'[24]

4.4.2. Existential readings

To account for the two existential readings - the experiential and the resultative - we propose a unified analysis hinging on the combination of an XN perfect aspect with a resultative viewpoint aspect. The view taken here is similar in spirit to Portner (2003) and differs, for instance, from that of Pancheva (2003). We favour a unified analysis based on the empirical observation that atelic predicates in Akan can yield experiential as well as resultative readings (see (32)).[26]

[24] In order to arrive at the truth-conditions in (31), we am assuming that the left-boundary adverbial PP right-adjoins to ViewP. Setting the technical details aside, the "*Begin*" function[25] introduced by "firi" sets the starting time of the temporal interval modified by the PP.

[26] Another piece of evidence is the fact that Akan, as opposed to several Indo-European languages, exhibits no morphological reflection of the experiential/resultative distinction. In fact, both the progressive marker *re* and the perfective marker *LEN* cannot co-occur with *a*.

(32) Kofi **a**-di salmon.
Kofi **a**-eat salmon
'Kofi has eaten salmon.'
a. *Exp*: ⇝ Kofi knows what salmon tastes like.
b. *Res*: ⇝ Kofi is not hungry.

Existential readings, unlike universal ones, require that the eventuality be completed by RT. To this end, we suggest that in existential contexts PERF combines with a resultative aspect. Drawing from Pancheva (2003)'s foundational work (cf. (Bhatt and Pancheva, 2005: 12)), we refine the semantics of the resultative viewpoint aspect building "current relevance" in its semantics, as is exemplified below.

(33) *Semantics of resultative viewpoint*
a. $[\![\text{RES}]\!](e'_v)(p_{\langle v,t\rangle})(t'_i)(t_i)$ defined iff $Rel_{Ag}(e')(t)$[27]
b. $[\![\text{RES}]\!](e'_v)(p_{\langle v,t\rangle})(t'_i)(t_i) = 1$ iff $\exists e[Result(e',e) \,\&\, t \subseteq \tau(e') \,\&\, \tau(e) \subseteq t' \,\&\, p(e)]$

According to (33), the definedness conditions of *RES* are satisfied if and only if the result state e' bears some relevance to the top-most reference time (t_c in *ná*-less clauses) for the subject. *RES* takes as arguments the result state e', a property of eventualities (the VP), the PTS t' and a second RT t (given by the top-most tense). In turn, *RES* binds the eventuality argument *e* of the main predicate and requires that: (i) the eventuality time be included in the PTS, (ii) the result state include the clausal tense's reference time. In T-less clauses, the top-most RT collapses into the EvalT t_c. As a consequence, the result state must include the t_c. The eventuality time preceding the result state, on the other hand, is located at some point within the PTS. This might be more or less proximal to t_c.

Based on the denotation in (33), upon combining with a result state pronoun and a predicate of eventualities, *RES* returns a property of times. This is a function from times to a predicate of times. The denotation of *PERF* is revised accordingly.

(34) $[\![\text{PERF}_{existential}]\!](p_{\langle i,\langle i,t\rangle\rangle})(t_{\langle i\rangle}) = 1$ iff $\exists t'[XN(t',t) \,\&\, p(t')(t)]$

The relevance function Rel_{Ag} in (33) is relativized to the event's agent and helps identify the result state that is relevant for the current discourse segment. What is considered "relevant" is guided by contextual and pragmatic considerations. In more concrete terms, the relevance function is sensitive to the question under discussion (QuD) (Roberts, 1996; Büring, 2003). Notably, topic situations, and hence topic times[28] (cf. Schwarz (2009); Kratzer (2023); Klein (1994)), can be derived by the QuD in that there needs to be equivalence between the topic situation/time of the QuD and that of its answer. On this view, if the QuD is about the utterance time, the answer cannot be about a prior time.[29]

To better illustrate the interplay of QuD and Rel_{Ag}, consider the following context.

(35) Context: We are coming back from a trip. Afiba looks exhausted and out of breath. You ask what happened.

[27] $Rel_{Ag}(e')(t)$ reads as: "the result state e' is relevant for Ag at t."
[28] Here reference times
[29] Of course, speakers often provide RT-defying answers, which yield well-known (cessation) inferences (Altshuler and Schwarzschild, 2012).

a. Afiba **a**-foro bepɔ.
Afiba A-climb mountain.
'Afiba has climbed a mountain.' (Resultative)

The sentence in (35a) is situated in a context that obtains at the context time. Since the predicate bears *a*-morphology, it depicts a situation whose result state must be evaluated with respect to the context time too. The output is a resultative interpretation. Its LF-structure and meaning are given in (36) and (37), respectively.

(36) $[_{CP}$ w@ $[\lambda w_0$ $[t_c$ $[_{TP\langle i,t\rangle}$ - $[_{AspP\langle i,t\rangle}$ $[_{Asp}$ $PERF_{\langle\langle i,\langle i,t\rangle\rangle,\langle i,t\rangle\rangle}$] $[_{ViewP\langle i,\langle i,t\rangle\rangle}$ $[_{View}$ RES e_4] $[_{VP\langle v,t\rangle}$ λe_3 $[_{VP}$ Afiba $[_{V'}$ {foro-bepɔ}$_{w0,e3}$]]]]]]]]]

(37) a. *Definedness conditions from LF* (36):
$[\![$ CP $]\!]^g$ defined iff Rel_{Afiba}(g(4))
Paraphrase: 'g(4) a contextually relevant eventuality whose agent is Afiba that satisfies the QuD (i.e., an eventuality that involves Afiba looking exhausted at t_c).'

b. When defined, $[\![$ CP $]\!]^g = 1$ iff
$\exists t'[XN(t', t_c)$ & $\exists e[$*Result*(g(4),e) & $t_c \subseteq \tau(g(4))$ & $\tau(e) \subseteq t'$
& *climb*(w@)(e)(ιz[*mountain*(z)])(A)
Paraphrase: 'There is a PTS t', such that t' extends until t_c & there is an eventuality e, such that g(4) is the result state of e & t_c is included in g(4) & e is included in t' & e is an eventuality in the actual world of Afiba climbing the unique z such that z is a mountain.'

According to the definedness conditions computed in (37a), the relevance function selects the contextually salient eventuality, g(4), that satisfies the question under discussion. The QuD is supplied by the context, which refers to a current state of Afiba being tired. Since the sentence denotes the answer to the QuD, the topic time needs to be preserved and, thus, g(4) needs to be relevant for the context time. This leads to a resultative reading. In a way, it is the QuD (and not the grammar) that generates a resultative interpretation.

Consider now an experiential-biasing context.

(38) You are organizing a trip with your friends to a local mountain. Your plan is to do some climbing, but you have no previous experience, so you decide to ask someone who does. You wonder whom you could talk to; your friend says:
a. Afiba **a**-foro bepɔ nó.
Afiba A-climb mountain DEF
'Afiba has climbed the mountain.' (Experiential)

Based on our analysis, the reading the system generates for (38a) is truth-conditionally indistinguishable from the resultative reading in (37). The definedness conditions are however different, since these are affected by the context-dependent QuD.

(39) $[\![$ (38a) $]\!]$ defined iff
Rel_{Afiba}(g(4))
With the relevance function picking out a suitable eventuality g(4) that is compatible with Afiba being a mountain-climber at t_c.

The felicity of the answer in (38a) does not hinge on how long ago Afiba climbed the mountain.

Therefore, no immediateness inference arises in this case. In other words, it is irrelevant when Afiba climbed the mountain. For what it's worth, she might have done it long ago. What matters is that she has acquired some currently relevant knowledge as a result of that. Under this analysis, the experiential reading is viewed as a special instance of a resultative reading, where the result state stretches throughout the experiencer's life, from the time a given event occurred until now.

5. Combinatorial restrictions and open questions

5.1. Complementary distribution between *LEN* and *ná*

The analyses put forward for *ná* and *LEN* suggest a potential overlap in use, in that both markers preferably occur in referential contexts. They, however, show some sort of division of labor in expressing (past) temporal reference, in that *LEN* correlates with episodic, punctual eventualities while *ná* with states or habits. Their specialized use might explain one important empirical finding: the fact that *ná* and *LEN* cannot co-occur. we will suggest that the reason for their mutual exclusive distribution may be ascribed to the fact that both their tense variables occupy the same position as heads of the tense phrase[30].

5.2. Co-occurrence patterns of *a* with *ná* and *LEN*'s exclusion

As previously noted, the hybrid perfect *a* can co-occur only with the distal deictic *ná*, while the past perfective *LEN* is strictly ruled out in sentences containing any tempo-aspectual marker. According to the LF architecture developed here for Akan clauses, in *a*-marked sentences *ná* fills the empty T-head slot, thus providing a topic time other than UT. Recall that *a*-marked clauses modified by *ná* typically give rise to a past perfect-like interpretation.

By contrast, *LEN* cannot surface in *a*-marked sentences. This time, the restriction is due to competition for the same ViewP position. Assuming that the aspectual head PERF can only combine with STAT or RES to derive universal and existential readings, respectively, the ViewP projection cannot further host PFV (that is *LEN*'s aspectual projection). In other words, *LEN* is prohibited from co-occurring with *ná* due to its temporal component, while it's in complementary distribution with *a* due to its aspectual properties.

6. Conclusion

This paper set out to investigate how temporal meaning can be compositionally computed in Akan. To this end, we isolated three main ingredients designated for past meaning: the final vowel lengthening *LEN*, the prefix *a* and the sentence particle *ná*. Building on the diagnostics in Bertrand et al. (2022) we found that *LEN* and *ná* primarily exhibit referential properties, while *a* correlates with existential and universal readings. Importantly, we argued that, in matrix

[30]Why a language should develop distinct specialized tense forms is an interesting theoretical question worth exploring through a diachronic investigation: we leave this enterprise for future research.

contexts, *ná*-clauses are in complementary semantic distribution with bare ones. Specifically, *ná* makes reference to any non-present time, lacking a specific orientation. This led to its treatment as a pronominal tense carrying an anti-UT presupposition and being compatible with imperfective aspect only. In contrast, the two affixes *LEN* and *a* present a higher internal complexity: while LEN exhibits a pronominal relative past tense alongside a perfective aspect, *a* combines an extended now perfect with a viewpoint aspect, which can surface as resultative or stative. Specifically, the resultative viewpoint aspect can contribute to both experiential and resultative interpretations based on the QuD. Conversely, when combined with stative aspect, the extended now perfect is able to generate universal interpretations.

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Perfective in Eastern Armenian[1]

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Abstract. In this paper I investigate the -c' perfective in Armenian addressing two puzzles related to its semantics. First, it is possible to cancel the culmination inference of an accomplishment VP in *-c'* perfective only if the event started a short while ago, and second, likewise, some stative verbs in the -c' perfective allow cancelation of the culmination inference. I propose that *-c'* perfective is the realization of two operators; a *ER* operator that establishes *a process* or *transition* relation between eventualities and events, and a *Result* operator that introduces a relation between a state and the event that caused it. The major contribution of this paper is to advance our understanding of the cross-linguistic options for encoding completed events and to show how micro-variation between languages can be captured by breaking down perfective aspect into component parts.

Keywords: Perfective aspect, Armenian, completed event, cancellation of a culmination entailment.

1. Introduction

This paper investigates the semantic properties of Armenian post-verbal particle *-c'* (*-ac'*, *-ec'*), with a particular focus on its status as a marker of Perfective aspect (Dum-Tragut, 2009; Giorgi and Haroutyunian, 2014). Perfective aspect describes a completed event (Comrie, 1976; Rothstein, 2008; Singh, 1998; Altshuler, 2014). For example, in (1) the completion of the arrival entails being at the airport, and the completion of the painting event in (2) entails the result of having a painted door.

(1) The airplane arrived at the airport.

(2) Kaden painted the door.

Similarly, the post-verbal particle *-c'* in Armenian denotes an event that culminated. For example, (4) describes a completed event of painting the door and (3) describes a completed event of arriving. The example (4) entails that the door is painted completely and (3) entails that the airplane is in the airport.

(3) inqnatir-ə jaman-ec' odanavakayan
airplane-NOM arrive-PRV airport
'The airplane arrived at the airport.'

(4) Aram-ə dur-ə nerk-ec'
Aram-NOM door-ACC paint-PRV
'Aram painted the door.'

If we assume that *-c'* is an exponent of the perfective aspect in Armenian, then two behaviors of this *-c'* perfective present a challenge to our current understanding of perfectives. First, it

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is possible to cancel the culmination inference of accomplishment events, but only *if the event began a short while ago*. For example, the sentence in (5) is true in a scenario when 15% of the door is painted and false when 90% of the painting is done.

(5) Aram-ə dur-ə nerk-ec' bayc minchev verg ch-nerk-e-c'
Aram:NOM-DEF door:ACC-DEF paint-PRV but till end NOT-paint-PRV
Lit: 'Aram painted the door but didn't paint it completely.'
Means:'Aram started to paint the door.'

Existing accounts of the perfective do not predict this, because instances of canceled culmination generally refer to a stage of the event that is close to the final stage of the event rather than the initial stage of the event (Altshuler, 2014; Singh, 1998; Filip, 2008; Martin and Gyarmathy, 2019). In Hindi, for example, it is possible to cancel the culmination inference of an accomplishment in Simple Perfective as shown in (6). But, unlike the Armenian example, (6) is true in a scenario when 90 % of the door is painted, and it is judged odd in a scenario when 15 % of the door is painted.[2]

(6) miiraa ne darwaazaa rangaa par puuraa nahii rangaa
Mira ERG door paint but completely NEG paint-PRV
'Mira painted the door but did not paint it completely.' (Singh 1998:194)

The second issue is related to the stative predicates in a perfective aspect. It is known that cross-linguistically only certain statives can take a perfective aspect and the combination of a stative and the perfective leads to an inchoative interpretation. For example, the stative *to know* in Hindi with the perfective aspect is interpreted as *come to know*.

(7) ye mE=ne us samay jaan-aa thaa
this I=ERG that time know-PFV be.PST
'This, I came to know (learned) at that time.' (Rajesh Bhatt, p.c.)

In Armenian the post verbal particle *-c'* productively can combine with all stative verbs. This combination for some statives has an inchoative interpretation, similar to the Hindi example in (7).

(8) Aramə havata-c' Ani-in
Aram-NOM believe-PRV Anbi-DAT
'Aram came to believe Ani'

However, for certain stative verbs the combination with the *-c'* particle doesn't give the expected inchoative reading, but rather an 'inceptive' interpretation similar to the one found for the accomplishments in (5). These stative verbs (e.g., *love, live*) likewise allow the culmination of the eventuality to be canceled in the *-c'* perfective.

(9) Aram-ə sire-c' Ani-in bayc ch-sire-c' minchev verj
Aram-NOM love-AOR Ani-DAT but NEG-love-AOR till end
Lit: 'Aram loved Ani but didn't love till the end'
Means: 'Aram started to love Ani.'

[2]A similar pattern has been reported for other languages (e.g., Spanish) that allow cancellation of the culmination inference of accomplishments in the perfective aspect. For more discussion see Martin and Gyarmathy, 2019.

To address this gap between the data and the literature, I put forward an analysis of Armenian *-c'* that takes it to be a realization of two operators; a *ER* operator that establishes *a process* or *transition* relation between eventualities and events, and a *Result* operator that introduces a relation between a state and the event that caused it.

This paper is structured as follows: In the next section, I will provide an in-depth exploration of the behavior of the post-verbal particle *-c'* in Armenian. In the third section, I will turn to a comprehensive examination of different event types, encompassing achievements, accomplishments, and statives within the -c' particle. I will delve into the fundamental distinctions between achievements and accomplishments, along with an investigation into why statives in the *-c'* perfective exhibit behaviors similar to these event types. In the fourth section, I will present my analysis of the *-c'* verbal particle and explore its place in a cross-linguistics typology of perfect(ive) aspectual operators.

2. Background on *-c'* perfective

The *-c'* perfective in Armenian productively can combine with all types of events, including achievements, accomplishments, and states. In the case of achievements, the attempt to cancel the culmination inference leads to a contradiction as shown in (10).

(10) *Aram-ə haxt-ec' mrcuytə bayc ch-haxt-ec' ayn minchev verg
Aram-NOM win-PRV competition:ACC but NEG-win-PRV that till end
Intended:'Aram won the competition but didn't win it completely.'

This pattern holds not only for Armenian -c' perfective but also for the perfective aspect in other languages as English and Hindi (e.g., (11), (12)).

(11) *The airplane arrived at the airport but didn't get to the airport.

(12) #pitaa-jii hamaare ghar aa-ye lekin hamaaraa ghar nahiiN DhuunD sake
father our house come-PRV but our house not find could
Intended: 'Father came to our house but was unable to find our house.' Hindi
(Altshuler 2014:737)

For accomplishments, as shown in the Introduction, it is possible to cancel the culmination inference in Armenian. However, it is possible only if the event had begun a short while ago. For example, when painting a door, the expected result is a fully painted door, as indicated in (13a), which holds if the entire door is painted. In cases of cancellation, as seen in (13b), the sentence remains true only if Aram has just started the painting process.[3]

(13) a. Aram-ə dur-ə nerk-ec'
Aram-NOM door-ACC paint-PRV
'Aram painted the door

[3]In fact, speakers didn't accept the cancellation inference easily. They reported that it makes the utterer sound "cynical". It is noteworthy that speakers asserted that the sentence gains meaningful interpretation only in situations where the event has just commenced. Additionally, there were speakers, who judged example (13a) true in a scenario when 90% of the door was painted (without (13b)), stating that it depends on what we count as the door having been painted. This intuition aligns with what Martin and Gyarmathy (2019) called 'cancellable accomplishments'.

b. bayc ch-nerk-ec' ayn michev verj
but NEG-paint-PRV that till end
...but didn't paint it completely'
Means: 'Aram started to paint the door'

For statives, the perfective in Armneian productively can combine with all statives. Concerning the culmination of statives in the perfective aspect is similar to what is found in (10) and (13). Some stative verbs (*to believe*, *to own*, *to know*) get inchoative interpretation in the *-c'* perfective and behave like achievements – the cancellation of the culmination leads to a contradiction. The other statives, such as *to live, to love, to hate*, behave like accomplishments, and the cancellation of the culmination results in the start of the state.

(14) *Aram-ə havata-c' Ani-i asac-ner-in bayc minchev verj ch-havata-c'
Aram-NOM believe-PRV Ani-GEN say-PL-DAT but till end NOT-believe-PRV
Intended :'Aram came to believe what Ani says but didn't believe completely.'

(15) Aram-ə sire-c' Ani-in bayc ch-sire-c' minchev verj
Aram-NOM love-PRV Ani-DAT but NEG-love-PRV till end
Intended:'Aram loved Ani but didn't love till the end.'
Means: 'Aram started to love Ani.'

The literature highlights instances in certain languages, such as Hindi and Spanish, where certain statives can take the perfective aspect, resulting in an inchoative interpretation, as exemplified by the verb *to believe* in Armenian. A notable divergence between these languages and Armenian lies in the fact that in Armenian, all statives can assume the perfective aspect, but not all statives get the inchoative interpretation. In cases where an inchoative interpretation is not attained, these statives convey a sense of a completed state. This prompts an immediate and pertinent question: what constitutes the culmination or completeness of a state, as observed in verbs like *to live* or *to love*? The notion of the completeness of a state is very similar to the completeness of an accomplishment. The main characteristic is whether it results in a new state. For example, the utterance of (16) has a contextually salient result in mind such as getting married or loved till the end of life.

(16) Aram-ə sire-c' Ani-in
Aram-NOM love-PRV Ani-DAT
'Aram loved Ani '

This becomes more visible in the case of *to live* (*aprel*), due to the culmination requirement of the perfective aspect that triggers cessation implicature. The example (17) denotes an event of living in Yerevan that has been completed. The natural way of thinking about this is that "living state", in other words, life culminates by death. The example (17) entails that David is dead, he does not live (in Yerevan) anymore.

(17) David-ə Yerevan-um apre-c'
David-NOM Yerevan-LOC live-PRV
'David lived in Yerevan'
a. *...ev michev hima ayntex e apr-um
...and till now there be:NON-PAST3SG live-IMPRF
'...and still lives there'

Note that the culmination requirement of the *-c'* perfective is stronger than the normal cessation implicature in the past imperfective. The past imperfective counterpart of (17) allows cancellation of the cessation implicature in Armenian.

(18) David-ə Yerevan-um er apr-um
David-NOM Yerevan-LOC be:PAST:3SG live-IMPRF
'David lived in Yerevan'
a. ...ev michev hima ayntex e apr-um
...and till now there be:NON-PAST3SG live-IMPRF
'...and still lives there'

In sum, *-c'* perfective denotes a culminated event in Armenian. With respect to the cancellation of the culmination, eventualities[4] lay into two groups: 1. achievements and statives that behave like achievements, and 2. accomplishments and statives that behave like accomplishments. In the case of the first group, Armenian is not different from other languages, while in the case of the second group, it is different from the languages discussed in the literature and the question is why. In the next section, I will turn to a detailed discussion about the nature of accomplishment and achievement events and address the question of why specific statives behave like achievements and others like accomplishments.

3. Durative vs inchoative readings

It is generally agreed that accomplishment events and achievement events are different with respect to their inner complexity: accomplishments denote an activity process within the event, and they are durative, while achievements don't have such complexity and are punctual. Consider an achievement *to arrive* and an accomplishment *to build*. Intuitively we understand that the arriving event on its own doesn't include a process, while building a house includes the whole process of building a house. This process includes all different types of activities (e.g., hammering the nails, making the door frame, etc.) that occur while building a house.

(19) The airplane arrived at the airport.

(20) John built a house.

The discussion about this difference between achievement and accomplishment events has been reflected in numerous authors' works including Verkyul (1989), Dowty (1977, 1979), Parson (1994), Rothstein (2008), Tenny (2000) and many others. Verkuyl (1989) has categorized achievements as a subtype of accomplishments based on the length of their associated process, where accomplishments involve a longer process while achievements entail a shorter one. This description of achievements has been utilized to explain their ability to occur in the progressive aspect.[5] Rothstein (2008) has presented an alternative view, suggesting that the distinction between achievements and accomplishments is not a matter of degree but rather lexicalized, based on the presence or absence of a process associated with the event. According to her, an activity process constitutes a part of an accomplishment event, while achievements lack such a

[4]By eventuality I refer to both events and states.

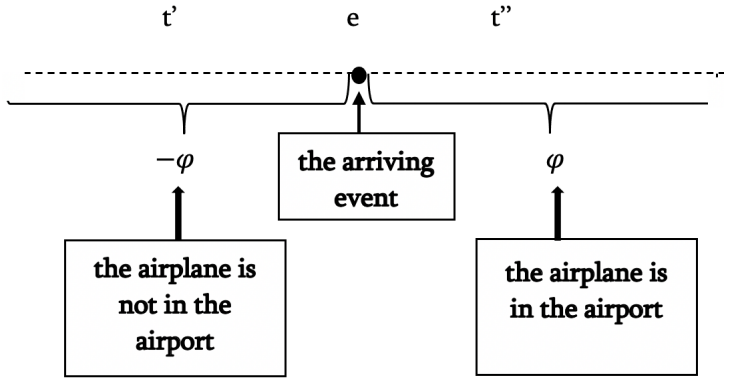
[5]Parsons (1994) and Dowty (1979) have proposed a similar, albeit less extreme, perspective. For them, the process of achievement represents a preparatory process that precedes the event rather than a constituent part of it.

process. Drawing on approaches advocated by Mittwoch (1991), Smith (1997), and Kamp and Reyle (1993), she contends that the progressive aspect can be applied to some achievements through coercion, where a process is coerced to accompany the event, rendering it similar to an accomplishment. In summary, accomplishments feature an activity process as a part of the event, whereas achievements lack such a process and merely indicate a change of state.

In Armenian, the difference between achievements and accomplishments in *-c'* perfective fits Rothstein's theory. Achievements luck a process and their culmination results in a change of state. For example, (3) repeated in (21) describes an event of arriving that causes a change of state of being in the airport. The diagram in (22) is the visual representation of (21): there is a time interval t' where it is not true that the airplane is in the airport, the event of arriving follows t' and that event causes the change of state of being in the airport.

(21) inqnatir-ə jaman-ec' odanavakayan
airplane-NOM arrive-PRV airport
'The airplane arrived at the airport.'

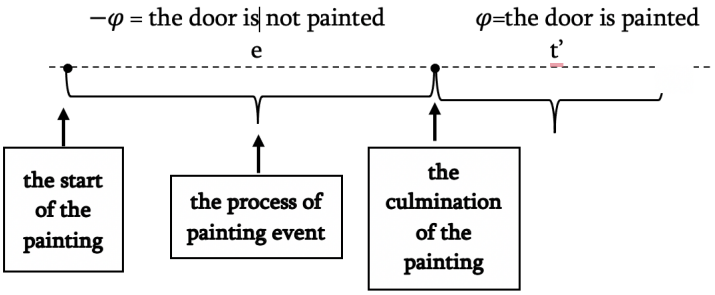
(22) Arriving event



In contrast, accomplishments denote an event that has a start, a process, and a culmination. The process includes all activities that lead to the culmination. The culmination, similar to the achievements, results in a change of state. For example, the event of painting the door in (23) can be pictured in (24): there is a time point when the event starts, some interval when the event is in progress, and the culmination. In this case, the state that has been changed as a result of the culmination is having a door being painted. By culmination here I refer to the natural endpoint of the event.

(23) Aram-ə dur-ə nerk-ec'
Aram-NOM door-ACC paint-PRV
'Aram painted the door.'

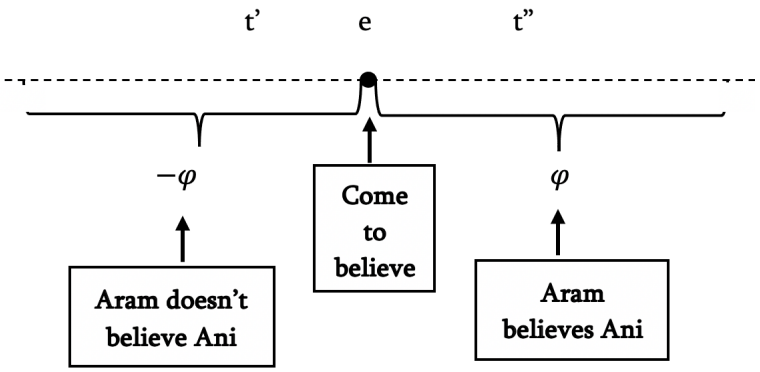
(24) Painting event



Based on the description of statives above, I argue that Armenian statives in the -c' perfective have the same pattern as achievements and accomplishments described in (22) and (24). The statives such as *havatal* (to believe), *unenal* (to own), *imanal* (to know), etc, with the *-c'* particle are achievement-like and denote an event that doesn't have a process as part of the event. For example, (25) means that there is a time interval t' preceding the event e, and in t' Aram didn't believe Ani. The state of not believing Ani is changed as soon as Aram comes to believe Ani.

(25) Aram-ə havata-c' Ani-i asac-ner-in
Aram-NOM believe-PRV Ani-GEN say-PL-DAT
'Aram came to believe what Ani says'

(26) *Believe-like* statives

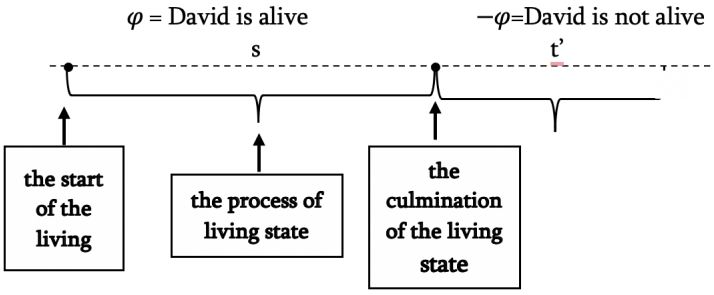


Statives such as *aprel* (to live), *sirel* (to love), *atel* (to hate) in *-c'* perfective have durative reading, and they are similar to accomplishments. For example, (27) means there was an interval where the event of David living in Yerevan is true, but the same doesn't hold for now. Furthermore, without any modification (27) triggers a cessation implicature. Such implicature is triggered by the natural endpoint (i.e., the culmination) of the state of living, which is death.

(27) David-ə Yerevan-um apre-c'
David-NOM Yerevan-LOC live-PRV
'David lived in Yerevan'

It is worth mentioning, that the type of the cessation implicature in the case of *-c'* perfective is different from the cessation implicature or *Lifetime Effect* (see Enç (1987), Altshuler (2016)) observed in the case of past imperfective. As shown in (17) and (18) the cessation implicature is possible to cancel in the case of the past imperfective, but it is not cancellable in the case of the *-c'* perfective.

(28) *Live-like* statives



I propose that this cut between the *believe*-like statives and *live*-like statives arises because of their internal structure. *Believe*-like statives are homogeneous eventualities in the sense that they don't involve different sub-events or actions in them. *Live*-like statives have a more complex inner structure in the sense that they involve different types of activities in them. For example, *to live* includes different types of activities such as washing every morning, doing groceries, saying "hello" to neighbors, and so on. Contrary, *to believe* doesn't include different activities while the state of believing holds. Based on this difference between stative verbs, the homogeneous statives get the inchoative interpretation, which makes them achievement-like, while non-homogeneous statives, due to the inner complexity, get a durative interpretation and behave like accomplishments.

This phenomenon is lexicalized in Armenian and shows up in the verb-multiplication test. In Armenian verb multiplication is used to describe a situation, where there were attempts to accomplish something, but didn't succeed to do so. For example, a speaker of Armenian can utter the sentence in (29) describing a situation where Aram tried to paint the door but didn't paint it. The sentence in (29) is true if Aram did some door-painting-related activities, such as getting the brush and color and painting a relatively small part of the door, but didn't paint the door completely. In other words, the verb multiplication is used to refer to subactivities of the event. Importantly, the verb multiplication is not possible in the case of achievements as illustrated in (30). This difference between accomplishments and achievements is based on their inner complexity, i.e., whether it is possible to identify subactivities of the event or not. Since achievements don't have such subactivities then verb-multiplication is infelicities for achievements.

(29) Aram-ə dur-ə nerke-c' nerke-c' bayc minchev verg ch-nerke-c'
Aram-NOM door-ACC paint-PRV paint-PRV but till end NOT-paint-PRV
'Aram painted, painted the door, but didn't finish painting it'

(30) *Aram-ə jaman-ec' jaman-ec', bayc ch-jaman-ec'
Aram-NOM arrive-PRV arrive-PRV, but NOT-arrive-PRV
Intended:'Aram arrived, arrived, but didn't arrive'

A similar pattern holds for homogeneous and non-homogeneous statives. In the case of non-homogeneous statives, it is possible to multiply the verb to describe a state that didn't reach its culmination or natural endpoint. For example, Aram's temporary residence in Yerevan can be elucidated through the use of the verb multiplication ilustrated in (31). Contrarily, the same technique is not felicitous for homogeneous statives (cf (31)) and (32).[6] In sum, the verb multi-

[6]Concerning momentarily and durative interpretations, some verbs get only momentarily reading within the per-

plication can be used only if the eventuality has identifiable subactivities, such as accomplishments and non-homogeneous statives, and it is infelicities with achievements and homogeneous statives that lack subactivities.

(31) Aram-ə apre-c' apre-c' Yerevan-um, bayc erku taruc gna-c Gyumri
Aram-NOM live-PRV live-PRV Yerevan-LOC, but two year:ABL go-PRV
'Aram lived, lived in Yerevan but moved to Gyumri after two years'

(32) *Aram-ə havata-c' havata-c' Ani-in, bayc ch-havata-c'
Aram-NOM believe-PRV believe-PRV Ani-DAT, but NEG-believe- PRV
Intended:'Aram believed, believed Ani, but didn't believe her.'

In the next subsection, I will present evidence that the *-c'* particle in Armenian also encodes a change-of-state meaning.

3.1. Transition to a new state

As it has been proposed by Tenny (2000), an adverbial such as *in an hour*, is a completive adverb and can be used for completed events. It measures the length of the interval that ends with the completion of the event. An adverbial *for an hour* is durative and it interacts with the event structure. Based on this generalization *in an hour/ for an hour* modification test is one of the common tests for telicity. In many languages *for an hour* (or the equivalent of it) is only felicitous with durative VPs in the perfective aspect and not with the punctual (telic) VPs. For example in English *for an hour* can modify a durative VP as *to dance*, but it is odd with a punctual VP as *to arrive* (cf (33) and (34)).

(33) Dave danced for an hour.

(34) *Dave arrived for an hour.

In general, telic accomplishment VPs are not felicitous with the *for an hour* modification in the perfective aspect. The *for an hour* modification becomes possible for telic accomplishment VPs in the perfective only if they are coerced into an atelic reading. For example, (35) is interpreted as 'Dave did some house-building activities for an hour'.

(35) ?Dave built a house for an hour.

In contrast, in Armenian, the *for an hour* modification is felicitous with both achievement and accomplishment VPs in the *-c'* perfective.[7] However, *for an hour* doesn't measure the duration of the event, but the length of the resulting state that has been caused by the event. For example, (36) can be understood as follows: after arriving at the airport the airplane enters the state of being in the airport and that state holds an hour, after an hour the airplane leaves. Similarly, in (37) the house that Aram built lasted an hour and after an hour it was destroyed.

(36) Inqnatirə mi jam-ov jaman-ec' odanavakayan
Airplane a hour-INS arrive-PRV airport
Means:'The airplane arrived and after an hour it left.'

fective aspect, such as *to believe, to know, to think, to own* etc., and verbs that get only the durative interpretation, such as *to live*. Verbs like *to love, to hate* can get both interpretations.

[7]Because of the page limit, I will not discuss the *in an hour* modification here.

(37) Ara-n mi jam-ov tun/tun-ə karuc'-ec'
Ara-NOM a hour-INS house/house-DEF build-PRV
Means: 'Aram built a house that lasted an hour.'

The same intuition holds for statives in the *-c'* perfective. In (38) the state of believing Ani lasted an hour, and after an hour Aram stopped believing her. In (39) Aram's residence in Yerevan lasted only an hour, after an hour he moved out of the city.

(38) Aram-ə mi jam-ov havat-ac' Ani-i asac-ner-in
Aram-NOM a hour-INS believe-PRV Ani-GEN say-PL-DAT
'Aram believed what Ani says for an hour (and after an hour he no longer believes her)'

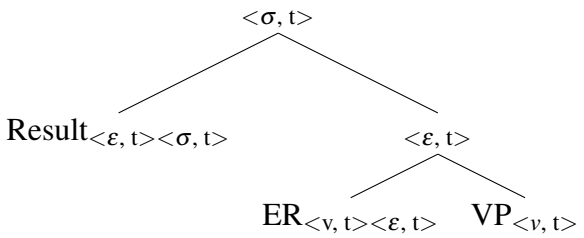
(39) Aram-ə mi jam-ov apre-c' Yerevan-um
Aram-NOM a hour-INS live-PRV Yerevan-LOC
Means: 'Aram came to Yerevan, lived there an hour, and left after an hour'

In sum, the *-c'* perfective in Armenian allows *for an hour* modification, where it measures the length of the result state of the event. This leads us to claim that the transition to a new state or a resulting state is something that is part of the meaning of the *-c'* perfective in Armenian.

4. Proposal

Summing up the pattern observed in the Armenian *-c'* perfective there are two things to highlight. First, the *-c'* perfective in Armenian reflects on the inner structure of the eventuality. If the event or state is homogeneous then they get momentarily or inchoative reading, and if they are non-homogeneous then they get durative interpretation. The cancellation of the culmination isn't possible for the first group of eventualities, but it is possible for the second group of eventualities. Second, the *-c'* perfective in Armenian has a result state requirement that is part of its meaning. A successful theory for the *-c'* perfective in Armenian needs to reflect on these two important generalizations. I propose that perfective in Armenian is the realization of two operators called *ER* (Event Relation) and *Result*. With the *ER* operator I aim to capture the differences between the events that have process as part of them and events that don't have process. The *Result* operator is for satisfying the result state requirement of the *-c'* perfective.

(40) Structural representation of perfective with two structural heads



ER is a relation between eventualities and events. It takes arguments of both state type (σ) and event type (ε) and maps both to a predicate of events (<ε, t>).[8] *ER* holds between an

[8]This also presupposes that for statives there is an additional "eventivization" in the *-c'* perfective and for the page limit I will not discuss it here. But as a short note, stative in the *-c'* perfective behave like events in Armenian and

eventuality (event or state)[9] e' and an event e iff either 1. e is the process of e' OR 2. e is transition into e'.

(41) $[[ER]] = \lambda\ P_{<v,\,t>}.\ \lambda e_{\varepsilon}.\ \exists e'[P(e')] = 1\ \&\ ER(e', e)$
   a. $ER(e', e)$ if either
      (i) e is the process for e'
      (ii) e is transition into e'

Achievements, as previously noted, denote a transition into a state. Similar to Rothstein, I assume that achievements don't have a process component, and the preparatory process isn't part of the event per se. Consequently, if e' is an achievement event, then *ER* will only ever relate e' to a transition event e into e' (41a-ii). Homogeneous statives, such as *to believe* and *to know*, within the *-c'* perfective also lack the process as a constituent of the event. Since these states do not have an identifiable process component, the only events that *ER* relates them to are transitions into those states. Contrarily, accomplishments and non-homogeneous states have the process as part of the eventuality itself. The *ER* operator can relate these kinds of evantualities to either their process componenets, (41a-i), or their transitions, (41a-ii). If e is a process component, then the resulting reading is a durative reading, but if e is a transition component, then it obtains a pure inchoative reading. The existence of the latter reading will be discussed below, as this is the claimed source for the culmination cancellation phenomenon. It is worth mentioning that the *ER* operator takes both event type and state type arguments and always outputs an event. This is why statives can be combined with the *ER* operator, resulting in an expression that always denotes an event.

Result is a relation between events and the result states, where the event causes the state s. In this paper, I adopt the concept of result states as proposed by Kamp and Reyle (1993), Parsons (1994), Tenny (2000), Rothstein (2008).

(42) $[[Result]] = \lambda\ P_{<\varepsilon,\,t>}.\ \lambda\ s_{\sigma}.\ \exists e.[P(e)] = 1 \&\ Result(e, s)$

A result state is defined as a relationship between events and their resulting states, where the event is the cause of the state. This connection between the event and the state is characterized as an inner or modal connection. For instance, consider the event of painting a door in the sentence "Aram painted a door." While the event may result in a state of fatigue for Aram, the actual result state of the event is the door being painted.

4.1. Deriving the pattern

Within this theory of perfective, the predicted denotation for an achievement event such as *to arrive* would be as presented in (43).[10] Applying the formal definition of two operators – *ER* and *Result*, – we get denotation for an event *to arrive* shown in (43a). Since achievements and homogeneous states don't have the process as part of the event itself then *ER*(e,e') is equivalent

they can be modified by manner adverbials or get an anaphoric reference by "it happened when..." (Maienborn (2005)), which are typically used to modify events, rather than states. This eventivization is not coercion, since it doesn't occur in other aspects and is typical only for the *-c'* perfective in Armenian.

[9]Here in addition to event type ε and state type σ, I use v as eventuality type.

[10]For simplification purposes I put aside tense and other parameters from the denotation.

to (41a-ii) where the event e is transitioned into e', ilustrated in (43b).

(43) Aram-ə jamane-c' odanavakayan
Aram-NOM arrive-PRV airport
'Aram arrived at the airport'
a. [[(43)]] = λ s_σ. $\exists$e. $\exists$ e'. Agent(e') = Aram & Goal(e') = airport & Arrive(e') & ER(e', e) & Result(e, s)
b. [[(43)]] = λ s_σ. $\exists$ e. $\exists$e'. Agent(e') = Aram & Goal(e') = airport & Arrive(e') & e is the transition into e' & Result(e, s)
c. for a state s, there is an event e that is a transition into an event of arriving e', Aram is the agent of the arriving event and the airport is the goal of that event, and the event e causes the result state s. This result state - the result of the transition into the event - is the state of having arrived.

In the case of the homogeneous states as *to believe*, similar to the achievements, the *ER* establishes the transition relation between the state of believing and e'. This is ilustrated in (44b).

(44) Aram-ə havata-c' Ani-in
Aram-NOM believe-PRV Ani-DAT
'Aram come to believe Ani'
a. [[(44)]] = λ s_σ. $\exists$e. $\exists$ e'. Experiencer(e') = Aram & Theme(e') = Ani & Believe(e') & & ER(e', e) & Result(e, s)
b. [[(44)]] = λ s_σ. $\exists$ e. $\exists$ e'. Experiencer(e') = Aram & Theme(e') = Ani & Believe(e') & e is the transition into e' & Result(e, s)
c. for a state s, there is an event e that is a transition into a state of believing e' Aram is the experiencer of the believing state and Ani is the theme of that state, and the event e causes the result state s. This result state - the result of the transition into the state - is the state itself.

The predicted denotation for an accomplishment *to paint* in *-c'* perfective is demonstrated in (45). The truth condition of (45) within the semantics of -c' perfective developed above will be as in (45a). In this case *ER*(e, e') holds if either e is a transition into e' or e is the process of e'. I assume that in cases where e could either be a transition or a process, there is a preference for e to be construed as a process. This is reflected in the relative orderings of the disjuncts in (41a-i) and (41a-ii). So the relation between the event e and the eventuality e' in this case will be (41a-i), where e is the process of e'.

(45) Aram-ə dur-ə nerke-c'
Aram-NOM door-ACC paint-PRV
'Aram painted the door '
a. [[(45)]] = λs_σ. $\exists$ e. $\exists$ e'. Agent(e') = Aram & Theme(e') = door& Paint(e') & & ER(e', e) & Result(e, s)
b. [[(45)]] =λs_σ. $\exists$ e. $\exists$ e'. Agent(e') = Aram & Theme(e') = door & Paint(e') & e is the process of e' & Result(e, s)
c. for a state s, there is an event e that is the process of an event of painting e', Aram is the agent of the painting event and the door is the theme of that event, and the event e causes the result state s. This result state - the result of the process - is the state of having the door painted.

Similarly, in the case of the non-homogeneous states as *to love* there is a preference for the state of loving to be a process of e'. The denotation of a state *to love* in the *-c'* perfective is given in (46).

(46) Aram-ə sire-c' Ani-in
Aram-NOM love-PRV Ani-DAT
'Aram loved Ani .'
a. [[(46)]] = λ s_σ. $\exists$e. $\exists$ e'. Experiencer(e') = Aram & Patient(e') = Ani & Love(e') & ER(e', e) & Result(e, s)
b. [[(46)]] = λs_σ. $\exists$e. $\exists$e'. Experiencer(e') = Aram & Patient(e') = Ani & Love(e') & e is the process of e' & Result(e, s)
c. for a state s, there is an event e that is the process of a state of love e', Aram is the experiencer of the love state and Ani is the patient of that state, and the event e causes the result state s. This result state- the result of the process - is the state of not loving.

Given this semantics, when the culmination of an event is 'canceled' in Armenian, what is denied is the result state of the process. For example, to say "Aram painted the door but didn't paint it completely" with the -c' perfective means that there isn't a state of the door being painted as a result of Aram's painting.

(47) Aram-ə dur-ə nerke-c' bayc minchev verg ch-nerke-c'
Aram-NOM door-ACC paint-PRV but till end NOT-paint-PRV
'Aram painted the door but didn't paint it completely'

The statement "he didn't paint it completely" effectively adds to the asserted content the information that there is no result-state of the "process" component of e'. So adding this statement to the denotation of 'Aram painted the door' we get a contradiction as shown in (48a).

(48) [(47)] =λs_σ. $\exists$ e. $\exists$ e'. Agent(e') = Aram & Theme(e') = door& Paint(e') & & ER(e', e) & Result(e, s)
a. [[(47)]] = λs_σ. $\exists$ e. $\exists$ e'. Agent(e') = Aram & Theme(e') = door & Paint(e') & e is the process of e' & Result(e, s) & $\neg\exists$s: e is the process of e' & Result(e, s)

To consistently conjoin this with the general truth-conditions of (47), it must be that the event e that ER relates to e' is NOT the process component of e', but instead the *TRANSITION* into e'. Given that, the truth condition of the sentence in (47) will be (49a) and the result state asserted into the meaning of the sentence is the result of having transitioned into the event of painting the door.

(49) The revised semantics for (47)
a. [[(47)]] = λs_σ. $\exists$ e. $\exists$ e'. Agent(e') = Aram & Theme(e') = door & Paint(e') & e is transition into e' & Result(e, s)
b. for a state s, there is an event e that is transition into an event of painting e', Aram is the agent of the painting event and the door is the theme of that event, and the event e causes the result state s. This result state - the result of the transition into the event - the result of having transitioned into the event of painting the door.

The issue at hand is the question as to why, in instances of event cancellations, refers to the initial stage of the event, and not any other stage of the event. This phenomenon can be attributed

to its pragmatic implausibility. Due to the cancellation, there is a new result state and the event is the transition into that state. For example, in (49a) that is entering the process of painting the door. The most natural way of interpreting “entering the process/state of X” is to understand that the process/state has begun. So “entering the process of painting” in the example (47) means “the painting begun”. Nonetheless, the “begun state" is considered to have ended once a substantial portion, such as 90%, of the door has been painted. If we assert that the “begun state” still exists, it implies that a significant portion of the painting has not yet occurred.

The underlying idea of pragmatic implausibility in (47) aligns with Gracian’s theory of conversational implicature advocating against providing not enough information. Uttering the sentence in (47) in a case when the 80% or 90% of the door is painted can be seen as a violation of the Maxim of Quantity. To illustrate this, suppose Aram is building a house and he has to paint 5 doors for this house. Now consider a conversation between two person (52), that are discussing Aram’s work. In a scenario when Aram painted one door the response from Person B is reasonable. However, in a scenario where Aram already painted four doors out of five saying that Aram started to paint the doors is odd.

(50) Scenario 1: Aram painted one door out of five.

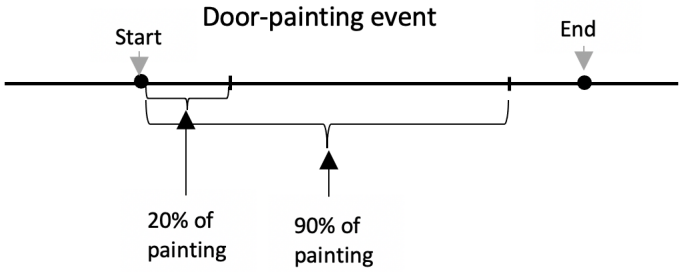
(51) Scenario 2: Aram painted four doors out of five.

(52) Person A: what does Aram do these days?
Person B: He started painting the doors ✓Scenario1, #Scenario2

The inadequacy of Person B’s response in Scenario 2 stems from the fact that when we use the term “started" (or “begun”) we intend to refer to a stage of the event that is proximate to its initial point and not to its final point. Suppose that Aram paints 5 doors in five days- one door each day. If we think about the initial point of this 5-door painting event as 0, then painting one door is closer to that initial point than having already 4 doors painted, i.e., $1 \approx 0$, but $4 \gtrapprox 0$. In the fourth day when he paints the fourth door he is closer to the final point of the event than the initial point, i.e., $4 \approx 5$.

Similarly, in the case of (47), if the 90% of the door is painted, then it is too far from the initial point of the event. When only 20% percent of the door is painted, then it is closer to the starting point of the event and far from the final point of the event.

(53) Schematic illustration of the pragmatics for (47)



Non-homogeneous statives follow the same pattern as accomplishment events in the case of the cancellation of the culmination inference. The statement “but didn’t love her till the end in (54) asserts that there is no result-state of the “process" component of e’.

(54) Aram-ə sire-c' Ani-in bayc ch-sire-c' minchev verj
Aram-NOM love-PRV Ani-DAT but NEG-love-PRV till end
'Aram loved Ani but didn't love till the end'
a. [[(54)]] = λ s_σ. $\exists$ e. $\exists$ e'. Experiencer(e') = Aram & Patient(e') = Ani & Love(e') & e is the process of e' & Result(e, s) & $\neg\exists$s: e is the process of e' & Result(e, s)

To puzzle out the contradiction ilustrated in (54a), the event e that ER relates to e' is the transition into e' and not the process. So, the revised truth-condition for the sentence (54) will be (55).

(55) [[(54)]] = λ s_σ. $\exists$ e. $\exists$ e'. Experiencer(e') = Aram & Patient(e') = Ani & Love(e') & e is transition into e' & Result(e, s)
a. for a state s, there is an event e that is transition into a state of loving e', Aram is the experiencer of the love and Ani is the patient of that state, and the event e causes the result state s. This result state - the result of the transition into the state - is the state itself.

For achievements and homogeneous statives, when we cancel the culmination, we essentially negate the existence of the resulting state that these events transition into. For example, cancellation of an arriving event in (43) is the negation of the existence of the state of having arrived. The event of arriving at the airport causes the state of being in the airport. If the state of being in the airport is canceled then the transition from not being in the airport to being in the airport is also canceled. This falsifies the transition relation, which raises contradiction. The same holds for the homogeneous states such as *to believe* ilustrated in (57).

(56) *Aram-ə jamane-c' odanavakayan bayc odanavakayan ch-hasav
Aram-NOM arrive-PRV airport but airport NOT-get:PRV
Intended: 'Aram arrived at the airport but didn't get there'
[(56)] = λs_σ. $\exists$ e. $\exists$ e'. Agent(e') = Aram & Goal(e') = Airport & Arrive(e') & e is transition into e' & Result(e, s)&$\neg\exists$s: e is transition into e' & Result(e,s)

(57) *Aram-ə havata-c' Ani-i asac-ner-in bayc minchev verg ch-havata-c'
*Aram-NOM believe-PRV Ani-GEN say-PL-DAT but till end NOT-believe-PRV
Intended:'Aram came to believe Ani, but didn't believe her completely'
[(57)] = λ s_σ. $\exists$ e. $\exists$ e'. Experiencer(e') = Aram & Theme(e') = Ani & Believe(e') & e is transition into e' & Result(e, s) & $\neg\exists$s: e is transition into e' & Result(e,s)

5. Conclusion

In this paper, I examined two phenomena connected to the perfective aspect in Armenian. The first phenomenon concerns its capacity to transform various types of verbs into achievement-like or accomplishment-like expressions based on their inner complexity. The second phenomenon pertains to the unique possibility of canceling the culmination inference for accomplishments and accomplishment-like states, which distinguishes Armenian from other languages that permit such cancellation. I presented an analytical framework that addresses how the Armenian perfective aspect distinguishes between eventualities based on their internal structure and elucidates the concept of canceling the culmination in the perfective.

This analysis also explains the difference between Armenian and languages like Hindi. First, it explains why the attempt to cancel the culmination inference of an accomplished VP gets different interpretations in Hindi and Armenian. Specifically, it addresses the question of why in Armenian the cancellation of the culmination leads to interpreting an event as it just started, while in Hindi the event is interpreted as almost finished. I propose that the source of this difference is whether the perfective requires the transition to a new state or not. In Armenian, it has such a requirement, and that requirement is encoded in the meaning of the *-c'* perfective. In Armenian the requirement of a result state comes from the semantics of *-c'* perfective, where that requirement assures the culmination of "some part" of the event - either the process, which yields a culmination entailment, or the transition, which yields that the event has only just begun. But in Hindi, the perfective doesn't have such a requirement. In Hindi and similar languages, the culmination of an event denoted by perfective is the natural endpoint of the event and not the result of the requirement of the new state. As proposed by Altshuler (2016) the cancellation of the culmination in Hindi, cancells the natural endpoint of the event and refers to a stage of the event that is close to that end. In Armenian, however, the cancellation of the culmination is a cancellation of the resulting state that is caused by the process of the event. After the cancellation of the result of the process, a new result state would be the result of the transition into that event, which pragmatically can refer only to the initial stages of the event.

Proposing that the *-c'* perfective has the result state as part of its meaning raises the question of whether it is truly the perfective aspect in EA and why it is not a kind of perfect. I leave this question open here and adress it to my future works. Meanwhile as a short note, there are couple of differences between the *-c'* perfective and the perfect *-el* in Armenian. The difference between them related to their compatibility with the present tense and evidentiality. Unlike the *-el* perfect, the -c' perfective is not compatible with the present tense in Armenian, but it is compatible with the direct evidence.

Additionally, this paper explains why in Armenian perfective can take both eventive and stative VP arguments, while in Hindi perfective can't take statives productively. The Armenian *-c'* perfective is "blind" with respect to the semantic type of the VP that it is combined with. What is relevant for the *-c'* perfective is the inner structure of the eventuality denoted by the VP. Contrarily, in Hindi perfective is restricted by the semantic type of the VP – it can combine with events. The combination with statives in Hindi is possible only if the state gets inchoative interpretation.

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Ideophones as iconic mixed items[1]

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Abstract. Ideophones such as the German *plitsch platsch* 'splish splash', *holterdipolter* 'helter-skelter' and *ratzfatz* 'very quickly, fast' have long been considered exceptions to the rule of arbitrariness in natural language. However, they have been argued to be a near universal feature of language (cf. Diffloth, 1972; Kilian-Hatz, 1999) and with the increased interest in the meaning contributions of iconic forms (cf. Ebert et al. (2020); Esipova (2019); Schlenker (2018b, a) among others), this article aims to contribute to the growing literature on iconicity and meaning by presenting an analysis of ideophones as "iconic mixed items", combining both descriptive and depictive meaning, similar to the expressive mixed items discussed by McCready (2010); Gutzmann (2011).

Keywords: ideophones, mixed items, at-issueness, iconicity, German.

1. Introduction

In recent years, there has been a growing interest in the meaning contributions of iconic enrichments in spoken languages, much of this focussed on the at-issue status of iconic co-speech gestures (see Ebert et al. (2020); Esipova (2019); Schlenker (2018b, a) among others). The research discussed here expands upon this work on gestures by looking at the meaning contribution of a prominent iconic enrichment in spoken language; ideophones.

Dingemanse (2019: p.16) defines ideophones as "open lexical class of marked words that depict sensory imagery". In other words, ideophones are conventionalised words which are marked with respect to the morphophonology of the languages in which they occur, rely on "perceptual knowledge that derives from sensory perception of the environment and the body" (Dingemanse, 2013: p.655) and form an open class, with new ideophones being able to be added to this class via ideophonisation or ideophone creation. Most importantly, Dingemanse (2019) argues that ideophones depict rather than describe. This clearly refers back to the different communication types outlined by Clark and Gerrig (1990), with Dingemanse arguing that ideophones constitute a depictive rather than a descriptive act. Instead of interpreting a set of arbitrary signs according to a conventionalised linguistic system, as one must do with descriptive expressions, depictive expressions directly illustrate the events to which they refer. For example, the German ideophone *plitsch platsch* 'splish splash' in (1a) iconically depicts the wetness of the frog and how it produced different kinds of splashing sounds as it moved up the stairs. This is in contrast to the descriptive expression *mit einem platschenden Geräusch*, which gives a more arbitrary description of how the frog moved up the stairs.[2]

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[2]The expression *mit einem platschenden Geräusch* is not entirely arbitrary as *platschend* is derived from the ideophonic verb *platschen* and has some sound symbolic, iconic properties. However, it is not depictive in the same manner as a 'true' ideophone. See Section 4.1 for further discussion of depiciton in ideophones.

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(1) a. Der Frosch geht plitsch platsch die Treppe hoch.
the frog goes IDEO the stairs up
'The frog goes splish splash up the stairs.'
b. Der Frosch geht mit einem platschenden Geräusch die Treppe hoch.
the frog goes with a splashing sound the stairs up
'The frog goes up the stairs, making splashing sounds.'

Languages such as German and English have often been claimed to be ideophone poor, with languages such as Japanese, Quechua and the Bantu languages having a much larger range of ideophones encompassing a variety sensory categories. Nevertheless, ideophones have been argued to be a (near-)universal feature of human language (cf. Diffloth, 1972; Kilian-Hatz, 1999) and while Western European languages may not contain the same range of ideophones as other languages, ideophones certainly do exist in their lexicons (see Barnes et al. (2022) for a discussion of how ideophones in German fit the definition provided by Dingemanse (2019)).

Previous research into ideophones has predominantly focused on their crosslinguistic typology, sound symbolism and the semantic categories they can express with little to no formal semantic work on ideophones, notable exceptions being Henderson (2016); Kawahara (2020). However, the crosslinguistic literature on ideophones provides some clues as to their at-issue status. For example, Dingemanse (2017) describes properties for ideophones in Siwu, which seem to resemble those of non-at-issue content, particularly Pottsian supplements (cf. Potts, 2005). Dingemanse argues that the majority of ideophones in Siwu are not subject to negation, cannot be used in questions and provide new rather than backgrounded information. Similar properties have also been noted for ideophones in Japanese by Kita (1997, 2001) and Toratani (2018). Kita (1997, 2001) even argues for a mulitdimensional approach to ideophones in Japanese. He proposes that ideophones occur in the affecto-imagistic dimension, while other parts of speech occur in the analytic dimension. As logical negation only targets linguistic material in the analytic dimension, ideophones cannot be targeted by logical negation. This approach suggests that ideophones contribute information in a different manner to more arbitrary content and the parallels to the multidimensional analysis of at-issueness proposed by Potts (2005) are striking.

Barnes et al. (2022) conducted the first experimental work on the at-issue status of ideophones, with the results indicating that sentence-medial adverbial ideophones in German are less at-issue than equivalent standard adverbial expressions. The initial hypothesis was that the ideophones are less at-issue due to their depictive nature. Descriptive content is the primary means of communication in spoken language, with depictive content adding an additional layer and it is therefore likely that depictive content is generally subordinated compared to descriptive content. However, it appears that although such ideophones in German are default non-at-issue, this is not universally so. The experimental work was replicated on ideophones in Akan, a language where ideophones occur much more frequently and showed that adverbial ideophones in Akan are no less at-issue than standard adverbials (cf. Asiedu et al., 2023). This indicates that the non-at-issue status of German ideophones cannot be purely due to their depictive nature, as Akan ideophones are equally depictive. Dingemanse (2019) has in fact argued that ideophones combine iconic and arbitrary mappings. As the range of possible iconic meanings in a language is vast, ideophones represent socially mediated and conventionalised iconic meanings and are therefore distinct from other non-conventionalised iconic forms. In (2), *splish splash* clearly has the conventionalised meaning that water was involved and that splashing sounds

were made. While this conventionalised meaning appears to be somewhat vague, it still holds across all contexts for the ideophone and allows speakers to say when the ideophone is used appropriately or not.

(2) Bill went splish splash through the puddles!

In this article, I will therefore propose that the differing at-issue status of ideophones in German and Akan is due to the fact that these ideophones are *iconic mixed items*, containing both iconic depictive *and* conventionalised descriptive content, and that this descriptive content can be more or less at-issue, which in turn influences the overall at-issue status of ideophones. Ideophones are therefore similar to expressive mixed items such as *cur*, as discussed by McCready (2010); Gutzmann (2011), in that they contain two types of meaning. In this analysis, the descriptive meaning component of ideophones contributes the same meaning as arbitrary adverbials, namely event modification, while the second meaning component of ideophones is their depictive meaning. Here I follow Henderson (2016) and analyse the depictive meaning component as a demonstration (cf. Davidson, 2015), which stands in a similarity relation to the given referent.

This article is structured as follows: Section 2 will give the necessary background on expressive mixed items, in particular the diagnostics for said items proposed by Gutzmann (2011) and will discuss how these diagnostics apply to ideophones in German, demonstrating that these also appear to be mixed items. Section 3 will discuss the approaches of Davidson (2015) to quotation and Henderson (2016) to ideophones, upon which this approach builds, before outlining the proposed semantic analysis of ideophones in Section 4, discussing the modelling of both the descriptive and depictive components of the ideophone and how these combine. Section 5 will discuss how this approach can account for the at-issue status of adverbial ideophones in German and Akan, with Section 6 will concluding the article.

2. Mixed items

This section will first provide the necessary background on expressive mixed items, particularly the diagnostics for such items that were proposed by Gutzmann (2011), before turning to how these diagnostics can be applied to ideophones in German.

2.1. Expressive mixed items

Expressives provide information about the speaker's attitude or emotions towards a particular situation or a particular referent. Examples include, but are not limited to, epithets such as *damn*, *fucking* and slurs such as *bastard*. For example, *damn* in (3) could indicate that the speaker has a negative attitude towards the dog, potentially due to its barking, or perhaps that the speaker dislikes dogs in general, or that the speaker is annoyed by the situation in general.

(3) The damn dog barked all night long.

Expressives are generally considered *descriptively ineffable* (cf. Potts, 2007b). For example, speakers would struggle to define an expressive modifier such as *damn*, other than to say that

it is somewhat negative. However, given a sentence as in (3), speakers will be able to say that *damn* refers to the speaker's negative attitude towards the dog or the situation as a whole. Potts (2007b) also argues that expressives such as *damn* are non-at-issue. In (4), the main assertion that the dog barked all night can be directly denied, as in (4b), whereas *damn* cannot be directly denied, as in (4c), but instead must be targeted by a discourse interrupting interjection, as in (4d).

(4) a. A: The damn dog barked all night long.
b. B: No, it didn't it! It only barked for 10 minutes!
c. #B': No, you like the dog!
d. B": Hey, wait a minute! You like that dog!

However, there do appear to be cases where expressives must be at least partially at-issue. For example, in (5), *bastard* must be somewhat at-issue in order for the sentence to be well-formed and interpretable.

(5) The bastard parked his car over my driveway.

In his seminal work on at-issueness and conventional implicatures, Potts (2005) argued that an atomic linguistic expression cannot contribute both at-issue and conventional implicature, or non-at-issue, content. Hence in Potts' framework, expressions must be either fully at-issue or non-at-issue. This would then suggest that in (5), *bastard* must be fully at-issue. However, McCready (2010) and Gutzmann (2011) have both argued for the existence of expressions that contain both at-issue descriptive and non-at-issue expressive content, or so called 'mixed items'. In this approach, *bastard* in (5) would contain descriptive at-issue content referencing a unique, salient individual in the context and the expressive content denoting the speaker's negative emotions. Some examples of expressive mixed items in German are given below:

(6) a. *Köter* 'cur, mutt'
AT-ISSUE: given individual is a dog.
EXPRESSIVE: the speaker has a negative attitude towards dogs, a particular dog, etc.
b. *Bulle* 'cop'
AT-ISSUE: given individual is a police officer.
EXPRESSIVE: negative attitude towards police, etc.
c. *Tussi* 'bimbo'
AT-ISSUE: given individual is a girl.
EXPRESSIVE: negative attitude towards said individual.
(Gutzmann, 2011: p.131)

Gutzmann (2011) argues that there are two distinct meaning components within these mixed items, an at-issue descriptive component and a non-at-issue expressive one, and that such mixed expressives cannot be analysed by assuming that the expressive content is contained within the descriptive meaning. Firstly, he argues that the sentences as in (7a) and (7b) have the same descriptive content and, from a descriptive standpoint, would be true in the same situations, namely those in which a unique, salient dog barked all night long. However, (7a) contributes additional, expressive meaning that is missing from (7b), namely the speaker's negative attitude. If *cur* were therefore to be substituted by *dog* then this expressive content would be lost.

Hence Gutzmann (2011) argues that this expressive meaning cannot be part of *cur*'s descriptive content.

(7) a. The cur barked all night long!
b. The dog barked all night long!

Gutzmann (2011) furthermore illustrates the two dimensions of meaning in mixed expressives using the outdated racist slur *Boche* 'German'. While it is possible to directly deny the assertion that Lessing was German, as in (8a), it is not possible to directly target the expressive content of a negative attitude towards Germans, cf. (8c), but instead this must be targeted using a discourse interrupting interjection, as in (8d).

(8) a. A: Lessing was a Boche.
b. B: No, he was not a German.
c. B': # No, I like Germans!
d. B": Hey, wait a minute! I like Germans!
(Gutzmann, 2011: p.133)

This indicates that the descriptive content of *Boche* is at-issue, while the negative attitude is non-at-issue. Hence Gutzmann (2011) argues again that the negative attitude cannot be part of *Boche*'s descriptive meaning. The two meaning components must be in different dimensions; the at-issue descriptive dimension and the non-at-issue expressive dimension. As it is not possible for a single meaning component to have two different levels of at-issueness, there must be two components here.

Finally, Gutzmann (2011) shows that the expressive component of such mixed items cannot be displaced. In (9), the speaker cannot call Daniel a *Boche* and then immediately follow this by stating that they like Germans today. This is because the expressive content of *Boche* is bound to the utterance time, meaning that the speaker commits themselves to not liking Germans at the utterance time through their use of *Boche*. The descriptive content on the other hand, is not utterance bound; it is possible that the property of being German can hold of a past time only.

(9) Daniel was a Boche. # But today, I like Germans.

Given these properties of expressive mixed items, I now turn to ideophones in German and discuss how these diagnostics apply to them, arguing that ideophones can also be viewed as mixed items, but instead of combining expressive and descriptive meaning, they combine *depictive* and descriptive meaning.

2.2. Ideophones as mixed items

As previously discussed, this analysis argues for two meaning components in ideophones; one descriptive and one depictive. I therefore argue that ideophones are mixed items due to the fact that they contribute two different meaning components. This is somewhat distinct to how both Gutzmann (2011); McCready (2010) used mixed item to refer to the fact that such expressives contribute meaning in two different at-issue dimensions, although as we will see, the descriptive and depictive meaning components of ideophones can have differing degrees of at-issueness.

Turning now to the two meaning components themselves, we can see that when comparing a sentence with a German adverbial ideophone to one with an adverbial equivalent, it is clear that the ideophone contributes additional meaning alongside its descriptive meaning. While for the mixed expressives, this meaning was expressive, for ideophones it is depictive. If we disregard at-issueness[3], then when an arbitrary equivalent substitutes an adverbial ideophone, it results in near identical descriptive content, as can be seen in (10).

(10) a. Peter rennt holterdipolter die Treppe runter!
Peter runs IDEO the stairs down
'Peter runs helterskelter down the stairs!'
b. Peter rennt laut und chaotisch die Treppe runter!
Peter runs loudly and chaotically the stairs down
'Peter runs loudly and chaotically down the stairs!'

Here (10a) and (10b) could be used to describe the same situation of an individual running loudly and chaotically down the stairs and would contribute very similar descriptive meaning with regards to the manner in which the individual did so. However, the ideophone *holterdipolter* in (10a) contributes additional depictive meaning about the event of running down the stairs. Hence, were *holterdipolter* to be substituted with *laut und chaotisch* then this depictive component would be lost.

This example also illustrates that German ideophones too appear to be somewhat descriptively ineffable. Although *laut und chaotisch* has roughly the same meaning as *holterdipolter*, it is difficult to exactly paraphrase the ideophone using standard adverbials. It seems that the descriptive content of ideophones is somewhat vague, although this is not necessarily a crosslinguistic property, but may be more specific to German ideophones. Although not directly discussed by Gutzmann (2011), descriptive ineffability seems to apply somewhat differently to mixed expressives. The descriptive content of *cur* in (11) is not in any way ambiguous, it refers to a unique, salient dog. The expressive content is, however, more vague. It is clear that the speaker probably dislikes this dog and maybe dogs in general, but it is also possible that the expressive meaning refers to the situation overall, i.e. the speaker is annoyed that they couldn't sleep because the dog was barking. As such, it is hard to say exactly what the expressive meaning of *cur* is and, similarly to the depictive content of ideophones, it appears to vary from utterance context to context.

(11) The cur barked all night long!

Complex ideophone predicates, such as *macht plitsch platsch* 'makes splish splash' also contribute additional depictive content when compared to non-ideophonic equivalents. (12a) and (12b) again make similar descriptive contributions, but *plitsch platsch* adds an additional depictive component that is not present in the more arbitrary *laut platschende Geräusche*.[4] Substitution here would again result in the loss of the depictive component.

[3]Here we are discussing overall meaning contributions and not distinguishing between at-issue and non-at-issue content.

[4]It is worth noting, however that this expression is not entirely arbitrary. The adjective *platschend* is derived from the verb *platschen*, which is an ideophonic verb and is almost definitely the origin for *plitsch platsch*. Nevertheless, the expression is clearly much less depictive than *plitsch platsch*.

(12) a. Ein Frosch macht plitsch platsch im Garten.
a frog makes IDEO in the garden
'A frog goes splish splash in the garden.'
b. Ein Frosch macht laut platschende Geräusche im Garten.
a frog makes loud splashing noises in the garden
'A frog makes loud splashing noises in the garden.'

Such complex ideophone predicates are even more similar to expressive mixed items as their descriptive and depictive components have different levels of at-issueness. For example, in (13), the descriptive meaning of *macht plitsch platsch*, namely that the frog made splashing sounds, can be directly denied, as in (13b), indicating that this component is at-issue. However, the depictive meaning cannot be directly targeted, cf. (13c), but instead must be addressed via a discourse interrupting interjection, as in (13d), indicating that this is non-at-issue. As with the mixed expressive *Boche*, the differing at-issue status shows that the meaning components must be distinct from one another.

(13) a. Ein Frosch macht plitsch platsch im Garten.
a frog makes IDEO in the garden
'A frog goes splish splash in the garden.'
b. Nein, das stimmt nicht. Man hört kein Platschen im Garten.
no that is right not one hears no splashing in the garden
'No, thats not true. I can't hear any splashing in the garden!'
c. #Nein, das stimmt nicht. Es hört sich ganz anders an!
no that is right not it sounds REFL completely different PREP
'No, thats not true. It sounds completely different!'
d. Hey warte mal! Es hört sich ganz anders an!
hey wait once it sounds REFL completely different PREP
'Hey wait a minute! It sounds completely different!'

Due to the default non-at-issue status of adverbial ideophones in German, the direct denial test is not as easy to apply. Nevertheless, it does appear possible to target the descriptive and depictive components of adverbial ideophones separately using a discourse interrupting interjection. In (14), *holterdipolter* is non-at-issue and hence its descriptive contribution cannot be targeted directly, cf. (14b), but can be denied if the speaker uses a discourse interrupting interjection, cf. (14c).

(14) a. Peter geht die Treppe holterdipolter runter.
Peter goes the stairs IDEO down
'Peter is going helterskelter down the stairs.'
b. #Nein, das stimmt nicht. Er geht doch völlig geordnet runter.
No that is right not he goes but completely orderly down
'No, that's not true. He's going down in a completely calm way.'
c. Hey, warte mal. Peter geht doch völlig geordnet runter.
hey wait once Peter goes but completely orderly down
'Hey wait a minute. Peter's going down in a completely calm way.'

The depictive content of *holterdipolter* is also non-at-issue here and as such, cannot be directly targeted, cf. (15b). It does appear that the depictive component may be targeted with a discourse interrupting interjection, as in (15c), however, this denial does not appear as acceptable as the

denial in (13d). There are a few potential reasons for this, which are not mutually exclusive. Firstly, we have seen that the depictive content of ideophones is somewhat hard to define and is almost entirely based on context, as such it is somewhat difficult to pick out what part of the depictive content could be denied. Secondly, the construction in (13a) highlights the depiction of sound via *plitsch platsch* and therefore it is easier for a speaker to deny the sound emission component of the ideophone. Finally, it also seems likely that *plitsch platsch* is more clearly depictive of sound than *holterdipolter*, which would also make the denial easier.

(15) a. Peter geht die Treppe holterdipolter runter.
Peter goes the stairs IDEO down
'Peter is going helterskelter down the stairs.'
b. #Nein, das stimmt nicht. Es hört sich ganz anders an!
no that is right not it sounds REFL completely different PREP
'No, thats not true. It sounds completely different!'
c. (?) Hey warte mal! Es hört sich ganz anders an!
hey wait once it sounds REFL completely different PREP
'Hey wait a minute! It sounds completely different!'

The third example by Gutzmann (2011) concerned the utterance bound nature of expressive content. However, it is not immediately clear if this property also applies to depictive content in ideophones. Perspective does appear to play role in ideophones, potentially due to their depictive nature and this could have an impact on how and when speakers can use ideophones. For example, it seems strange for the speaker to use *helterskelter* while also asserting that they did not witness the event. As this issue is rather complex and not immediately comparable to the non-displaceability of expressives, it will not be discussed further here.

(16) Peter ging die Treppe holterdipolter runter. ?? Ich habe ihn gar nicht
Peter went the stairs IDEO down I have him absolutely not
gesehen, aber er ging sicher holterdipolter runter.
seen but he went surely IDEO down
'Peter went helterskelter down the stairs. I didn't see him, but he definitely went down them helterskelter.'

The examples discussed above indicate that adverbial ideophones occurring alone and in complex predicate structures have a depictive component, which adds additional meaning on top of their descriptive meaning component, and can be targeted separately to this descriptive meaning in discourse. Having established that ideophones can be considered iconic mixed items, I now turn to how to semantically model these two meaning components, starting by outlining previous approaches to ideophones which I adapt within my analysis.

3. Previous approaches: Quotations and ideophones as demonstrations

In order to model the depictive content of ideophones, I draw upon the demonstration based account provided by Henderson (2016) for ideophones in Tseltal. Davidson (2015) originally proposed *demonstrations* as a means of modelling spoken language quotation, but as we will see, they can be used to model a range of iconic phenomena. I will therefore first give a brief outline of Davidson's approach to quotation in order to provide the necessary background both

to understand Henderson's (2016) analysis of ideophones, as well as my proposal. I will then outline the analysis given by Henderson (2016) for ideophones in Tseltal.

3.1. Davidson (2015)

Davidson (2015) follows Clark and Gerrig (1990) and models quotations as demonstrations, whereby speakers do not simply give verbatim repetitions of speech, but instead perform utterances using a range of mulitmodal linguistic resources, such as inflection, prosody, facial expressions and gestures in order to imitate the full speech report and not just what was said. For example, in (17), it is clear that the speech reported in (17a) is intended as a performance of how Bob was scared when he saw the spider, while in (17b) and (17c), we are clearly not supposed to understand the quoted speech as verbatim speech reports, but rather as an overall demonstration of how Bob and the cat acted in their respective situations.

(17) a. Bob saw the spider and was like "ahhh!"$_{\text{SCARED}}$
b. Bob saw the spider and was like "I can't kill it!"
c. My cat was like "feed me!"
(Davidson, 2015: 485)

In order to model these performances, Davidson (2015) introduces a new type into the ontology, demonstrations d. Davidson argues that demonstrations can be considered a superset of the linguistic objects of type u introduced by Potts (2007a). Davidson (2015), however, argues that d is somewhat more flexible than Potts' linguistic objects, allowing "for more natural language data beyond the words used" (p.486).[5] Furthermore, Davidson (2015) introduces the predicate *demonstration-of*, which takes demonstrations and events as its arguments. She provides the following definition of the *demonstration-of* predicate:

(18) A demonstration d is a *demonstration of* e (i.e. demonstration*(d, e)* holds) if d reproduces properties of e and those properties are relevant in the context of speech.
(Davidson, 2015: p.487)

Properties that the demonstration can reproduce include, but are not limited to words, intonation, facial expressions and gestures. *demonstration-of* is purposefully underspecified in order to allow for the varieties of ways that a speaker may choose to reproduce the original speech event.

In English, the *demonstration-of* predicate is lexicalised via the expression *be like*:

(19) $[\![\text{like}]\!] = \lambda d \lambda e[\text{demonstration}(d,e)]$

As such, the quoted clause "I'm happy" in an utterance such as (20) can be analysed as in (21).

(20) John was like "I'm happy"

(21) $[\![\text{"I'm happy"}]\!] = d_1$
$[\![\text{like}]\!] = \lambda d.\lambda e.\text{demonstration}(d,e)$
$[\![\text{like "I'm happy"}]\!] = [\lambda d.\lambda e.\text{demonstration}(d,e)](d_1)$

[5]It should be noted that Potts (2007a) does briefly discuss how his system could be extended to non-linguistic quotations, such as the sound of a machine gun. However, he does not go into any further detail on this.

$= \lambda e.\text{demonstration}(d_1, e)$
$[\![\text{John was like "I'm happy"}]\!] = \exists e.[\text{agent}(e, \text{John}) \wedge \text{demonstration}(d_1, e)]$

The demonstrated event is therefore the act of John saying "I'm happy", which is reported by the demonstration d_1, with the *be like* construction licensing this demonstration.

Having now given the necessary background on Davidson (2015), we can turn to Henderson (2016), who adapts Davidson's approach in order to analyse ideophones in Tseltal.

3.2. Henderson (2016)

The basic ideophone construction in Tseltal is the ideophone stem combined with the reported speech particle *chi*. Henderson (2016), however, argues that using an ideophone is not simply a case of quoting the ideophone stem, but rather that ideophones are a distinct lexical class in Tseltal, with this construction being a unique type of ideophone demonstration that can be analysed using compositional semantics just as other expressions in the language can also be.

Henderson (2016) formalises the analysis proposed by Davidson (2015), defining type d as a subtype of ε, the type of events, and assumes that just as the domain of events is connected to the domains of individuals and times via θ-roles, demonstrations are also connected to their participants via θ-roles.

Henderson (2016) then analyses ideophone stems as predicates of events, i.e. $\lambda e.\text{IDEO}(e)$ and introduces the IDEO-DEMO operator, which forms the core of the analysis. This operator selects for ideophone stems in the syntax and semantically returns an expression that can be embedded under the verb *chi* 'to say'. The operator takes "takes a linguistic expression (here always an ideophone stem denoting a predicate of events) and derives a relation between demonstrations and events" (Henderson, 2016: p.673).

(22) IDEO-DEMO: $\lambda u \lambda d \lambda e[\text{TH}_\delta(d) = u \wedge \text{STRUC-SIM}_{\llcorner u \lrcorner}(d, e)]$

More specifically, this operator takes the utterance of the ideophone, as a linguistic object, to be the theme of the demonstration event, with the demonstration then standing in a similarity relation to the demonstrated event. Unlike Davidson (2015), Henderson chooses not to underspecify the similarity relation between the demonstration event and demonstrated event, instead proposing the $\text{STRUC-SIM}_{\llcorner u \lrcorner}$ relation to connect the ideophone demonstration to the event, with the corner brackets, as in $\llcorner u \lrcorner$, denoting the semantic content of the linguistic object u. The basis of this relation is that the demonstration event is structurally similar to the demonstrated event. $\text{STRUC-SIM}_{\llcorner u \lrcorner}$ essentially requires that the demonstrated event must be partitionable into a set of subevents P, so that all subevents satisfy the lexical definition of the ideophone, the cardinality of the atomic parts of the demonstration event must be equal to or less than the cardinality of P, and there must be a temporal similarity between the partition and the atomic parts of the demonstration event.

Henderson (2016) therefore proposes the analysis in (24) for the sentence in (23).

(23) Tsok' x-chi-∅ ta mantekat
IDEO say in lard
'It goes "tsok' " in the lard.'

(24) $\exists e[\text{AG}(e) = x_1 \wedge \text{TH}_\delta(d_{13}) = \text{tsok'} \wedge \text{STRUC-SIM}_{\llcorner tsok' \lrcorner}(d_{13}, e) \wedge \text{LOC}(e) = \sigma x[\text{LARD}(x)]]$

The truth conditions for (23) can then be given as follows:

- there is an event e that takes place in the lard and the agent is x_1 (an individual given by the context or variable assignment).
- the demonstration event has the linguistic object *tsok'* as its theme.
- the demonstration event is structurally similar to e:
  - As d_{13} is an atomic event, e must also be partionable into an atomic event (trivial partition).
  - e must satisfy the predicate. In this case, the predicate is derived from the linguistic object *tsok'*, as in $\llcorner$tsok'$\lrcorner = \lambda e[\text{TSOK'}(e)]$. e must therefore be an event of frying sound emission.

Having now provided the necessary background, I will move on to my proposal for modelling the meaning of ideophones. Although this draws from both Davidson (2015) and Henderson (2016), there are several important differences, which I argue provide a better model of ideophonic meaning.

4. Modelling meaning in ideophones

In this section, I will first discuss the depictive meaning component of ideophones, before moving on to the descriptive meaning component of ideophones and how this combines with the depictive component in order to give an analysis for the overall meaning contribution of ideophones.

4.1. Depictive content

In this analysis, the depictive content of the ideophone is modelled as a demonstration, per Davidson (2015). Dingemanse et al. (2016) argue that ideophones are not depictive purely because they are sound-symbolic, but rather a range of utterance level factors such as prosody, intonation, reduplication and so on contribute to how the ideophone depicts. I propose therefore that ideophones are iconic at the utterance level and that the main property which makes them depictive is that the context and manner in which they are uttered will impact upon the way that their iconicity is interpreted. As such, their iconicity can vary from context to context, depending on when and how exactly they are uttered. For example, if a speaker utters *splish splash* in a monotone with a slow reduplication in (25), the depicted event is taken to be one where Bill walks slowly through the puddles, perhaps in a depressed manner. Whereas if the speaker reduplicates *splish splash* quickly, with a high excited voice, the depicted event appears to be one where Bill splashes happily through the puddles. The ideophone *splish splash* therefore contrasts with the verb *splash* in (26), which cannot be manipulated in the same manner to produce the same iconic effect. It would clearly be possible to create an iconic depiction using the utterance in (26), but this would not be solely reliant on the utterance of the verb and would likely need to involve gestures to create the same inferences as for (25).

(25) Bill went splish splash through the puddles!

(26) Bill splashed through the puddles!

Modeling the utterance as a demonstration therefore allows us to capture the depictive nature of ideophones. Unlike the linguistic entities proposed by Potts (2007a), the demonstration does not contain any information about the syntactic or semantic representation of an utterance, it is purely concerned with the form of the utterance. It could be argued that a demonstration simply represents the phonological form of the utterance, however, there are aspects beyond phonology that we may wish to include in this demonstration, such as facial expressions. Therefore, I propose that a demonstration, *d*, models the surface form of the utterance, i.e. the exact manner in which the speaker uttered the ideophone, including prosody, phonation type, reduplication and anything else that may have contributed to the iconicity of the utterance. The use of an ideophone, due to its depictive qualities, automatically introduces the demonstration variable. Hence, the utterance of an ideophone automatically triggers two dimensions of meaning, one being the semantic interpretation of the ideophone, i.e. its descriptive meaning and the second being the demonstration of the event via the utterance of the ideophone, i.e. its depictive meaning. I adopt the notation proposed by Potts (2007a) and use upper corner brackets to indicate the exact utterance which is being used as a demonstration. For example, an utterance of the ideophone *plitsch platsch* would be given as $d^{\ulcorner \text{plitsch platsch} \urcorner}$.

The demonstration introduces the utterance of the ideophone as an variable in the semantics, however, this alone does not model the iconic relation between the ideophone and the event depicted. Therefore, the introduction of the demonstration variable also triggers a similarity relation between the demonstration and the event contributed by the main predicate. Diverging from both Davidson (2015) and Henderson (2016), I chose to model this iconic relation using the SIM predicate (cf. Umbach and Gust, 2014; Ebert et al., 2020). SIM(x,y) holds iff x and y are similar in the relevant dimension as given by the context.[6] When an ideophone is uttered therefore, a demonstration *d* is introduced, which models the form of the utterance and then stands in a similarity relation to the event being discussed. For ideophones, the SIM predicate can therefore be defined as follows:

(27) If *d* is the utterance of an ideophone, and *e* an event that the ideophone depicts, then SIM(d,e) holds iff *d* and *e* are similar in the relevant dimension as given by the context.

As we have seen, what this means exactly for ideophones can vary from context to context, as the depictive meaning of ideophones is dependent on the context in which it occurs and the exact manner in which it is uttered. As such, the SIM predicate is left purposefully underspecified to allows for the multidimensional and contextually dependent nature of an ideophone's iconicity.

This modelling of the iconic relation is very different from the STRUC-SIM$_{\llcorner u \lrcorner}$ relation proposed by Henderson (2016). Henderson (2016) argues that STRUC-SIM$_{\llcorner u \lrcorner}$ can be reduced to similar cardinality between the ideophone utterance and the demonstrated event referent and through his definition of the relation attempts to give an exact analysis of how the iconicity

[6]Umbach and Gust (2014) actually propose a three place SIM predicate, where SIM(x,y,z) holds if x and y are similar in terms of z. I.e. z specifies the dimension of similarity. However, as discussed later in this section, the SIM predicate is purposefully underspecified for ideophones and this dimension variable is therefore not part of the similarity relation between ideophones and events.

of the ideophone arises. This difference in approaches brings us to a larger point overall in the semantics of iconicity. While some argue for an explicit semantics of iconicity beyond demonstrations (cf. Schlenker, 2023), I argue that this is not necessary in a formal semantics of language. Within compositional semantics, the goal is to model how the individual parts of an utterance contribute to the overall meaning of an utterance. We do not attempt to compositionally model how the individual morphemes of a word contribute to the overall meaning, but rather take the word itself as the smallest possible component and model how this contributes to the utterance meaning. Similarly, in this iconic semantics, I take the utterance of the ideophone is the smallest possible component and I do not attempt to model how each component of this utterance, such as the prosody, the amount of reduplication or even the sound symbolism of the ideophone itself contributes individually to the iconicity. Instead the model simply captures that, thanks to its iconic nature, the utterance of the ideophone stands in a similarity relation to the depicted event.[7] Furthermore, attempts to specify the exact source of an ideophone's iconicity often appear to be too restrictive and cannot account for the huge variety of ways in which an ideophone can be iconic. STRUC-SIM$_{\llcorner u \lrcorner}$ in particular does not seem to allow for the contribution of iconic elements outside of the words spoken, for example prosody, intonation, gesture and facial expressions, among others.

As to why I do not use the *demonstration-of* predicate proposed by Davidson (2015), this is more of a preference in terminology. The term *demonstration of* seems to indicate an intentionality, i.e. that someone is intentionally recreating an event. Hence the *demonstration-of* predicate indicates that quotations are intended to be direct demonstrations of a previously occuring speech (or action) event, i.e. when the speaker utters the quotation they are imitating or recreating an event. While this seems appropriate for cases of quotation, I do not want to argue that ideophones are always intended as recreations of the events they depict. Instead, the ideophones, thanks to their depictive nature, naturally trigger the similarity relation when they are uttered.

Aside from STRUC-SIM$_{\llcorner u \lrcorner}$ giving a highly specified definition of the ideophone's iconicity, the relation also directly combines the depictive meaning component of ideophones with its descriptive content. However, ideophones appear to contain both descriptive and depictive content meaning components, which can be targeted separately. If these meaning components are combined as in the STRUC-SIM$_{\llcorner u \lrcorner}$ relation, then this should not be possible. The approach outlined here, however, models the two meaning components as two distinct contributions made by the ideophone. The following section will therefore discuss the descriptive meaning components of ideophones and how these combine with the depictive components in order to give an analysis for the overall meaning contribution of ideophones.

4.2. Descriptive content

This approach proposes that the descriptive component of adverbial ideophones is the same as ordinary adverbial items with the same syntactic distribution, but with obvious differences in

[7] One potential exception to this would be iconic gestures co-occurring with the ideophone, which may add iconic elements to the demonstration that should be semantically interpreted independently from other components of the utterance form. However, such gestures would arguably not be comparable to prosody, reduplication and sound symbolism as they can easily be separated from the main utterance of the ideophone.

at-issueness. Adverbial ideophones in German appear to pattern with manner modifiers. While they do appear odd when used in answer to questions as in (28), this appears to be mainly due to their default non-at-issue status. When shifted towards at-issueness using the demonstrative *so*, as in (28c), *holterdipolter* is a perfectly acceptable answer to the question of how Peter went down the stairs.

(28) a. Wie geht Peter die Treppe runter?
how goes Peter the stairs down
'How does Peter go down the stairs?'

b. #Holterdipolter
helterskelter
'Helterskelter.'

c. So holterdipolter.
DEM IDEO
'Like helterskelter.'

This analysis assumes a Neo-Davidsonian approach to event semantics in which the predicate contributes an event argument and the ideophone's descriptive meaning serves as an event modifier of said event. Adverbial ideophones as manner modifiers are therefore functions from events to events. If events are of type v and assuming a predicate of type (v,t), then the event modification provided by the ideophone is of the same type as a standard manner adverbial, namely $(v,(v,t))$. Hence in (29), the main predicate contributes an event of running down the stairs of which Peter is the agent. The ideophone *holterdipolter* then takes this event as its argument and returns the modified event, namely some sort of *holterdipolter*-ing event.

(29) Peter geht die Treppe holterdipolter runter.
Peter goes the stairs IDEO down
'Peter is going helter-skelter down the stairs.'

Due to the descriptive ineffability of ideophones in German, what exactly qualifies as a *holterdipolter*-ing event is up for debate. Most speakers would agree that there must be some amount of loud noise and chaotic movement in order for an event to qualify as such, but, as with most ideophones in German, *holterdipolter* has a somewhat vague descriptive meaning. There are exceptions to this rule, for example both *ratzfatz* and *ruckzuck* clearly seem to behave very similarly to the arbitary adverbial *schnell* 'fast, quickly' and in other languages, such as Akan, ideophones appear to have much more conventionalised descriptive meanings. The (im)precise nature of ideophones descriptive meaning will be discussed in greater detail in Section 5. For now, due to this vagueness, I choose not to provide an arbitrary paraphrase of the ideophone when modelling its descriptive meaning, but rather choose to leave the ideophone as the modifier of the event. For example, an event, e, of Peter going down the stairs would be modified so that *holterdipolter(e)*.

Overall then, the use of an ideophone as a manner adverbial in reporting an event compositionally leads to the modification of the event so that it has the property of said ideophone, as well as introducing a demonstration d, representing the form of the utterance, which then stands in a similarity relation to the reported event. (29) can therefore be analysed as in (30).

(30) $[e] \wedge \text{goes-down-the-stairs}(e) \wedge \text{agent}(e, \text{Peter}) \wedge \text{holterdipolter}(e) \wedge [d] \wedge d = d_{\ulcorner \text{holterdipolter} \urcorner} \wedge \text{SIM}(e, d_{\ulcorner \text{holterdipolter} \urcorner})$

Here the descriptive content of the whole sentence is that there is an event of going down the stairs, of which Peter is the agent and that this event has the property of being *holterdipolter*. The depictive content is that there is a demonstration, namely the utterance of *holterdipolter* and this utterance is similar in the relevant dimensions to the event of Peter going down the stairs.

One key component of this analysis is still missing, namely the at-issue status of the two meaning components. The final section will therefore discuss the at-issue status of the two meaning components of ideophones within a gradient approach to at-issueness.

5. Ideophones and at-issueness

This analysis of ideophones' at-issueness is based upon the gradient approach proposed by Barnes and Ebert (2023). Barnes and Ebert (2023) argue that propositions can be more or less at-issue with respect to other propositions and that this at-issue status is based on their relevance to a given QUD. A relevance metric *r* specifies for every proposition *p* and QUD *Q* the degree to which *p* is relevant to (the resolution of) *Q*, or *r(p, Q)*. This relevance metric then allows for partial ordering of propositions, with *r(p, Q)* being ranked relatively low if there are many other propositions which better resolve *Q* and relatively high if there are few propositions which better resolve *Q*. Furthermore, Barnes and Ebert (2023) argue that "the less at issue a proposition is the less it contributes to the overall(graded) semantic value of the underlying joint proposition evaluated in the actual world [...]"(p.51) and propose that the joint (graded) truth value *T(u)* of an utterance *u* can be calculated by multiplying the normalised relevance and truth value of each component proposition and then summing this value for all component propositions. This calculation is spelled out in (31)

(31)
$$T(u) = \sum_i \tilde{r}(\llbracket t_i \rrbracket, Q^*) \cdot \llbracket t_i \rrbracket(w^*)$$

In terms of the at-issueness of ideophones, it is assumed that the depictive content of the ideophone, in the absence of other factors, has a very low degree of relevance and is therefore minimally at-issue. If the descriptive content of the ideophone is more at-issue however, this can boost the overall at-issue status of the ideophone utterance by boosting the joint truth value for the ideophone. In German, the default at-issue status of an ideophone's descriptive content is relatively low meaning that the overall at-issue status of the ideophone is relatively low. However, if the ideophone's descriptive meaning contribution is otherwise equivalent to that of a manner adverbial, then why would its at-issue status be relatively low, while manner adverbials appear to be more at-issue?

One possible explanation could be the vague nature of German ideophones' descriptive content. Kennedy (2013) has, for example, argued that there are two types of of subjectivity; while *fun* is a gradable evaluative predicate, which is subjective, Kennedy argues that vague, dimensional predicates such as *rich* or *tall* can also be somewhat subjective. Vague predicates, however,

are only subjective due to uncertainty around the standard of comparison used The descriptive component of ideophones in German appear to demonstrate this second type of subjectivity. In (32b), B disagrees with the use of *holterdipolter* because they do not think that the event of Peter going down the stairs is chaotic enough to satisfy the descriptive component of *holterdipolter*. Here speaker A appears to define an event as *holterdipolter* if it is predominantly loud, whereas B requires the event to be predominantly chaotic.

(32) **Context:** Peter runs very loudly down the stairs past speakers A and B.
   a. A: Peter ging holterdipolter die Treppe runter!
      Peter went IDEO the stairs down
      'Peter went helterskelter down the stairs.'
   b. B: Naja, er war schon laut, aber so chaotisch ging er nicht.
      well he was definitely loud but so chaotic went he not
      'Well, he was definitely loud, but he wasn't that chaotic.'

If we assume then that there is a degree of uncertainty around the standard of comparison for the descriptive meaning component of an ideophone such as *holterdipolter*, then this can help to explain why this meaning component is less at-issue than a standard adverbial.

In the gradient approach to at-issueness proposed by Barnes and Ebert (2023), the degree of relevance for a given proposition is determined with respect to alternative propositions that also (partially) resolve Q in the given context; $r(p, Q)$ is relatively low on the scale if there are many other alternative propositions a speaker could have made to resolve the question which are ordered above *r(p, Q)*. We can furthermore assume that a proposition is more relevant to Q if it is more informative with respect to resolving Q. Therefore, when there is uncertainty around the standard of comparison for an ideophone then speakers will find the proposition contributed by the ideophone less informative than that contributed by a standard adverbial with a more precise meaning, where the standard of comparison can easily be determined. The vague meaning components of ideophones in German, such *plitsch platsch* and *holterdiepolter* then results in *r(p, Q)* being rated low on the at-issueness scale as other propositions with standard adverbials are more informative with respect to resolving the QUD.

What then is the situation for languages such as Akan, where the ideophone appears to be equally as at-issue as other adverbials? Thanks to the more frequent use of ideophones in Akan, their meanings are more conventionalised and therefore more specified. Hence, when speakers use an ideophone in Akan, there is no confusion around the standard of comparison and the relevance of the ideophone to the QUD can more easily be assessed. This means that the ideophone proposition is just as informative as a proposition modified by an arbitrary adverbial. Unlike in German, there are not a large number of alternative propositions which would better resolve the QUD. The result is therefore a *r(p, Q)* for the the ideophone which is equivalent to that of other arbitrary expressions.

Another important point to make about languages, such as Akan, where ideophones occur frequently, is that often the ideophone is the only choice of adverbial (cf. Markus Steinbach, p.c.). This fits well into this account of at-issueness, however. Given that the relevance of a proposition to a QUD is based on how well alternative propositions resolve the QUD, then if there is no alternative, equally informative proposition which also resolves the QUD, then the ideophone will clearly be highly relevant to the QUD and therefore highly at-issue.

The mixed item approach is therefore advantageous in explaining the difference between the at-issue status of ideophones in German and Akan without having to assume that depictive content contributes information differently between the two languages. In this approach, the depictive content of ideophones in both languages is equally non-at-issue, but the descriptive content differs and as such the overall at-issueness of the ideophones differs between the languages.

6. Conclusion

This article has outlined an analysis of German ideophones as iconic mixed items similar to expressive mixed items, such as *cur* (cf. Gutzmann, 2011; McCready, 2010). I proposed that ideophones contain both a descriptive and a depictive meaning component and showed that, similarly to expressive mixed items, it is possible to target the descriptive and depictive meaning components of German ideophones separately and that these meaning components can have different degrees of at-issueness, indicating that they are indeed two distinct meaning components. The descriptive content of the ideophone is the same as the meaning contribution of an arbitrary item with the same distribution, so the descriptive content of an adverbial ideophone will be event modification. I modelled the depictive meaning component of the ideophone as a demonstration, *d*, following Davidson (2015); Henderson (2016) and a similarity relation, modelled using the SIM predicate (cf. Umbach and Gust, 2014; Ebert et al., 2020). I argued that the utterance of an ideophone, as a depictive utterance, automatically introduces both the descriptive meaning of the ideophone and a demonstration variable, triggering the inference that the demonstration stands in a similarity relation to the event contributed by the main utterance. This mixed iconic item approach, combined with the gradient approach to at-issueness proposed by Barnes and Ebert (2023) can also account for the difference in at-issue status between adverbial ideophones in German and Akan, with both having equally at-issue depictive content. Ideophones in Akan appear to have more at-issue descriptive content, likely due to a more specified meaning component due to their more frequent use, meaning that ideophones in Akan are more at-issue relative to standard adverbials in the language. While this analysis can account for the differing at-issue status of ideophones in German and Akan, it also raises more questions about the nature of ideophonic meaning such as why the depictive content of ideophones appears to be minimally at-issue and whether the distinction between the at-issue status of ideophones in German and Akan holds for other languages.

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On the semantics of unit fractions[1]

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Abstract. We present two novel observations concerning the linguistic behavior of unit fractions, e.g., *half, third* etc., which challenge their analysis as proportional quantifiers/modifiers, arguing instead that in certain environments fractions presuppose *contextually salient* partitions over individuals. We distinguish environments that require a salient partition from those that do not, and propose a syntax and semantics for fractions that derives the distinction.

Keywords: fractions, *half*, quantifiers, numerals, partitions.

1. Introduction

This paper is concerned with the semantics of unit fractions (hereafter, UFs); i.e., *half, quarter, eighth,* or generally fractions of the form $1/n$. In the generalized quantifier literature, UFs and numerals have been treated, explicitly or implicitly, as quantificational determiners (1) (cf. Keenan and Westerståhl 1997). This approach is supported by the ability of UFs and numerals to surface without an overt determiner (2), suggesting they themselves might be the determiner of the NP of which they are a part. However, since both numerals and UFs can surface under overt determiners as well (3)-(4), the determiner approach seems untenable.[2] Indeed, since Bartsch 1973, numerals are often treated as adjectival modifiers; an approach that has been extended to fractions in Ionin et al. 2006. In cases like (2) where no overt determiner appears, the modifier approach posits a silent existential quantifier above both numerals and UFs.

(1) a. $[\![\textit{half}]\!] = \lambda f_{\langle e,t\rangle}.\lambda g_{\langle e,t\rangle}.\ |f \cap g| = (1/2 \times |f|)$
b. $[\![\textit{five}]\!] = \lambda f_{\langle e,t\rangle}.\lambda g_{\langle e,t\rangle}.\ |f \cap g| = 5$

(2) a. Half of the students passed the exam.
b. Five (of the) students passed the exam.

(3) a. A half of the students passed the exam.
b. The tall half of the students passed the exam.[3]

(4) The five students were found hiding behind a willow tree.

Under the modifier approach, *half of the students* denotes the set of all student pluralities whose cardinality is equal to half the cardinality of the maximal plurality of students (cf. Ionin et al.,

[1]Authors are listed in alphabetical order. We would like to thank Omri Doron, Kai von Fintel, Danny Fox and Martin Hackl for fruitful comments.

[2]For a survey of arguments against the quantificational determiner approach see Bylinina and Nouwen 2020.

[3]Given the uniqueness presupposition introduced by definite determiners, embedding a UF under a definite determiner without an additional modifier – e.g., *the half of the students* – sounds odd out of context, as there is no contextually unique half to which the definite can refer. This, however, changes in a context that makes salient a unique $1/n^{th}$. For instance, if a quarter of the students and half of the post-docs in a department came to the field-trip, the following sentence seems felicitous: *The quarter of the students walked faster than the half of the post-docs.* To avoid specifying a context of utterance, we embed UFs under definite determiners only with an additional modifier, which seems to help accommodate a unique $1/n^{th}$ that satisfies the determiner's presupposition.

 In: Baumann, Geraldine, Daniel Gutzmann, Jonas Koopman, Kristina Liefke, Agata Renans, and Tatjana Scheffler (eds.) 2024. Proceedings of Sinn und Bedeutung 28. Bochum: Ruhr-University Bochum, 131-149.

2006: 6 ex. (18)). Similarly, *five (of the) students* denotes the set of all plural individuals whose cardinality is 5. A straightforward way of implementing this, which we term here *the standard approach*, involves assigning *half* and *five* the lexical entries in (5a)-(5b).[4]

Note that in (5) and for the remainder of the paper we assume: (i) that $|X|$ counts atomic parts of X if X is an individual, and counts the number of elements in X if X is a set; (ii) that the characteristic set of f (i.e., the $\langle e,t \rangle$ input to both numerals and UFs) is closed under sum-formation; (iii) that $\oplus f$ is the maximal element in f (the plural individual $x \in f$ such that every element in f is a part of x); and (iv) that $[\![\textit{students}]\!] = [\![\textit{of the students}]\!]$.[5]

(5) Unit fractions: *the standard approach*
   a. $[\![\textit{half}]\!] = \lambda f_{\langle e,t \rangle}.\lambda x.\ f(x) \wedge |x| = (1/2 \times |\oplus f|)$
   b. $[\![\textit{five}]\!] = \lambda f_{\langle e,t \rangle}.\lambda x.\ f(x) \wedge |x| = 5$

If the standard approach is correct, we expect certain logical equivalences between numerals and unit fractions to hold. In particular, given a domain which contains 10 students, the approach predicts *five (of the) students* and *half of the students* to both denote the set containing all student-pluralities of cardinality 5. This prediction can be generalized as in (6).

(6) **Prediction of the standard approach:** Given a set f, numeral n_i and UF $1/n_j$, such that the maximal element in f contains $n_i \times n_j$ atoms, $[\![n_i]\!](f) = [\![1/n_j]\!](f)$

This paper introduces several novel observations that constitute exceptions to the prediction in (6). We show that in certain environments using the phrase *half of the students*, requires that the context of discourse make salient a partition of the relevant students into two equal parts; a requirement that is not imposed on the corresponding numeral. We propose to account for the data by analyzing UFs as modifiers that take a variable ranging over partitions as a syntactic argument, and argue that in the particular environments where UFs differ from numerals, the value of their partition variable must be contextually determined. We then turn our attention to environments where UFs pattern with numerals and do *not* require a salient partition of their input set, and show that our partition-based semantics can account for UFs in those environments by allowing an existential quantifier over partitions to occupy the partition argument slot.

The idea that partitions play a role in the semantics of UFs is not itself new. In fact, Ionin et al. (2006) incorporate existentially closed partitions in the lexical entries of both UFs and numerals. However, we make two novel contributions to the debate over the semantics of UFs. First, we show that with respect to the prediction in (6), existentially quantifying over partitions is equivalent to the standard approach and is thus insufficient. Crucially, the partition in the semantics of UFs must be a syntactic variable, which in certain contexts is *not* existentially bound. Second, we present a novel generalization according to which whether UFs pattern like numerals or not (i.e., whether they verify (6) or not) is determined by their syntactic environment: only UFs under indefinite determiners pattern like numerals, while those under definite ones do not. Finally, we offer some remarks about how this generalization can be derived.

[4] In (5b) we are not committing to a non-intersective account of numerals, but merely having the numeral take the element that it modifies as an argument to maintain parallelism with (5a), where this is necessary.

[5] By assuming that $[\![\textit{of the students}]\!] = [\![\textit{students}]\!]$ we are not committing to the position that '*of*' and '*the*' in that PP are semantically vacuous. Rather, we adopt the following entry for partitive *of* from Ionin et al. 2006: $[\![\textit{of}]\!] = \lambda x.\lambda y.y \leqslant x$. This entry, together with the assumption that a plural definite description like *the students* denotes the maximal student (i.e., $\oplus [\![\textit{students}]\!]$), results in $[\![\textit{of the students}]\!] = \lambda x.x \leqslant \oplus [\![\textit{students}]\!] = [\![\textit{students}]\!]$.

We proceed as follows: Section 2 presents constructions with UFs that challenge the standard numeral-style modifier approach. Section 3 then illustrates how the challenging data can be accounted for by introducing partition variables to the syntax of UFs, and how binding these variables existentially accounts for constructions that the standard approach captures correctly. In section 4 we provide a characterization that distinguishes the two kinds of constructions, and remark on how one might derive the distinction in section 5. Section 6 concludes.

2. Problems for the standard approach

According to the prediction of the standard approach in (6), given a domain with 10 students, (7a) and (7b) should be equivalent to each other. This is clearly borne out when UFs surface without an overt determiner, which on the standard approach, indicates that they are embedded under a covert existential. When there are ten students in a class, the sentence with the numeral *five* in (8a) is truth-conditionally equivalent to the sentence with the UF *half* in (8b).

(7) a. $[\![\textit{five of the students}]\!] = \lambda x.\ [\![\textit{students}]\!](x) \wedge |x| = 5$
b. $[\![\textit{half of the students}]\!] = \lambda x.\ [\![\textit{students}]\!](x) \wedge |x| = \frac{|\oplus[\![\textit{students}]\!]|}{2}$

(8) Context: There are 10 students in a class.
a. Five of the students passed the exam.
b. Half of the students passed the exam.

However, the equivalence breaks down in two environments. First, in *which*-questions. Consider (9), where it is stipulated that there are ten students in a class, five of whom passed the exam. In this context, the question with *five* (9b) is felicitous, given that the presupposition of the *which*-question that five students passed is met.[6] Yet the example with *half* (9a) is infelicitous, even though the presupposition that half of the students passed is also met.

(9) Context: A class has ten students. It is known that five of them passed the exam. I want a list of names of students who passed, so I ask:
a. #Which half of the students passed the exam?
b. Which five of the students passed the exam?

Interestingly, when the context partitions the students into two specific halves, the *which*-question in (9a) becomes felicitous. In (10), for instance, there is a contextually salient division of the students into equi-sized groups of computer science (henceforth, CS) majors and math majors, and the *which*-question with *half* can be used to inquire about which of the two groups passed the exam. As expected, the numeric counterpart is also felicitous. Thus, what sets UFs apart from numerals in *which*-questions, is that only the former require a contextually salient partition. This problem for the standard approach generalizes to any UF, like *third*, *fourth* etc.

(10) Context: A 10-student class consists of two groups: one group of 5 math majors, and another of 5 CS majors. It is known that one of these groups passed the exam.
a. Which half of the students passed the exam?
b. Which five of the students passed the exam?

[6]This presupposition follows from the requirement of questions to have a maximally informative true answer (Dayal, 1996)

The second challenge to the standard approach comes from the behavior of a specific UF, *half*, and its corresponding numeral in definite descriptions with a comparative/superlative modifier; i.e., in descriptions schematized in (11). To see why the standard approach fails here, some setup is required: it seems to be a general characteristic of comparatives that they are only licensed in definite descriptions when the predicate they modify denotes a set containing exactly two elements. Superlatives, on the other hand, seem to be licensed in definite descriptions only when their input set contains more than two elements. Consider (12): when there are only two students, only the comparative is licensed (12a), and when there are more than two only the superlative is (12b). We therefore take for granted the generalization in (13).

(11) $[_{\text{DP}}$ [the] $[[_{\text{AP}}$ A+{-er/-est}] $[_{\text{NP}}$ N]]]

(12) a. Of these two students, give the award to the {smarter / #smartest} student.
b. Of these ten students, give the award to {#smarter / smartest} student.

(13) Given a predicate f of type $\langle e,t\rangle$ and a gradable predicate A of type $\langle d,et\rangle$:
a. $[\![\textit{The A+er}\, f]\!]$ is defined only if $|\{x : f(x) = 1\}| = 2$
b. $[\![\textit{The A+est}\, f]\!]$ is defined only if $|\{x : f(x) = 1\}| > 2$

Now, consider the behavior of *half* and a corresponding numeral in these constructions. In the context in (14), there are ten students. Thus the predicate $[\![\textit{five of the students}]\!]$ is clearly true of more than one entity; it is true of any 5-sized plurality of students (so it is true of *10 choose 5*, or 252, entities). The principle in (13) thus correctly predicts that only the superlative modifier should be licensed in a definite description with the numeral *five*, as shown in (14a). Given that the standard approach predicts equivalence between $[\![\textit{five of the students}]\!]$ and $[\![\textit{half of the students}]\!]$ in this context, we expect that of the counterparts with *half* in (14b), only the superlative will be licensed as well. Yet the opposite pattern emerges with *half*.

(14) **Context**: A class consists of ten students. Five of them passed the exam.
a. (i) ??The smarter five of the students passed the exam.
(ii) The smartest five of the students passed the exam.
b. (i) The smarter half of the students passed the exam.
(ii) ??The smartest half of the students passed the exam.

Note, importantly, that if the generalization we take for granted in (13) is correct, what the felicity of the comparative modifier in (14b) teaches us is that the denotation of $[\![\textit{half of the students}]\!]$ must be a set containing only two elements.

We argue next that these counterexamples to the standard approach demonstrate a unique property that distinguishes UFs from numerals; namely, that in *which*-questions and superlative/comparative DPs, UFs must be evaluated relative to a contextually salient partition.

3. Proposal: A partition-based semantics for UFs

To implement our account of the data above, we adopt the notion of *partition* of a plural individual. Informally, a set S partitions a plural individual x if every atomic part of x is a part of an element in S, and all the elements in S are disjoint; i.e., there is no individual that is a part of two distinct elements in S (cf. Higinbotham 1981; Schwarzschild 1996) – this is formally

defined in (15). We then propose that a UF of the form 1/n denotes the function in (16a) that takes as arguments a predicate f and a variable S over $\mathscr{D}_{\langle e,t\rangle}$, and presupposes that S is a specific kind of partition over the maximal individual in f – namely, a partitions that consists of *n equal* parts, as defined in (16b). If defined, the UF simply returns its partition argument S.

(15) S is a partition of an individual x iff: $\oplus S = x \wedge \forall s,s' \in S : \neg\exists y : y \leqslant s \wedge y \leqslant s'$

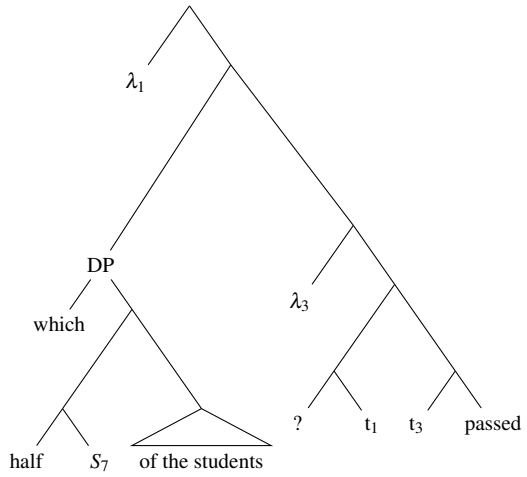
(16) a. $[\![1/n]\!] = [\![1/\square]\!](n) = \lambda S_{\langle e,t\rangle}\lambda f_{\langle e,t\rangle}$: S is a partition$^{+}_{n}$ of $\oplus f$. S
b. S is a partition$^{+}_{n}$ of $\oplus f$ iff S is a partition of $\oplus f$, $|S| = n$, and $\forall s,s' \in S : |s| = |s'|$

In (16a) we decompose 1/n into a fractionalizing function 1/□ and the denominator n, but nothing below hinges on this decomposition. Given (16a), applying (e.g.) $[\![\textit{half}]\!]$ to $[\![\textit{of the students}]\!]$ derives a set containing two disjoint, plural individuals, each of cardinality half of $|[\![\textit{the students}]\!]|$.

3.1. Accounting for the challenges to the standard approach

We present above two enviornments in which the predicted equivalence between UFs and numerals seems to break down. Here is how our proposal accounts for that: First, in *which*-questions, according to the argument structure we assign UFs in (16a), and assuming a Karttunen (1977) syntax-semantics for questions (as implemented in von Fintel and Heim 2011), the *which*-question in (9a) (i.e., *which half of the students passed?*) has the structure in (17) – where the UF *half* takes a variable argument in addition to a set of individuals (which includes pluralities). This structure derives the truth-conditions in (18), which can be paraphrased as follows: The *which*-question is defined only if the variable argument of *half* (i.e., S_7 in (17)) is assigned to a partition of the maximal element in the set of students by the contextually determined assignment function g. If defined, the question denotes the set of propositions that are true only if there is an element in the contextually salient partition that passed the exam.

(17)



$[\![\textit{which}]\!] = \lambda f_{\langle e,t\rangle}.\lambda g_{\langle e,t\rangle}.\ \exists x : f(x) \wedge g(x)$
$[\![?]\!] = \lambda p_{\langle s,t\rangle}.\lambda q_{\langle s,t\rangle}.\ p = q$
$[\![\textit{of the students}]\!] = [\![\textit{students}]\!]$ (see fn. 5)

(18) $[\![(17)]\!]^g$ is defined iff $7 \in \text{DOM}(g)$ and $g(7)$ is a partition$^{+}_{2}$ of $\oplus[\![\textit{students}]\!]$; and
If defined, $[\![(17)]\!]^g = \lambda p_{\langle s,t\rangle}.\exists x \in g(7) : p = \lambda w.[\![\textit{passed}]\!](w)(x)$

Given (18), the infelicity of the *which*-question in the context of (9), where context does not make salient a partition of the students into halves, is simply an instance of presupposition

failure: Without a salient partition, the presupposition of the UF in the *which*-phrase is not met.

In the context of (10), however, the ten students are partitioned into two groups; one of five math majors and the other of five computer science majors. Suppose that $a \oplus b \oplus c \oplus d \oplus e$ are the math majors, and $f \oplus g \oplus h \oplus i \oplus j$ are the CS majors. If S_7 is assigned by the assignment function g to the partition $\{a \oplus b \oplus c \oplus d \oplus e, f \oplus g \oplus h \oplus i \oplus j\}$, $[\![(17)]\!]^g$ is defined, and denotes the set in (19). The question denotation in (19) can be paraphrased as *which of the two groups a,b,c,d,e and f,g,h,i,k passed*. This, intuitively, is exactly what we want to derive, as in (10), the inquirer wants to know which part of the salient partition passed the exam.

(19) $\{\lambda w.[\![passed]\!](w)(a \oplus b \oplus c \oplus d \oplus e), \lambda w.[\![passed]\!](w)(f \oplus g \oplus h \oplus i \oplus j)\}$

Our second challenge to the standard approach had to do with the behavior of *half* in particular, in definite descriptions with comparative/superlative modifiers. Recall that we show that even given a domain of ten students, $[\![$*half of the students*$]\!]$ is not equivalent to $[\![$*five of the students*$]\!]$ in that particular environment: While the latter behaves as if it is a set whose cardinality is *10 choose 5* (i.e., 252), the former seems to behave as if has cardinality 2. This is an immediate result of our analysis in (16a), according to which the number of elements in the set that results from applying the UF function to its input set is equal to the denominator of the UF. Thus, a phrase headed by *half* will always denote a set whose cardinality is 2. Note that we correctly predict that this phenomenon is restricted to *half*, and does not generalize to other UFs. Other UFs do not denote two-sized sets, and therefore, should only be compatible with a superlative modifier as per the generalization in (13). That this prediction is borne out is illustrated in (20).

(20) a. The smartest quarter of the students passed.
b. ??The smarter quarter of the students passed.
c. $|[\![$*quarter of the students*$]\!]| = 4$, as a partition$^+_4$ of $\oplus[\![$*students*$]\!]$ has cardinality 4.

3.2. Accounting for cases that the standard approach captures correctly

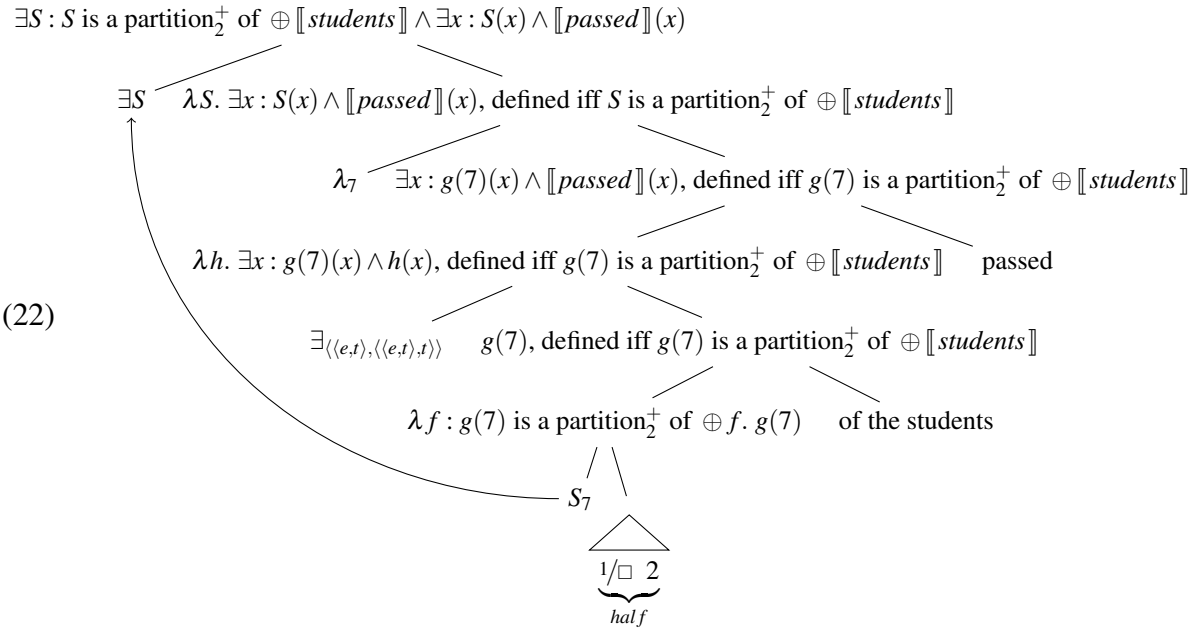
Recall that the standard approach was a good account of a subpart of the data; namely, of UFs that surface without an overt determiner above them (2). In those cases, it was assumed that the bare UFs are preceded by a covert existential quantifier, and the standard approach correctly predicts bare UFs to be equivalent to their corresponded numerals. In (21), for instance, using the UF *half* or a numeral to refer to sixteen students out of thirty-two does not seem to make a difference. Furthermore, contrary to what our entry for UFs in (16a) predicts, no salient partition of the students in the class is required for the use of *half* in (21a) to be felicitous.

(21) Context: Of the 32 students in a class, 16 passed the exam. The TA tells the professor:
a. Half of the students passed the exam.
b. Sixteen students passed the exam.

To capture the truth-conditions of (21a) without giving up on the entry in (16a), we propose that this sentence has the LF in (22), where the partition argument of the UF is occupied by a generalized existential quantifier over partitions, as defined in (23). Since UFs, as we define them, are of type $\langle et, \langle et, et \rangle \rangle$ and the quantifier in (23) is of type $\langle \langle et, t \rangle, t \rangle$, the quantifier has to QR and leave a $\langle e, t \rangle$-type trace.

This results in the truth conditions in (24), as long as we assume that the presupposition of $[\![half]\!]$ is locally accommodated below the generalized quantifier over partitions. Informally, (21a) is predicted by (24) to be true as long as there is some partition of the students into two halves such that all the members of one of the halves passed the exam. Thus, if we allow the partition variable of a UF to be existentially closed in the case of (21a), we correctly predict the truth-conditions for (21a) and (21b) to be equivalent – as the standard approach does.

(22)



(23) $[\![\exists S]\!] = \lambda P_{\langle et,t \rangle}.\exists S : P(C) = 1$

(24) $[\![(22)]\!]^g = 1$ iff $\exists S : S$ is a partition$_2^+$ of $\oplus [\![students]\!] \wedge \exists x : S(x) \wedge [\![passed]\!](x)$

3.3. Restricting the distribution of existentially closed partitions

To account for the behavior of UFs in *which*-questions and certain definite DPs, we introduce a partition argument into their lexical entry and saturate it with a free variable. To account for the behavior of bare UFs (i.e., UFs under a covert existential determiner), we suggest that in these environments a generalized quantifier over partitions can also occupy the partition argument slot. However, once we introduce existentially closed partitions, an immediate worry arises: if existentially closed partitions and contextually-valued variables over partitions are in a free distribution, do we not lose our account of *which*-questions and definite DPs? In the remainder of this section we use the case of *which*-questions to illustrate that, indeed, we do lose our account of UFs in that environment if we allow free existential closure of the partition variable.

To show conclusively that no existential closure of the partition argument is possible in *which*-questions, we must determine what the predicted truth-conditions would have been had closure been allowed. If in the question *which half of the students passed the exam?* the partition argument is occupied by a generalized existential quantifier, that quantifier must QR for type reasons — but where to? There seems to be only one possibility, if we want to maintain Hamblin's (1976) insight that questions denote sets of propositions: $\exists S$ must QR to a position

between the *which*-phrase and the propositional binder, as in (25). (25) is identical to the LF in (17) but with existential closure of the partition argument.

(25) $[\lambda_1\ \exists S\ \lambda_7[_{\text{DP}}\text{which}[[\text{half } S_7] \text{ of the students}]][\lambda_3[[?\ t_1][t_3 \text{ passed}]]]]$

The truth-conditions derived from (25) are in (26). Informally, the question denotes a set of propositions true if any plurality of students whose cardinality is half of $\oplus[\![\textit{students}]\!]$ passed the exam. Crucially, (26) is equivalent to what the standard approach predicts here. Thus, if (25) were a possible LF for *which half of the students passed the exam?*, we would incorrectly predict that no salient partition is required for this question to be defined, contrary to fact. We conclude that the partition argument cannot be existentially bound for UFs in *which*-phrases.

(26) $[\![(25)]\!]^g = \lambda p.\ \exists S : \exists x \in S : S \text{ is a partition}_2^+ \text{ of } \oplus[\![\textit{students}]\!] \wedge p = \lambda w.[\![\textit{passed}]\!](w)(x)$

If we claim that an UF's partition argument is a bound variable in some environments but is *mandatorily* free in others, then the onus is on us to distinguish environments that require existential closure from those that require free variables. Next, we attempt to do just that.

4. Definiteness *vs* Indefiniteness of the partition

In order to account for the different behavior of UFs in indefinites, *which*-questions and the particular kind of definite DPs discussed above, we have proposed that the partition argument of the UF can either be existentially closed or supplied by the context. However, we also had to comit to the position that these two options are not freely available in all environments. For example, in *which*-questions, we argued that the value of the partition must be supplied by context. In this section, we show that whether or not the partition argument of a UF is existentially bound depends on the in/definiteness properties of the determiner that the UF is embedded under. In short, we argue that the generalization in (27) correctly captures the distribution of existentially bound *vs* contextually salient partitions.

(27) **(In)definiteness generalization:** UFs in definite DPs can only combine with *free* partition variables. UFs in indefinite DPs can only combine with $\exists S$ (defined in (23)).

4.1. Indefinite DPs

We show above that bare UFs (assumed to be indefinite) do not require a salient partition, but we did not determine whether the option of a contextually supplied partition is *also* available for UFs in indefinite DPs. We show next that existential closure in this environment is obligatory.

To see this, we have to examine UFs in environments that are not upward-entailing, as in upward-entailing contexts the interpretation derived when the partition argument of a UF is contextually salient entails the interpretation derived when the partition argument is existentially closed. If there is a contextually salient partition of a class into two halves, say, of math and CS majors, and one of those halves passed the exam, then – trivially – there is *some* partition of the students into two halves such that one of these halves passed the exam.

Consider, then, the example in (28a) where a UF is embedded under negation.

(28) **Context**: There are three books in box #1 and three books in box #2. Students in a reading competition are assigned points when they read all of the books in a box. Mary read two books from box #1 and one book from box #2. A asks: Does Mary get a prize? B responds:
a. #It is not the case that Mary read (a) half of the books.
b. #It is not the case that Mary read three books.

In this context, the books are partitioned into two halves, namely the half in box #1 and the one in box #2, and it is in fact true that Mary did not read all of the books in either of these two halves. Thus, if the partition argument of the UF in (28a) were allowed to be a free variable, we would have assigned the truth-conditions in (29b) to (28a), incorrectly predicting that the sentence is true in the given scenario.[7] To predict the infelicity of (28a) here, we therefore have to assume that existential binding of the partition argument is obligatory in this environment.

(29) Assume that the books in box #1 are a, b, and c and in box #2 are d, e, and f.
a. $S_7 = \{a \oplus b \oplus c, d \oplus e \oplus f\}$
b. $[\![\textit{It is not the case that Mary read half } S_1 \textit{ of the books}]\!]^g =$
1 iff $\neg\exists x \in g(1) : \forall y \leqslant_{AT} x : [\![\textit{read}]\!](y)(\textit{Mary})$
(where for any x, y, $y \leqslant_{\text{AT}} x$ iff $y \leqslant x \ \wedge \neg\exists y' : (y' \neq y \wedge y' \leqslant y)$)

4.2. Definite DPs

Turning to definite DPs, we show next that in this environment, UFs can only take a contextually salient partition as an argument. For reasons to be discussed below, we use the example in (30a), in which there is universal quantification ('*all*') on the modifier, to illustrate this (rather than the more simple case in (30b)). When the UF's partition argument is a free variable, we predict (31) to be the denotation of the definite DP in (30a). Thus, the DP denotes the unique plurality in the contextually-supplied partition S_1 whose atomic parts are all tall. The entire sentence is then predicted to be true iff that unique plurality read the books, as shown in (32).

(30) a. The half of the students who are all tall read the books.
b. The tall half of the students read the books.

(31) $[\![\textit{the half } S_1 \textit{ of the students who are all tall}]\!]^g = \iota x : \forall y \leqslant_{AT} x : [\![\textit{tall}]\!](y) \wedge x \in g(1)$,
defined iff $g(1)$ is a partition$_2^+$ of $\oplus[\![\textit{students}]\!]$ and $\exists! x : \forall y \leqslant_{AT} x : [\![\textit{tall}]\!](y) \wedge x \in g(1)$

(32) $[\![\textit{The half } S_1 \textit{ of the students who are all tall read the books}]\!]^g = 1$ iff
$[\![\textit{read}]\!]([\![\textit{the book}]\!])(\iota x : \forall y \leqslant_{AT} x : [\![\textit{smart}]\!](y) \wedge x \in g(1))$,
defined iff $g(1)$ is a partition$_2^+$ of $\oplus[\![\textit{students}]\!]$ and $\exists! x : \forall y \leqslant_{AT} x : [\![\textit{tall}]\!](y) \wedge x \in g(1)$

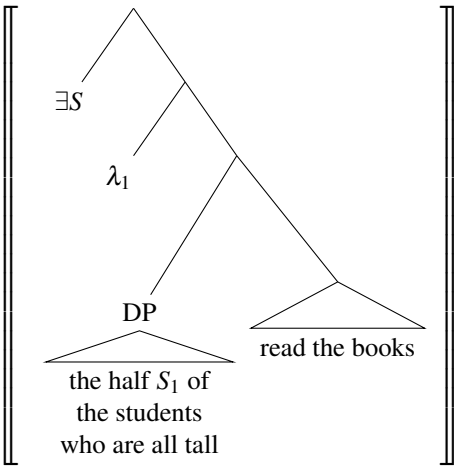
For the partition argument to be existentially closed, we stipulated that a generalized existential

[7] We assume no homogeneity effects arise when $[\![\textit{half}]\!]$ is in an indefinite. Otherwise, we would make the false prediction that (28a) is only true if Mary read none of the books, regardless of whether the partition argument is existentially closed or not. This assumption is shared with numerals in indefinites DPs, which also do not show homogeneity, and is presumably part of a larger puzzle of why certain constructions remove homogeneity (Križ, 2015 a.o.). It is of course logically possible within our analysis that we do get homogeneity in indefinite DP but only when the partition argument is not existentially closed, which would undermine our argument regarding (28), but we set this possibility aside for the purposes of this paper.

quantifier over partitions must reside in the UF's partition argument slot. For type reasons, this quantifier must then QR to a position outscoping the rest of the sentence. An LF for the sentence in (30a) in which this is the case is provided in (33), alongside the truth-conditions it derives. The LF is predicted to be true as long as there is some way to partition the students into two halves, one of which is all tall, such that the half which is all tall read the books.

The truth-conditions in (32) and in (33) are not equivalent. To see this, let us examine them with respect to the scenarios in (34a)-(34b). In (34a) there is no salient partition of the 10 students, so the LF with the free partition variable in (32) is undefined in this context. On the other hand, the truth-conditions in (33) hold in this scenario, since there is a way of partitioning the students into two halves such that the unique half which is all tall read the books. On the other hand, both sets of truth-conditions are true given the scenario in (34b).

(33)



$= 1$ iff $\exists S : S$ is a partition$_2^+$ of $\oplus[\![students]\!] \wedge$
$\exists!x[\forall y \leqslant_{AT} x : [\![tall]\!](y) \wedge x \in S] \wedge$
$[\![read]\!]([\![the\ books]\!])(\iota x : \forall y \leqslant_{AT} x :$
$[\![tall]\!](y) \wedge x \in S)$

(34) a. Context: There are ten students, eight of them are tall. Five of the eight tall students read the books.

b. Context: There are ten students, of whom five are CS majors and five are math majors. The CS majors are all tall but only three of the five math majors are tall. The CS majors read the books, but the math majors did not.

Now let us consider our judgements regarding (30a) – *the half of the students who are all tall read the book*: uttering this sentence seems infelicitous in the scenario in (34a), and felicitous (and true!) in the scenario in (34b). We thus conclude that the the sentence *cannot* be assigned the LF in (33), where the partition argument is existentially bound. This result falls under our generalization in (27), given that the UF in (30a) is embedded under a definite determiner.

The reason we use the sentence with *all* in (30a), rather than the simpler sentence in (30b) is that the latter obscures the truth-conditional difference between salient partitions and existentially closed ones. In particular, it seems that unlike (30a), (30b) presupposes that exactly half of the students are tall: it seems infelicitous in both the contexts in (34a) and (34b), where more than half of the students are tall,[8] and is felicitous only in a context like (35) where that is the case.

(35) Context: There are five tall students and five short students in the class.

Given (35), the truth-conditional differences between the salient partition reading (32) and its

[8]This is arguably due to homogeneity effects, which are removed by quantifiers like *all* (Löbner, 2000).

existentially closed counterpart (33) seem to disappear: both are true as long as the five tall students passed. This is because there is only one way to partition the students in (35) such that the presupposition of the definite that one of the halves in the partition is all tall is met; i.e., the partition into the five tall students and the five short ones. Therefore, the existential quantifier in (33) is trivial in this context and (33) becomes truth-conditionally equivalent to (32).

Indefinite DPs with UFs, headed either by a covert existential quantifier or by the determiner '*a*', thus only allow for existential closure of the UF's partition, while definite DPs headed by '*the*' only allow for a contextually salient partition, supporting the generalization in (27). Next, we provide evidence for our that generalization beyond '*a*' and '*the*', from *wh*-questions.

4.3. Wh-questions

To be able to test the (in)definiteness generalization in *wh*-questions, we need to be able to test whether a given *wh*-determiner is definite or not. One environment where definite and indefinite determiners are known to behave differently is the post-copular position of existential *there*-constructions (henceforth TCs). Milsark (1974) observes that while DPs headed by the indefinite '*a*' are licensed in TCs (36a), their definite counterparts are not (36b). Interestingly, Heim (1987) noticed that different *wh*-phrases behave differently in TCs as well. Particularly, *which*-phrases pattern with definites (37b), while *how-many*-phrases pattern with indefinites (37a). The observation *vis-a-vis which*-phrases is consistent with independent arguments for analyzing these elements as definite DPs (cf. Rullmann and Beck 1998).

(36) a. There is a car in your garage.
b. # There is the car in your garage.

(37) a. How many cars are there in your garage?
b. # Which cars are there in your garage?

We thus conclude that *which*-phrases are definite, while *how many*-phrases are indefinite,[9] and our (in)definiteness generalization predicts two things: first, UFs embedded in *which*-phrases are predicted to only combine with a contextually salient partition, and second, the partition argument of UFs in *how many*-phrases must be existentially bound.

We have already shown in section 3.3 that the former prediction is indeed borne out. If we allow an UF's partition argument in *which*-phrases to be existentially closed, the *which*-question no longer requires a salient partition, contrary to the observations we use to challenge the standard approach. To illustrate that the latter prediction is also borne out we show first that UFs in *how-many*-questions do not require a salient partition, and second, that they in fact disallow it.

To see that *how-many*-questions do not require a salient partition, consider (38), where it is common ground that a multiple of an eighth of the cars was sold, but there is no salient partition

[9]It is not clear whether it is definiteness *per se* that determines whether a DP is licensed in existential constructions (cf. Abbott, 2006). In fact, Milsark (1974) himself posits the well-known distinction between weak and strong determiners, which he argues captures the distribution of DPs in TCs. In any case, it is clear that definite DPs are a subset of Milsark's *strong* DPs which are not licensed in TCs. The felicity of *how many*-questions in these constructions therefore argues that they are not definite. And since *which*-questions have been independently argued to pattern like definite DPs in other respects, we attribute their infelicity in (37b) to their alleged definiteness.

of the products into eighths. We take the felicity of the *how-many*-question in this context to show that it is possible for the UF's partition argument there to be existentially closed.

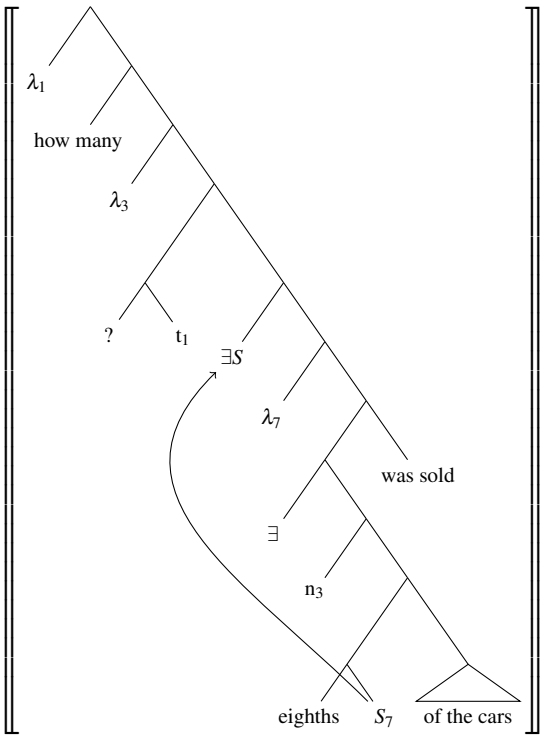
(38) Context: A car factory has hundreds of cars, but it is only worth it for them to sell cars in bulk. They therefore have a policy that they only sell multiples of an eighth of the cars they have at the beginning of the day. The boss asks one of his employees:
a. How many eighths of the cars were sold today?

Note that deriving the correct reading for UFs in *how-many*-questions, even with an existential quantifier over partitions, requires some non-trivial assumptions about the semantics of *how-many*-questions. What is crucial for our present purpose, of course, is the correlation between the felicity of UFs in *how-many*-questions even when there is no contextually salient partition available, and the status of *how-many*-DPs as indefinites, given Milsark's test. However, it will serve us in the discussion below to have a working hypothesis in mind.

For illustrative purposes, then, we adopt the idea that '*how many*' is an existential quantifier over cardinalities, and that pied-piping in *how-many*-questions is undone at LF via reconstruction, which gives rise to the structure in (39) where the pied-piped phrase is interpreted in its base position while its *wh*-specifier is interpreted above Karttunen's question operator (an idea originally due to von Stechow (1996), see implementations in e.g., Beck and Rullmann 1999; Fox and Nissenbaum 2018; Gentile and Schwarz 2018). We can then assume that the generalized quantifier in the UF's partition argument slot QRs to a position below Karttunen's question operator for type reasons, deriving the set of propositions in (39).[10]

While the example in (38) shows that UF's in *how-many*-phrases do not *require* a contextually salient partition, determining whether a contextually salient partition is *allowed* in that environment raises its own complication. This is because the presupposition of the *how-many*-question with a salient partition entails the presupposition when the partition is existentially closed, and we therefore cannot simply examine a question's felicity conditions in order to determine whether there is a contextually salient partition option here.

[10]We have not commented on how the cardinal n_3 which is bound by the *wh*-phrase in (39) compositionally combines with the constituent headed by the UF. For the structure in (39) we must assume that cardinals are subsective modifiers that can count minimal elements in their input set, rather than atoms (cf. Ionin and Matushansky 2006).

(39) 

$= \{\lambda w.\ \exists S{:}S \text{ is a partition}^{+}_{8} \text{ of } \oplus[\![cars]\!] \wedge$ n things in S were sold in $w \mid n \in \mathbf{N}^{+}\}$

To see this consider the truth-conditions for the question with a salient partition in (40).

(40) $[\![$*How many eighths* S_1 *of the cars were sold today?*$]\!]^{g}$ is defined iff $g(1)$ is a partition$^{+}_{8}$ of $\oplus[\![cars]\!]$ and some element in $g(1)$ was sold today. If defined, is equal to: $\{\lambda w.\ n$-many elements in $g(1)$ were sold in $w \mid n \in \mathbf{N}^{+}\}$

Assuming again that questions are presupposed to have a true answer (Dayal, 1996), (40) presupposes that there is a salient partition of the cars into eighth, such that at least one eighth in this partition was sold today. This clearly entails the presupposition in (39), which is simply that at least an eighth of the cars was sold, without requiring a specific partition.

In order to show whether a free variable over partitions is available for UFs in *how-many*-DPs, we will therefore consider cases where the *how-many*-question is in an embedded environment. Consider the example in (41) with the question-embedding predicate *ask*. Given the context in (42), (41) can be felicitously uttered if the boss wants to know the number of cars sold today, as in (42b). On the other hand, (41) is infelicitous in the scenario in (42a), where the boss only cares about how many lots were emptied. If the embedded question in (41) were able to have the denotation in (40) with the salient partition, (41) would be incorrectly predicted to be true in (42a). In particular, the context in (42) makes salient the partition in (43) into the cars in different lots. Given this partition, under the denotation in (40), (41) is true when the boss wants to know how many elements in this partition, namely how many lots, were sold.

(41) The boss asked how many eighths of the cars were sold today.

(42) **Context**: The cars produced by a car factory are stored in eight lots, each housing an eighth of the cars available at any given time. As in (38), the factory only sells cars in bulks whose size is an eighth of the product. However, the division of cars into lots is random. Therefore, a buyer might buy a bulk of cars consisting of cars stored in different lots. We know that at least one lot of cars was sold in full today.

a. **Scenario 1:** The boss wants to know how many of the lots in the factory were sold in full today.
b. **Scenario 2:** The boss wants to know how many cars were sold today.

(43) $[\![S_1]\!]^g = \{\text{the cars in lot \#1}, \text{ the cars in lot \#2}, \ldots, \text{ the cars in lot \#8}\}$

In order to explain the infelicity of (41) in the scenario (42b), we therefore have to conclude that, as predicted by our (in)definiteness generalization, UFs in *how-many* questions cannot combine with a contextually salient partition. In conclusion, if (as suggested by Heim's implementation of Milsark's diagnostic with *wh*-words) *which*-phrases are definite while *how-many*-phrases are indefinite – then both of these elements conform to the (in)definiteness generalization we argue for in this section.

5. Deriving the (in)definiteness generalization

We argued that the distribution of contextually salient partitions *vs* existentially closed ones with UFs follows the (in)definiteness generalization, repeated in (44). In this section, we offer some tentative remarks regarding potential ways of accounting for this generalization.

(44) **(In)definiteness generalization:** UFs in definite DPs can only combine with *free* partition variables. UFs in indefinite DPs can only combine with $\exists S$ (defined in (23)).

5.1. Contextually salient partitions as a last resort

The first idea we consider is to tie the generalization in (44) to the inability of quantifiers to move out of definite islands. As we saw in section 3.2, when the sister of a UF is an existential quantifier over partitions, this quantifier has to move out of the host DP in order to be interpreted and avoid a type mismatch. Given that definite DPs are islands for movement (Chomsky, 1973), it is therefore possible that the existential quantifier option is ruled out in definites due to the inability of the quantifier to scope out of the definite DP.

If the above assumption about definiteness islands applying to our existential quantifier is correct, the principle in (45) predicts our (in)definiteness generalization. When a UF is in an indefinite DP, its sister is obligatorily an existential quantifier which takes scope outside the DP to avoid type mismatch. On the other hand, when the UF is in a definite DP, having its sister be a quantifier over partitions leads to ungrammaticality: the quantifier cannot be interpreted in its base position as this will lead to type mismatch, but at the same time it cannot move out of the definite DP due to definiteness island effects.

(45) **Last resort principle:** By default, the sister of a UF has to be an existential quantifier over partitions, *Some C*. If the LF with *Some C* leads to ungrammaticality, the sister of the UF is a free variable over partitions whose value is contextually supplied.

In what follows, we discuss the necessary assumption here that our existential quantifier over partitions cannot raise above its host DP. It has been observed since Chomsky (1973) that definite DPs are islands for movement. This is evidenced by the contrast in (46): in (46a), *who*

can move out of the indefinite DP object (*a picture of* __), while the counterpart with a definite DP (*the picture of* __) is ungrammatical.

(46) a. Who did Mary see a picture of?
b. ??Who did Mary see the picture of?

Just like with overt wh-movement in (46), it seems that QR is also not possible out of a definite DP. In (47a), *every student* can take scope above the indefinite DP that is its host. This is evidenced by the fact that (47a) is true in the context in (48), where there is a different picture for every student such that Mary saw them all. On the other hand, in (47b), *every student* cannot take scope outside the definite DP: (47b) is not true in (48), but is rather only true if there is a single picture that every student is in, and Mary saw *that* picture (i.e., *every student* scopes inside the definite DP hosting it). We can therefore conclude that QR out of a definite is not possible (though see caveat below).

(47) a. Mary saw a picture of every student. $\exists > \forall, \forall > \exists$
b. Mary saw the picture of every student. $the > \forall, ??\forall > the$

(48) **Context:** The students each submitted a picture for the yearbook, and Mary, the yearbook editor, looked through all the pictures.

Under the assumption that our existential quantifier over partition patterns with the universal quantifier in (47) in being unable to scope outside a definite DP, the last resort principle in (45) predicts our (in)definiteness generalization.

This approach faces several problems. First, there are counterexamples to the claim that QR is subject to definie islands. In (49), *every* seems to scope above the definite DP, for instance. Furthermore, we know that indefinites in particular seem to be able to take scope outside of islands (Reinhart, 1977 a.o.). Since our existential quantifier over partitions is arguably an indefinite, one might be skeptical that the scope constraint illustrated in (47b) applies to it.

(49) I cleaned the top of every table.

Finally, there are conceptual problems with the last resort principle in (45). In particular, it is not clear why the existential quantifier over partitions should be the default option. Moreover, the constraint in (45) is transderivational, since the grammaticality of the free variable option here depends on whether an alternative LF with existential closure is grammatical. One has to therefore posit a mechanism in the grammar that licenses certain LFs only if certain alternative LFs behave in a particular way. While this is not unheard of, further work is required to determine whether this approach is justified in the context of the semantics of UFs.

5.2. Inherited (in)definiteness

It has been noted at least since Jackendoff (1977) that the (in)definiteness of a possessive DP in the Saxon genitive is determined by the (in)definiteness of its possessor. Jackendoff illustrates that DPs with an indefinite possessor are indeed indefinite by applying Milsark's diagnostic for indefiniteness; i.e., by showing that these DPs are licensed in TCs and thus cannot be definite.

(50) a. John's book → [+def]
b. A boy's book → [−def]

(51) a. #There is John's book on the table.
b. There is a boy's book on the table.

Similarly, it is argued that the Semitic construct state (hereafter, CS) also presents a case of inherited (in)definiteness (e.g., Borer 1984; Hazout 1991; Ritter 1991; Siloni 1997; Dobrovie-Sorin 2000). In the CS, a DP's head noun lacks an overt article and its definiteness feature is determined by the genitive; when the genitive is indefinite, the whole DP is indefinite, and when it is definite so is the whole DP (see overview in Alexiadou 2005). In (52) is an example from Hebrew, which lacks indefinite articles. Thus, when the genitive is bare (52a), the whole DP is indefinite and when the genitive has a definite article (52b), the whole DP is definite.

(52) a. beyt more
house teacher
'a teacher's house'

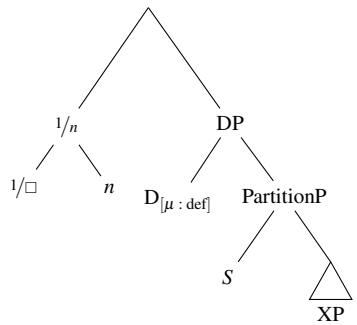
b. beyt ha- more
house DEF- teacher
'the teacher's house'

This phenomenon has been dubbed *(in)definiteness spread*. And, while the mere existence of this phenomenon is still up for debate (see, e.g., Danon 2001; Heller 2002 for arguments against (in)definiteness spread in the CS), if it does exist it seems suspiciously similar to our generalization *vis-a-vis* partition variables (44). A review of how inherited (in)definiteness has been accounted for in different languages is beyond the scope of this paper (cf. Alexiadou 2005). For the remainder of this section, we toy with one way of implementing (in)definiteness spread for UFs, using agreement of definite features of nested DPs.

First, let us modify our syntax of UFs as in (53), where instead of taking two arguments, a partition and a set of individuals, the UF selects for a DP headed by a determiner of partitions, whose restrictor is a partition phrase with a head *S* and a set of individuals in its complement. The head *S*, defined in (54), denotes a function from a set f, to the set of all possible partitions of $\oplus f$. Thus, $[\![S \textit{ of the students}]\!]$ denotes the set of all partitions of $\oplus [\![\textit{students}]\!]$.

We assume that the determiner of partitions D carries a feature $[\pm def]$, and denotes the definite article when the feature's value is $[+def]$ (55a), and an existential quantifier when that value is $[-def]$ (55b) ((55a)-(55b) are higher-type counterparts of the definite and indefinite articles as formalized in, e.g. Heim and Kratzer 1998,[11] with context-dependency introduced as an index on the definite article). This allows the sister of the UF to denote a contextually salient partition when the feature on D is $[+def]$ and an existential quantifier over partitions when the feature is $[-def]$. Finally, we posit the modified lexical entry for UFs in (56), according to which a UF like *half* takes as its input a set of individuals (a partition), "checks" that this set consists of two equi-sized elements, and if it does, simply returns that set.

(53)



[11] We need higher types here given that the input to a determiner whose restrictor is a partition phrase is of type $\langle et,t \rangle$, unlike determiners of $\langle e,t \rangle$-denoting elements.

(54) $[\![S]\!] = \lambda f_{\langle e,t\rangle}\lambda g_{\langle e,t\rangle}$. 1 *iff* g is a partition of $\oplus f$ (see definition of partition in (15))

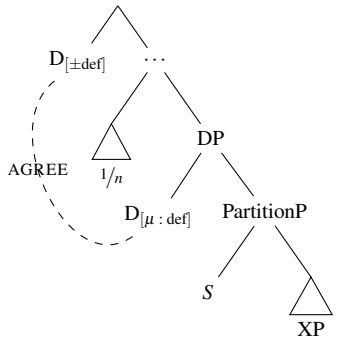
(55) a. $[\![D_{[+def]}]\!]^g = [\![the_i]\!]^g = \lambda f_{\langle et,t\rangle} : \exists!x \in g(i)[f(x)].\ \iota x : f(x)$
where $g(i)$ is a contextually salient subset of $\mathscr{D}_{\langle e,t\rangle}$

b. $[\![D_{[-def]}]\!]^g = [\![\exists]\!]^g = \lambda f_{\langle et,t\rangle}\lambda h_{\langle et,t\rangle}.\ \exists x \in \mathscr{D}_{\langle e,t\rangle} : f(x) \wedge h(x)$

(56) $[\![1/n]\!] = \lambda f_{\langle e,t\rangle} : |f| = n \wedge \forall x,y \in f : |x| = |y|.\ f$

The final assumption we make is the one in charge of deriving the generalization in (44). As illustrated in (53), UFs select for DPs whose head D is unvalued for [±def]. We then stipulate that the value of [±def] is determined via agreement with the host DP of the UF as in (57).

(57)



We thus achieve the desired result as follows: Under definite determiners, a UF's input DP inherits a $[+def]$ feature, and the uniqueness presupposition that it enforces – demanding that among the set of contextually salient partitions (i.e., the contextually salient subset of $\mathscr{D}_{\langle e,t\rangle}$), only one will partition of the maximal element in its restrictor. The input to the UF as defined in (56) will then be *that* partition. On the other hand, under indefinite determiners, a UF's input DP inherits a $[-def]$ feature, thus denoting an existential quantifier over partitions. To avoid type-mismatch this quantifier will need to raise above the UF for interpretation, and the result would be the truth conditions for indefinite sentences detailed in section 3.

6. Conclusion

We argue for a novel semantics for unit fractions, which has them take a partition as one of their arguments, and allows us to solve two novel puzzles involving UFs. We show that the partition argument must be existentially closed when the UF is in an indefinite DP, and a free variable whose value is contextually assigned when the UF is in a definite DP.

In our discussion, we focus only on a subclass of partitive constructions with UFs; namely, only on cases where the partitive phrase denotes a plural individual, as in (58a). In that case, the number of atoms in each element of the UF's partition argument is counted to ensure that the elements in the partition are equal in size. Our analysis can be extended, however, to cases where the partitive phrase denotes an atomic individual, like (58b). In such cases, rather than counting atoms, some other measure of the size of the relevant parts is needed. This has already been observed, and implemented by Ionin et al. (2006) and their implementation could be incorporated into our semantics for UFs. Note that the puzzles that motivated our partition-based analysis of UFs to begin with can both be replicated with the singular partitive *half of the orange*. First, the *which*-question in (59a) is only felicitous in a context like (59),

where there is a salient partition of the orange into two halves. Our second puzzle, namely, the behavior of *half* in descriptions with superlative and comparative modification, also extends to UFs in partitives with a singular NP. This is illustrated by the contrast in (60), where only a comparative modifier seems to be licensed with *half* inside a definite description.

(58) a. Jane ate half of the oranges.
b. Jane ate half of the orange. (Adapted from Ionin et al., 2006)

(59) Context: Mary cut the orange into two halfs, one of them was a bit rotten but the other was good. Someone asks:
a. Which half of the orange did Jane eat?

(60) a. The tastier half of the orange.
b. ??The tastiest half of the orange.

An important implication of the data we present in this paper is that it posits a challenge to theories that aim to unify the semantics of numerals and fractions (e.g., Ionin et al. 2006). Only one of these, namely UFs, are shown to be subject to a felicity constraint, requiring that context make salient a particular partition, when embedded under a definite determiner. It is at least prima facie surprising that this is the case, given that UFs and numerals (in some pre-theoretical sense) seem to be used to "do the same thing," namely, to count elements in their input sets. Our observations thus raise some obvious conceptual questions like why numerals and UFs should differ in this way, and why do they differ only in particular environments.

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Crew members of the Titanic – a lexical temporal account[1]

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Abstract. In this paper, I propose an analysis for the temporal interpretation of noun phrases according to which nouns independently locate the time at which they are temporally evaluated depending on noun class and context. I will argue that nouns separate into two aspectual classes: eventive and stative nouns. On top of this, noun phrases possess a covert time pronoun that is semantically under-specified for nouns that are eventive, and restricted to the utterance time if they are stative. This novel approach explains puzzling data and unifies previous accounts by means of extending analyses of verbal tense phenomena (i.e., pronominal tense, superficial tenselessness) to the nominal domain.

Keywords: temporal interpretation of noun phrases, nominal lexical tense and aspect, superficial tenselessness

1. Introduction

Research on the temporal interpretation of noun phrases (Enç, 1981, 1986; Musan, 1995, 1999; Tonhauser, 2002, 2006, 2020; Rapp, 2015; O'Leary, 2022, among others) has aimed to determine under which conditions noun phrases can receive a temporally independent interpretation (i.e., the NP and VP are evaluated with respect to different times). Previous work has focused on the role played by context, the type of determiner, or the type of noun. Research on context argues that the temporal location of noun phrases is independent of verbal tense and determined by the context (Enç, 1981, 1986). Work on determiner type generalizes this to be the case if and only if the NP is presuppositional (Musan, 1995, 1999). Tonhauser's (2002) example in (1) challenges this: despite its non-presuppositional determiner, *some crew members* is naturally interpreted at the time of the Titanic being operative. Tonhauser (2002, 2006, 2020) concludes that noun phrases are best analyzed as temporal anaphors due to their property of referring directly to times in the context, suggesting first parallels between nominal and verbal temporality.

(1) *Context: At a reunion of the survivors of the Titanic disaster.*
Look, there are even some crew members here. (Tonhauser, 2002: 294)

Theories on noun type propose that the lexical temporal properties of the noun affect the temporal interpretation (Rapp, 2015; O'Leary, 2022). Under this view, *crew members* is analyzed as something like *former crew members* to capture that the relevant individuals were crew members at some time before the reunion. Crucially, this does not reconcile the contradiction of

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examples such as (1) to Musan's generalization. Despite being temporally independent, the assumption of *former* as part of the noun denotation is not presuppositional. Thus, the crew members of the Titanic continue to prevent a unified analysis under which the temporal independence of (1) can be explained in terms of presuppositionality.

Since the gap between Musan and Tonhauser cannot be accounted for via bridging (Schwarz, 2009) or quantifier domain restriction (Stanley and Gendler Szabó, 2000), I propose to extend analyses of verbal temporal phenomena, such as pronominal tense and superficial tenselessness, to the nominal domain. Nominal semantic representation is enriched to include lexical tense and aspect. The lexical aspect separates eventive from stative nouns motivated by their underlying ontological properties. Although nouns lack tense morphology, I argue that noun phrases possess a covert time pronoun that directly refers to salient times in the discourse. The pronoun is presuppositionally restricted by one of two tense features whose selection is determined by the lexical aspect of the noun. The tense feature selected by eventive nouns restricts possible referents to being non-future. Stative nouns select one that restricts the noun phrase time to include the utterance time. This novel approach to the temporal interpretation of NPs unifies previous accounts, explains the status of (1) in terms of temporal presuppositionality, and treats temporality in language as a uniform phenomenon across domains.

2. Background

In this section, an overview of the background relevant for the proposal is provided. First, necessary terminology concerning the different times used in language is established, followed by a summary of earlier approaches.

2.1. Times in language across domains

I will follow Tonhauser's (2021) time relational framework of noun phrases which, in turn, is an extension of Klein's (1994). According to the latter, three times are necessary for the temporal interpretation of sentences. For this, consider the two examples in (2).

(2) a. Ede arrived this morning.
b. When Ede arrived this morning, Cornelia had already left.

Intuitively, it may seem to suffice to talk about (2a) in terms of two times: The time at which the sentence is uttered and the time at which Ede arrived, i.e., *this morning*. The past perfect construction in (2b), however, highlights the need to further distinguish between the time to which the sentence as whole refers (i.e., *this morning*) and the times at which the events of Ede arriving and Cornelia leaving take place (i.e., at some point within *this morning* and some time before *this morning* respectively). The three times are given in (3).

(3) a. Utterance time: The time at which a sentence is uttered.
b. Reference time:[2] The time to which the speaker's claim refers.
c. Event time: The time of the eventuality taking place.

[2]Klein (1994) uses the term *topic time*; however, I find Reichenbach's (1947) *reference time* more intuitive, as verb (or noun) phrases quite literally refer to a time in the context.

The different times are associated with distinct properties. Specifically, the utterance time is deictic, given by the context of utterance, the reference time is a temporal anaphor (Partee, 1984), and the event time is existentially quantified (Klein, 1994). The semantic function of tense and aspect is to establish temporal relations between them. Tense is defined to indicate the location of the reference time relative to the utterance time. Aspect contributes a particular relation between the event time and the reference time. Going back to the examples in (2), the past tense picks out the reference time *this morning*, and contributes an anteriority relation between it and the utterance time. While the lack of aspectual markers results in the event time being subsumed in the reference time in (2a), the past perfect construction contributes that Cornelia's leaving event takes place at some undefined point before the reference time (2b).

Like verb phrases, nominals contribute temporal information to the utterance. In order to adequately talk about the temporal properties of noun phrases, Tonhauser (2021) extends the three way distinction to the nominal domain: the utterance time, the noun phrase time (i.e., the time at which the NP is evaluated), and the nominal event time (i.e., the time at which the nominal property holds of its referent). Similar to the examples in (2), in the absence of aspectual markers, the noun phrase time and event time coincide but this need not be. Consider (4).[3]

(4) a. In 2007, I met a priest.
b. In 2007, I met a former priest.

On their salient reading, the noun phrase time of both nominals in (4) is 2007. The event time of *a priest* in (4a) coincides with the noun phrase time, i.e., the individual was a priest in 2007. In contrast, the event time of the nominal in (4b) must *not* coincide with the noun phrase time and is instead restricted to precede it, i.e., the individual was a priest at some point before - but not during - 2007. Tonhauser (2021) points out that the default are cases like (4a) where the nominal event time overlaps the noun phrase time. Like their verbal counterparts, the noun phrase time is a temporal anaphor, and the event time existential (cf. Tonhauser, 2021). This terminology allows us to define what it means for a noun phrase to be temporally independent, given in (5).

(5) The temporal (in-)dependence of noun phrases:
A noun phrase is temporally independent if and only if the noun phrase time is distinct from the verbal reference time.

Under this view, the crew member example in (1) is considered temporally independent: The noun phrase *some crew members* refers to the time of the Titanic being operative and the verbal predicate of being at the reunion refers to the time of utterance. In contrast, the salient reading of (4b) is then *not* considered temporally independent: Both, the verb and noun phrase, refer to the same reference time, *2007*.[4]

[3]For this comparison I am assuming that the temporal adjective *former* is a nominal aspectual marker that quantifies over the noun's event time. The adjective asserts that the nominal property holds at some point before (but not during) the noun phrase time (cf. Tonhauser, 2006).

[4]This view is in opposition to the weaker definition according to which a nouns phrase is independent if the nominal event time is distinct from the (verbal) reference time. There is no conclusive argument for either definition, and both variations are used in the literature; though, not always made explicit because earlier theories do not distinguish between the noun phrase time and event time.

2.2. Context

Previous work on context argues that the temporal location of noun phrases is independent of the time introduced by verbal tense, and that context determines the time at which NPs are temporally evaluated (Enç, 1981, 1986). A case in point is Enç's famous example in (6). Despite the present tense of the VP, the individuals quantified over were fugitives at some past time and are in jail at the utterance time.

(6) *Context: Last month, five people broke out of prison. Today, the last one was caught.*
Every fugitive is now in jail. (Enç, 1981: 38)

Enç (1986: 422-423) concludes that the only constraints on the temporal argument of the noun phrase are pragmatic, and the noun phrase time refers to times previously introduced in the context by tenses and temporal adverbs. According to this proposal, the noun phrase time of *every fugitive* can be a past time, as it is recoverable from the context in (6).

2.3. Determiner type

The contextual approach was challenged by Musan (1995, 1999) who argues that only presuppositional noun phrases may be temporally independent, while non-presuppositional noun phrases *must* be evaluated at the time introduced by verbal tense. The author illustrates this dichotomy with the example in (7). Only the nominal in (7a) allows for an interpretation under which the individuals were fugitives in the past and are in jail now. In contrast, she argues, the nominal in (7b) must be evaluated with respect to the same time as the VP, either resulting in a contradictory interpretation or one in which the individuals fled from something other than jail.

(7) a. Many [of the] fugitives are now in jail.
b. #There are many fugitives in jail. (Musan, 1995: 11)

According to Musan's proposal, strong determiners (i.e., determiners that cannot occur in existential constructions) are necessarily presuppositional. Weak determiners (i.e., determiners that can occur in existential constructions), on the other hand, may have a presuppositional or a non-presuppositional reading. The example in (7) is a case in point. In (7a) the weak determiner *many* as part of a partitive construction receives a presuppositional reading. The nominal presupposes the existence of its referents which allows it to be evaluated at a past time. In contrast, *many* in an existential construction forces a non-presuppositional reading of the determiner, only allowing for a temporally dependent interpretation, i.e., a reading under which the individuals are fugitives and in jail at the same time. Like Enç (1986), Musan assumes that the temporal interpretation of (presuppositional) noun phrases is contextually determined.

2.4. Context - anaphoric noun phrases

Tonhauser (2020) adds to this discussion by showing that Musan's requirement of non-presuppositional NPs being temporally evaluated at the time introduced by the verbal tense is too strong. The example in (8) illustrates this convincingly. Although *some crew members* is part

of an existential construction and, thus, non-presuppositional according to Musan, it receives a temporally independent interpretation. The nominal is naturally interpreted at the time of the Titanic being operative rather than the time of the reunion.

(8) *Context: At a reunion of the survivors of the Titanic disaster.*
Look, there are even some crew members here.

The temporal anaphoricity exhibited in (8) is similar to the one shown in (6) despite the difference in determiner type. Building on this, Tonhauser (2020) argues that the noun phrase time is, in fact, a temporal anaphor by which she illustrates first similarities between the temporality of the verbal and nominal domain.

Temporal anaphora are subject to deictic, discourse anaphoric, and bound interpretations, first shown by Partee (1973, 1984) for verbal tense in (9). Deictic and discourse anaphoric interpretations receive their semantic value from temporal referents introduced in the discourse. Bound interpretations do not pick out a referent in the context; instead, they function as a variable bound by a quantificational operator.

(9) a. I didn't turn off the stove! [deictic]
b. Sheila had a party last Friday. Sam got drunk. [discourse anaphoric]
c. Whenever Mary telephoned, Sam was asleep. [bound]
(Partee, 1973: 603, 1984: 245-246)

The past tense in (9a) is anaphoric to some time before leaving the apartment, whose identity is made clear through non-linguistic context, at which the speaker did not turn off the stove. In (9b), the first sentence introduces a reference time which serves as a temporal antecedent for the time at which Sam got drunk. Finally, the *whenever*-clause in the sentence (9c) denotes a quantifier that is applied to the times of Sam being asleep. Similarly, the examples in (10) show that the interpretations of temporal anaphora are available for noun phrases as well.

(10) a. When I first met **my fiance**, I was with my ex-girlfriend. After we broke up, I started dating him. [deictic]
b. In November, Mary sold raffle tickets at her art show. **No visitor** returned the following month to claim the prize. [discourse anaphoric]
c. Whenever Peter hosted a birthday party for a friend last year, **some guest** sued him the next year. [bound]
(Tonhauser, 2020: 12)

The bold-faced noun phrase in (10a) receives a deictic interpretation according to which the time at which *my fiance* is evaluated is anaphoric to the utterance time, rather than the time of first meeting them. *No visitor* in (10b) is temporally interpreted at the time introduced by the first sentence, the art show in November, instead of the time of claiming the prize. Lastly, the temporal interpretation of the noun phrase *some guest* in (10c) is bound by the *whenever*-clause where the relevant individuals are guests at times at which Peter hosted a party and not at the times at which they sued him.

Importantly, analyzing noun phrases as temporal anaphors entails that the temporal noun phrase interpretation is context dependent as motivated by Enç (1981, 1986) and Musan (1995, 1999).

2.5. Noun type

More recent accounts explain the crew member example in (8) in which non-presuppositional nominals receive an independent interpretation by assuming that lexical properties of nouns may affect the temporal interpretation of NPs. To my knowledge there are two such accounts in the literature.

2.5.1. Label nouns

Rapp (2015) draws from the verbal domain and argues that so-called *label nouns* are eventive personal nouns which can be used to characterize an individual after the event time. Label nouns presuppose one or several events in which the referents are involved.[5]

(11) Eventive personal nouns:
   a. Single event nouns (e.g. *Mörder* 'murderer', *Opfer* 'victim', *Sieger* 'winner')
   b. Habitual event nouns (e.g. *Betreuer* 'care taker', *Lehrer* 'teacher', *Schreiner* 'carpenter', *Flüchtling* 'fugitive')

(Rapp, 2015: 502-503)

Rapp notes that pragmatics are the biggest factor whether a noun is lexicalized with a single or habitual meaning, as well as the Aktionsart of the underlying verb. She represents single event nouns like *murderer* in (12a), where the run-time of the murder event can be before or equal to the noun phrase time. Habitual event nouns such as *teacher* are represented by assuming series of events with the reference time being temporally located somewhere between the first and last event (12b).

(12) a. $[\![\textbf{murderer}]\!]^g = \lambda x.\lambda t.\exists y[\exists e[MURDER(y,x,e)\&\tau(e) \leq t]]$
   b. $[\![\textbf{teacher}]\!]^g = \lambda x.\lambda t.\exists y[\exists e_1...e_n[TEACH(y,x,e_1...e_n)\&\tau(e_1) \leq t \leq (e_n)]]$

(Rapp, 2015: 502-504)

This way, eventive nouns headed by a non-presuppositional determiner may allow for an interpretation at which the nominal property holds before the time at which it is evaluated.

2.5.2. Flexibility of nouns

O'Leary (2022) argues that nouns have different sets of available event times, i.e., the intervals throughout which the nominal property holds of their referents.[6] Based on this, the author postulates that all stage nouns separate into two lexical aspectual classes that affect the temporal interpretation of nominals. The two classes are illustrated in (13).

(13) a. A fugitive is in jail.
   b. #A bachelor is married. (O'Leary, 2022: 5)

[5]In a personal conversation Rapp clarified that eventive nouns, such as in *Ron is a murderer*, do not presuppose the existence of an event. Instead, eventive nouns used in a definite description (e.g., *the murderer is bald*) invoke an existence presupposition of the event.

[6]Instead of *nominal event time*, O'Leary uses the analogous term *property time*.

While (13a) can be interpreted as *a former fugitive is in jail*, (13b) does not allow an interpretation that there is a former bachelor who is married. O'Leary calls nouns that behave like *fugitive* flexible nouns and nouns like *bachelor* inflexible nouns, formalized in (14).

(14) a. $[\![\text{flexible noun}]\!]^g = \lambda t.\lambda x.\exists t'\colon t' \leq t \wedge noun(x)(t')$
b. $[\![\text{inflexible noun}]\!]^g = \lambda t.\lambda x.\exists t'\colon t' \circ t \wedge noun(x)(t')$ (O'Leary, 2022: 47)

Under this view, it is stipulated that in unembedded clauses the noun phrase time of any nominal with a non-presuppositional determiner allows to be evaluated with respect to one of two times:[7] the time introduced by verbal tense or the utterance time (O'Leary, 2022: 46). In addition to this, the nominal event time is existentially quantified over. In the case of flexible nouns, the event time may be before or equal to its noun phrase time (14a). For inflexible nouns, the event time and noun phrase time must overlap.

3. The obstacle to a unified analysis

We may then summarize the insights of previous theories as the set of (temporal) properties of noun phrases in (15).

(15) The temporal properties of noun phrases:
a. The temporal location of noun phrases is independent of the time introduced by verbal tense. Context determines the time at which NPs are temporally evaluated.
b. A noun phrase can be temporally independent if and only if it is presuppositional.
c. Noun phrases are temporal anaphors that pick out salient times in the context.
d. The lexical temporal properties of the noun affect the noun interpretation.

Crucially, the properties are not necessarily mutually exclusive. However, Tonhauser's (2002) crew member example, repeated in (16), has so far prevented a unified analysis. As previously stated, the temporal interpretation of *some crew members* obeys (15a) and (15c), but seems to violate (15b).

(16) *Context: At a reunion of the survivors of the Titanic disaster.*
Look, there are even some crew members here.

More recent theories assume that the lexical temporal properties of the noun affect the temporal interpretation (15d) and, specifically O'Leary's (2022), commands a high explanatory power in terms of accounting for the empirical landscape. Yet, they do not reconcile the contradiction of the temporal independence of (16) to the generalization that only presuppositional NPs can be independent. Under O'Leary's (2022) view, *crew member* is assumed to be a flexible noun with the semantics in (17a). Assuming a pronominal analysis for verbal tense (Partee, 1973; Kratzer, 1998), Tonhauser's example in (16) receives the truth-conditions in (17b).[8]

(17) a. $[\![\textbf{crew member}]\!]^{g,c} = \lambda t.\lambda x.\exists t'\colon t' \leq t \wedge cm'(x)(t')$

[7] Rather than noun phrase time, O'Leary's uses the term *input time*.

[8] Note that O'Leary (2022) adopts a quantificational approach to tense as her semantic theory on (non-presuppositional) noun phrase interpretation relies heavily on scopal relations. However, she assumes a pronominal view of tense for her analysis of presuppositional noun phrases couched in DRT. The analysis here is spelled out in terms of the framework I adopt in this paper. This difference is not reflected in the given truth-conditions.

b. $[\![(16)]\!]^{g,c}$ is defined only if $g(1) \subseteq t_c$. (t_c = UT)
When defined, $[\![(16)]\!]^{g,c} = 1$ iff $\exists x \exists t'$: $t' \leq g(1) \wedge cm'(x)(t') \wedge be\text{-}present'(x)(g(1))$

The temporal independence of (16) is achieved by existentially quantifying over the nominal event time and allowing it to precede the noun phrase time. The analysis in (17b) predicts that the relevant individuals were crew members at a time before the reunion. However, the anteriority meaning as part of the noun denotation in (17a) results in truth-conditions that are too weak, including individuals who were crew members after the Titanic had already sunk, and does not invoke presuppositionality. Thus, the temporal independence of nominals headed by a non-presuppositional determiner such as (16) continues to prevent a unified analysis under which their status can be explained in terms of presuppositionality.

Before proposing an alternative approach that aims to explain (16) by means of a unifying analysis of (15), I would first like to entertain the possibility that the issues concerning the lack of presuppositionality and anaphoricity in (17) could be reconciled with other available options in the literature. The first point concerns the NP's status of temporal (in-)dependence in (17b) which may resolve its violation of Musan's generalization. The second point relates to bridging in the spirit of Schwarz (2009) and how it might rescue the nominal being presuppositional and anaphoric. Lastly, quantifier domain restriction is considered to potentially account for the lack of anaphoricity.

3.1. The status of *some crew members*

The reader may have noticed that under the definition of temporal independence given in (5), *some crew members* in (17b) is not considered temporally independent. The noun and verb phrase are both evaluated at the same reference time, the reunion, whose temporal value is assigned to $g(1)$. One might now argue that by weakening the definition of temporal independence to only require that the nominal event time be distinct from the verb phrase time, O'Leary's (2022) theory no longer violates the property in (15b). This is indeed the case for the crew member example, but consider the sentence in (18).

(18) A woman was born in 1973.[9]
a. $[\![\textbf{woman}]\!]^{g,c} = \lambda t.\lambda x.\exists t'$: $t' \circ t \wedge woman'(x)(t')$
b. $[\![(18)]\!]^{g,c}$ is defined only if $g(2) < t_c$.
When defined, $[\![(16)]\!]^{g,c} = 1$ iff $\exists x \exists t'$: $t' \circ t_c \wedge woman'(x)(t') \wedge be\text{-}born'(x)(g(2))$

The noun *woman* is an inflexible noun with the semantics in (18a) that denotes that the time of being a woman has to overlap with the noun phrase time.[10] As illustrated in (18b), the noun phrase time and event time of *a woman* thus both coincide with the utterance time (represented as t_c). The verb phrase time is evaluated at 1973, which is the value assigned to $g(2)$. Crucially, the nominal is temporally independent according to either definition we may stipulate despite

[9]Example from O'Leary (p.c.).
[10]O'Leary's test to determine whether a noun is flexible or inflexible is if they allow modification by *former*. *Woman* (generally) does not, which makes it inflexible. Note that this does not account for cases in which the referent has, for instance, undergone gender reassignment surgery. Compare with section 4.1.2 how those examples can be explained.

not being presuppositional. Thus, Musan's generalization remains violated and a unified account a distant goal.

3.2. Bridging the Titanic

As for the lack of anaphoricity in (17b), it is sometimes noted in passing that the relational noun *crew member* involves a covert prepositional phrase that actually means something like *crew members of the Titanic*. This would then account for the anaphoricity via bridging and (potentially) introduce presuppositionality with the definite determiner.[11] Conversely, from this follows that non-relational nouns do not exhibit the same kind of anaphoricity. For this consider the noun *novelist* which is non-relational according to the tests for relationality in (19).

(19) a. The crew member(s) of the Titanic
b. #The novelist of the book/novel. (Schwarz, 2009: 248)

If the anaphoricity in (16) was indeed due to the noun's relation property, it would predict that non-relational nouns are not anaphoric in similar contexts. This is not borne out: *Novelist* exhibits anaphoricity in (20) despite not being relational.

(20) *Context: At a 40-year reunion for the associates of a no longer existing publisher.*
Wow, everyone came. Look, there are even some novelists here.

Just like (16), the context in (20) does not necessarily exclude individuals who are crew members/novelists at the time of the reunion. Nevertheless, the natural interpretation of the nominal is the time at which the publisher was still in business and published said novelists. Due to this under-generalization, the anaphoricity is therefore not fully accounted by bridging.

3.3. Quantifier domain restriction

A reviewer noted that the lack of anaphoricity in (17) might be reconciled by simply restricting the domain of the quantifier à la Stanley and Gendler Szabó (2000). The idea of domain restriction is illustrated with (21).

(21) I fed every cat.

Most likely (21) will be used to express that the speaker fed a restricted class of cats (e.g., the cats the speaker owns) rather than claiming that they fed every cat in existence. The domain over which the quantifier *every* ranges is restricted by the context of utterance. In a similar fashion, one may argue that the nominal *some crew members* under the Titanic scenario is contextually restricted to the set of individuals who were crew members on the Titanic. This approach would predict that any noun phrase can be anaphoric if the context gives rise to a salient time, which is not too dissimilar to the proposals made by Enç (1981) and Tonhauser (2020). However, this leads to over-generalization, as shown in (22), where the only difference is the noun upon which the ability to refer to past times depends.[12]

[11] Though, it is also possible that the determiner in that instance is semantically empty.
[12] O'Leary (2022).

(22) *Context: At a 1932 reunion for the survivors of the 1912 Titanic disaster.*
   a. Look, there are even some crew members here.
   b. Look, there are even some 30 year olds here.

Only the noun phrase in (22a) allows for a reading under which the individuals were crew members at the time of the Titanic. In contrast, the nominal in (22b) must be interpreted at the time of the reunion, and does not give rise to a reading where the relevant individuals were 30 back then and 50 at the reunion.

Note that there is a second quantifier whose domain we might consider restricting: the existential quantifier over the nominal event time (represented as $\exists t'$ in (17a)). After all, the truth-conditions in (17b) are under-specified so as to include crew members at the time of the Titanic. Recall, in section 2.1, the noun phrase time and event time were distinguished by their properties. The noun phrase time is an anaphor, while the event time is existentially bound. Restricting the domain of the quantifier over (event) times in the way suggested here would imply that the event time is an anaphor, too. This would predict that noun phrases can be evaluated with respect to two times simultaneously which seems conceptually difficult to reconcile with established assumptions about times in language.

As a result, neither restricting the domain of the determiner's quantifier, nor restricting that of the noun's event time will solve the issue of anaphoricity without over-generalizing or leading to odd predictions.

4. Proposal

The tension between Musan's generalization that only presuppositional NPs can be temporally independent and Tonhauser's claim that the noun phrase time is a temporal anaphor is very intriguing. At face value, it provides compelling evidence against Musan showing that even NPs with a non-presuppositional determiner can be independent. Under the surface, however, it contains the key with which we can reconcile both views: From the assumption of NP's being temporal anaphors follows the presupposition of a temporal antecedent. In the verbal domain, temporal presuppositions are traditionally formalized as part of the tense denotation. The appeal of adopting such an analysis to the nominal domain is three-fold: it entails the set of temporal properties of noun phrases in (15), explains the temporal independence of the crew member example in terms of temporal presuppositionality, and provides a uniform analysis of temporality across domains.

Tonhauser (2002, 2006, 2020) suggests first parallels between the temporal properties of noun phrases and verbal tense by showing that both involve temporal anaphora. On top of that, Rapp (2015) made a case for nouns benefiting from a lexical aspectual treatment based on the underlying verbal properties of the noun. Building on these contributions, I propose to enrich nominal semantic representations to include lexical tense and aspect. The separation of nouns into eventive and stative lexical aspectual classes is motivated by their underlying ontological properties. The two classes map onto distinct patterns of available temporal interpretations of noun phrases. Contrasting these patterns to the temporal interpretation of tenseless languages, such as St'át'imcets (Matthewson, 2006), motivates the assumption of a covert time pronoun

as part of the NP. The pronoun recovers its value from the context and is presuppositionally restricted by one of two tense features whose selection is determined by the lexical aspect of the noun. The tense feature of eventive nouns is semantically under-specified and restricts the noun phrase time to being non-future. Stative nouns select a tense feature that is restricted to include the utterance time.

4.1. Lexical aspect

Rapp (2015) and O'Leary (2022) claim that nouns have lexical aspectual properties that affect the way in which NPs are temporally interpreted. Rapp identifies *label nouns* (e.g., *fugitive*) as having eventive properties that allow for temporally independent interpretations in German participles. Independently from Rapp, O'Leary (2022) systematically establishes two classes of nouns with only one allowing an (independent) past interpretation, as the contrast, repeated in (23), illustrates.

(23) a. A fugitive is in jail.
b. #A bachelor is married.

Interestingly, Rapp's idea of some nouns being eventive neatly maps onto O'Leary's distinction in (23), i.e., *fugitive* has eventive properties, *bachelor* does not. Thus, fleshing out the idea of *label nouns* provides ontological evidence for O'Leary's distinction and may give rise to an explanation as to why the two noun classes behave differently with respect to their temporal interpretations. Additionally, it aims to demonstrate that nouns benefit from a (verbal) lexical aspectual treatment, and constitutes the foundation of my analysis of extending verbal temporality to the nominal domain.

4.1.1. Eventive vs. stative nouns

I distinguish two (main) classes of nouns: eventive and stative, given in (24).

(24) a. Eventive nouns:
murderer, fugitive, champion, widow, crew member, teacher, student, CEO, ...
b. Stative nouns:
man, bachelor, woman, teenager, adult, 30 year old, mortal, person, ...

Eventive nouns are characterized by entailing an event in which their referent is involved. In contrast, stative nouns do not entail an event; they merely assign a property to their referent. Compare (25) and (26).

(25) Ron is a murderer.
$\models$ Ron killed someone.

(26) Ron is a man.
$\not\models$ any event.

For (25) to be true, it has to be the case that Ron murdered someone. The truth of (26), however, does not depend on Ron being involved in any particular event.[13] Further evidence for

[13] One could argue that Ron's birth is an event in which he has to be involved in. In this case, we would have to restrict the event implication further to, for instance, actions.

the ontological distinction between eventive and stative nouns is the application of common diagnostics for (verbal) event expressions to nouns, given in (27).[14]

(27) Linguistic diagnostics for events:
   a. Event expressions combine with locative and temporal modifiers.
   b. Event expressions combine with manner adverbials.
   c. Event expressions can be picked up via anaphoric pronouns.
   d. Event expressions can be quantified.

(Maienborn, 2019: 30, adjusted)

If nouns like *murderer* were eventive, its event would be expected to behave in the ways indicated in (27). This is borne out, as shown in (28). The expression in (28a) describes a particular individual who only murders in September or downtown. The nominal in (28b) is ambiguous between someone who is a murderer and gentle or someone who murders gently.[15] The sentence in (28c) is construed to mean that every murderer regrets that they murdered someone, where the murder event serves as the antecedent for the anaphoric pronoun *it*. Lastly, (28d) conveys the number of times its referent has murdered.

(28) Eventive nouns:
   a. The September/downtown murderer
   b. The gentle murderer
   c. Every murderer regrets that he did it.
   d. The 5-time murderer

Given this evidence, it is a reasonable assumption that eventive nouns not only entail an event, but that it is compositionally accessible. This is formalized in (29) where nominal predicates are treated as functions from events and individuals to truth values and express that the nominal property holds of its referent throughout the event.

(29) $[\![\text{eventive noun}]\!]^{g,c} = \lambda e.\lambda x.noun'_{ev}(e)(x)$

Stative nouns were shown not to entail an event, i.e., the referent of the noun is not required to be involved in any event for them to be assigned the property denoted by it. Applying the diagnostics for event expressions to stative nouns like *man*, as shown in (30), reinforces the assumption of an ontological distinction to nouns like *murderer*: Only (30b) does not result in oddness, but then it does not give rise to the same ambiguity as (28b).

(30) Stative nouns:
   a. #The September/downtown man
   b. The gentle man
   c. #Every man regrets that he did it.
   d. #The 5-time man

[14]Maienborn (2019) uses the diagnostics to show the contrast between Davidsonian eventualities, i.e., events and states, and so-called Kimian states. She illustrates that the former are spatio-temporal entities, and thus subject to the diagnostics in (27). In contrast, Kimian states are ontologically poorer and fail some of the tests (cf. Maienborn, 2019). The behavior of stative nouns seems closer to the notion of Kimian states. However, I will continue to call them just *stative nouns*. I thank Daniel Hole for making me aware that I need to clarify on this point.

[15]Larson (1998) argues that this ambiguity arises as part of the noun having two available arguments for the adjective to modify. My analysis is in line with this assumption (cf. (29)).

As a result, stative nouns are treated as functions from states and individuals to truth values that denote that the nominal property holds of its referent throughout the states it is related to (31).

(31) $[\![\text{stative noun}]\!]^{g,c} = \lambda s.\lambda x.noun'_{st}(s)(x)$

According to section 2.1, the nominal event time is existentially bound and, by default, coincides with the noun phrase time. Based on this, we may model the semantics of the default nominal lexical aspect. The default aspect is phonologically empty and situated in its own aspect projection within the NP c-commanding the N-head (32a), with the semantics in (32).[16]

(32) Nominal lexical aspect:
- a. $[_{DP}\ [_{D}\ a]\ [_{NP}\ [_{Asp}\ \varnothing_{\alpha}]\ [_{N'}\ [_{N}\ noun_{\alpha}]]]]$
- b. $[\![\varnothing_{ev}]\!]^{g,c} = \lambda P.\lambda t.\lambda x.\exists e{:}\tau(e) \circ t \wedge P(e)(x)$
- c. $[\![\varnothing_{st}]\!]^{g,c} = \lambda P.\lambda t.\lambda x.\exists s{:}\tau(s) \circ t \wedge P(s)(x)$

The two aspectual operators contribute a quantifier over events (32b) or states in (32c) and establish that their run-time overlap with the noun phrase time, represented as λt. Naturally, eventive nouns such as *crew member* are restricted to select the eventive operator, while stative nouns like *man* select the stative one. The denotation of nouns describing their lexical aspectual properties then amount to (33).

(33)
- a. $[\![\textbf{crew member}]\!]^{g,c} = .\lambda t.\lambda x.\exists e{:}\tau(e) \circ t \wedge cm'(e)(x)$
- b. $[\![\textbf{man}]\!]^{g,c} = \lambda t.\lambda x.\exists s{:}\tau(s) \circ t \wedge man'(s)(x)$

In words, the nominal predicates are functions from times and individuals to truth-values such that there is an event/state whose run-time overlaps with the noun phrase time and the nominal property holds of its referent throughout the event/state. At this point, there is barely a semantic difference with respect to their temporality. The difference is reflected in combination with the second component of the proposal, lexical tense.

4.1.2. Eventive nouns: achievement and activity

A brief note on eventive nouns: there are further aspectual differences within this class. Consider *crew member* or any other noun denoting individuals that perform an activity. Clearly, it entails the existence of one or several events. For the individual to be a crew member, it must be given that they are involved in some kind of 'crew member events' (e.g., cleaning the decks, maintaining equipment, etc.). For this reason, I am assuming the two sub-classes in (34).

(34) Eventive nouns:[17]
- a. Achievement nouns: *murderer, champion, widow, fugitive, ...*
- b. Activity nouns: *crew member, teacher, dancer, gamer, ...*

Unlike achievement nouns, activity nouns fail the diagnostics in (27c) and (27d). This is because achievement nouns entail a definite event which is clearly characterized (e.g., murder,

[16]The default aspect cannot co-occur with overt aspectual modifiers like *former*, which introduces an anteriority relation between the nominal event time and the noun phrase time and can only modify eventive nouns.

[17]This distinction is similar to Rapp's (2015) categories in (11). Achievement nouns correspond to her single event nouns and activity nouns to her habitual event nouns.

winning championship, death of spouse, jail break, ...), which can then serve as an antecedent for pronouns or be counted. Activity nouns entail several generic events that are associated to that which the noun describes, which do not lend themselves to that kind of modification. Similar to verbal lexical aspect, the categories are somewhat shifty. Some nouns may have an activity as well as achievement reading, as in (35).

(35) a. John is a teacher at Goethe high-school. [activity]
b. John is a teacher but currently unemployed. [achievement]

Under the activity reading of *teacher* in (35a), John is involved in generic teacher events (e.g., teaching, grading, supervising, etc.). These events are negated by John's unemployment in the sentence in (35b). The noun receives an achievement reading that entails only one (definite) event that licenses John's description as a teacher: the completion of his teacher training. Most activity nouns that describe a profession entail their achievement reading.

Naturally, achievement nouns can also be coerced into an activity reading (e.g., a professional murderer), or stative nouns into eventive ones (e.g., a bachelor who lives the 'bachelor life-style' to the extreme or a woman who has undergone gender affirming surgery).[18] Eventive nouns, however, cannot be coerced into statives. There is more to be said about the difference between eventive nouns and their coercion processes, but since this (sub-)distinction is not reflected in their temporal interpretation patterns, I will not do this here. For the purpose of this paper, I will treat both kinds of eventive nouns as one homogeneous class.

4.2. Lexical tense

The idea of noun phrases having a (covert) tense is by no means novel. In fact, one of the first formal analyses for temporal noun phrase interpretation briefly makes such an assumption to account for the notorious fugitive example in (36a), where P represents a past tense operator shifting the time at which the relevant individuals were fugitives to the past (36b).

(36) a. Every fugitive is in jail.
b. $\forall x[P[fugitive(x)] \rightarrow in\text{-}jail(x)]$ (Enç, 1986: 411)

The author ultimately rejects this view on the basis of nouns lacking tense morphology. Instead, she assumes a referential analysis in which temporal variables are introduced in the object language (37a) with their value being determined by the variable assignment (37b). This allows nominal predicates to be relativized to times introduced in the context (37c); for example, $g(3)$ may be assigned the temporal value of when they broke out of jail.

(37) Every fugitive is in jail.
a. $[_{NP}\ [_{D}$ every$]\ [_{N'}\ [t_3]\ [_{N}$ fugitive$]]]$
b. $[\![t_3]\!]^{g,c} = g(3)$
c. $\forall x[fugitive(x)(g(3))] \rightarrow in\text{-}jail(x)]$

Despite their generalization issues, which I will not discuss here, the analyses coupled with Tonhauser's evidence of noun phrases being anaphoric, a defining feature of verbal tense, mo-

[18] The event entailed by the coerced use of *woman* need not be surgery. It may as well be the act of coming out. I thank James Holmes Smith for this suggestion as well as discussions on this point.

tivate further investigation in this direction. Following this, the available interpretation patterns of noun phrases are reminiscent of the temporal behavior of (superficially) tenseless languages, whose analysis may provide just the necessary formal tools with which we can bring together all of the previous insights.

There are a number of languages, such as St'át'imcets (Lillooet Salish), that lack overt tense morphology which results in the temporal interpretation of finite clauses being compatible with a past or present time. Consider (38) and (39).

(38) táyt-kan
hungry-1SG.SUBJ
'I was hungry / I am hungry.'

(39) sáy'sez'-lhkan
play-1SG.SUBJ
'I played / I am playing.'
(Matthewson, 2006: 676)

Interestingly, the default interpretation of the above examples is tied to the lexical aspect of the verbal predicate. In out of the blue contexts, stative predicates, like (38), strongly favor a present tense interpretation. Activity predicates, such as (39), show no preference, and achievement predicates strongly favor a past tense interpretation. Apart from that, the temporal location of the eventuality is determined by salient times in the context, given they are non-future.

In a similar fashion, (eventive) nominals are compatible with non-future times. The eventive noun *fugitive* in (40) receives a present and past interpretation, but not a future one. In O'Learyan fashion, a verbal predicate is chosen that contradicts a temporally dependent interpretation to exclude verbal tense interfering with the noun phrase interpretation.

(40) A fugitive
a. A fugitive was born in the 90s. [t_{np}: now]
b. *Context: talking about the jail break last month*
A fugitive is now in jail. [t_{np}: last month]
c. *Context: talking about the upcoming prison break*
#A fugitive is now in jail. [t_{np}: now]

In (40a), *a fugitive* refers to an individual who is currently a fugitive since they could not have been one at the time of their birth.[19] The sentence in (40b) describes someone who was a fugitive last month, while (40c) is odd because a future reading of the nominal is not available to rescue the contradiction. In contrast, stative nominals are only compatible with present times, shown in (41).

(41) A bachelor
a. A bachelor was born in the 90s. [t_{np}: now]
b. *Context: talking about the bachelor party last month*
#A bachelor is now married. [t_{np}: now]
c. *Context: talking about the upcoming divorce*
#A bachelor is now married. [t_{np}: now]

[19] It may also describe an individual who was a fugitive at some point after their birth but before the speech time.

The nominal *a bachelor* in (41a) receives a present interpretation, but results in oddness when the only available time for the noun to be evaluated at is a past (41b) or future (41c) time.[20] The general pattern of lexical aspect affecting the interpretation of clauses in St'át'imcets extends to nominals: while achievement and activity predicates allow past and present interpretations, stative predicates not only favor but exclusively allow a present interpretation.[21]

Given the evidence from Tonhauser (2002, 2006, 2020) and the contrast to tenseless languages, we may model the temporal dimension of the NP on the basis of how temporal reference in (tenseless) languages is formalized (Partee, 1973; Kratzer, 1998; Matthewson, 2006; Cable, 2013). That is, the NP is enriched to include a tense projection, occupied by a covert time pronoun and a set of tense features (42). The pronoun (42b) recovers its value from salient times in the context, and comes with one of two tense features that impose a presupposition on its range. The tense feature selected by eventive nouns presuppose a non-future time (42c), the tense feature of statives restricts the value of possible referents to the speech time (42d).

(42) Lexical tense:

a. $[_{DP}\ [_{D}\ a]\ [_{NP}\ [_{TP}\ [T_2][\{\text{NON-FUT}_{ev}\ /\ \text{PRES}_{st}\}]]\ [_{N'}\ [_{Asp}\ \varnothing_{\alpha}]\ [_{N}\ noun_{\alpha}]]]]$

b. $[\![T_n]\!]^{g,c} = g(n)$

c. $[\![\text{NON-FUT}_{ev}]\!]^{g,c} = \lambda t.t \leq t_c.t$

d. $[\![\text{PRES}_{st}]\!]^{g,c} = \lambda t.t \subseteq t_c.t$

The denotation of a nominal predicate describing all of its temporal and aspectual properties then amounts to a function from individuals to truth-values such that the run-time of the event (43a) or state (43b) overlaps with the noun phrase time. The possible times relative to which the predicates can be evaluated are restricted by their respective presupposition.

(43) a. $[\![\textbf{fugitive}]\!]^{g,c}$ is defined only if $g(n) \leq t_c$.
When defined, $[\![\textbf{fugitive}]\!]^{g,c} = \lambda x.\exists e{:}\tau(e) \circ g(n) \wedge fugitive'(e)(x)$

b. $[\![\textbf{bachelor}]\!]^{g,c}$ is defined only if $g(n) \subseteq t_c$.
When defined, $[\![\textbf{bachelor}]\!]^{g,c} = \lambda x.\exists s{:}\tau(s) \circ g(n) \wedge bachelor'(s)(x)$

Importantly, (43) denote functions of nominal predicates whose interpretation occurs independent of verbal tense. Naturally, they can receive a dependent interpretation some of which may not be accounted for by (43). Consider, for instance, a future interpretation in (44), where the utterance time precedes the time of being a fugitive.

(44) John will be a fugitive.

In (40c) it was shown that *a fugitive* cannot independently refer to future times. Thus, verbal tense alone is responsible for the temporal location of *fugitive* in (44), and the lexical tense of the noun is not interpreted at all. Similar cases are found in the verbal domain where a past tense embedded under future-oriented attitude verbs do not contribute a past meaning (45).

(45) Mary predicted that she would know that she was pregnant the minute she got pregnant.
(Kratzer, 1998: 92)

[20] Technically, *bachelor* describes men who have never been married which would make (41c) odd either way. To be safe, consider *A 30 year old is 29 right now* under a context in which the referent's 30th birthday party is being planned for the following month. Its oddness confirms that independent future interpretations of statives are out.
[21] Determining the default (independent) interpretations of the nominals may be subject to future investigations.

For this, Kratzer proposes a zero pronoun to account for instances in which tenses do not seem to be interpreted. The zero pronoun has no interpretable features, carries no presupposition, and must be locally bound by the nearest lambda abstractor over times. The zero pronoun can be added to the nominal lexical tense paradigm, with its denotation in (46).

(46) $[\![\varnothing_n]\!]^{g,c} = g(n)$ (Kratzer, 1998: 101)

4.3. Analysis

With the given ingredients, the temporal interpretation of any noun with a non-presuppositional determiner can be derived.[22] Since the crew member example is at the heart of this paper, it will be used as an illustration and repeated one last time:

(47) *Context: At a reunion of the survivors of the Titanic disaster.*
Look, there are even some crew members here.

Given the above set-up, the sentence in (47) is assigned the LF in (48a). The temporal independent interpretation of (47) presupposes that the noun phrase time, $g(2)$, is assigned a value that precedes the utterance time, t_c. Since (47) is uttered under a scenario where this condition is satisfied, (48a) says of individuals who were crew members at some time that overlaps with that of the Titanic being operative, the value assigned to $g(2)$, and that they are at the reunion now, the value of $g(1)$.

(48) a. $[_{TP}\ \text{PRES}_1\ [_{vP}\ [_{DP}\ [_{D}\ \text{a}]\ [_{NP}\ [_{T}\ [\text{T}_2][\text{NON-FUT}]]\ [_{N'}\ [_{Asp}\ \varnothing]\ [_{N}\ \text{cm}]]]]]\ [_{VP}\ \text{be-present}]]]$
b. $[\![(48a)]\!]^g$ is defined only if $g(1) \subseteq t_c$ and $g(2) \leq t_c$.
When defined, $[\![(48a)]\!]^g = 1$ iff $\exists x \exists e{:}\tau(e) \circ g(2) \wedge cm'(e)(x) \wedge be\text{-}present'(g(1))(x)$

The analysis sketched here entails the set of temporal properties of noun phrases in (15), and explains the temporal independence of (47) in terms of (temporal) presuppositionality. Specifically, nominal temporality receives an independent treatment of verbal tense with the context determining the NP's temporal location (15a). A noun phrase is independent if and only if it is presuppositional since tense introduces a temporal presupposition (15b). The noun phrase time is analyzed as a temporal anaphor (15c), whose potential referents are restricted by the lexical aspectual properties of the noun (15d).

5. Concluding remarks

This paper identifies several similarities between the temporality of the nominal and verbal domain that have been made throughout the literature which are used to motivate further investigation into this direction. Building on those parallels, it shows that nominal predicates benefit from a lexical aspectual treatment based on the underlying ontological properties of the noun

[22] From the data in 4.2 it can be inferred that the determiner does not contribute to the location of the noun phrase time. While I cannot spell this out for space reasons, I assume this to extend to presuppositional determiners. Note that presuppositional determiners allow stative nouns to refer to the past (e.g., *Every bachelor is now married*). In this case I assume that *every* presupposes a set of individuals whose property of being a bachelor is inherited through the presupposition, rather than the noun phrase time being located by *every*.

which maps onto distinct patterns of available temporal interpretations of noun phrases. Contrasting these patterns to the temporal interpretation of finite clauses in (superficially) tenseless languages motivates a lexical temporal analysis of noun phrase interpretation. Under this view, the noun phrase time is modelled as a time pronoun whose range is presuppositionally restricted by one of two tense features. The tense feature selection is determined by the lexical aspect of the noun. The appeal of this approach lies in the fact that it explains previously puzzling data in terms of the unification of previous accounts, and treats linguistic temporality as a uniform phenomenon across domains.

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The role of scalar diversity and question under discussion in deriving implicatures with embedded scales[1]

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Abstract. We investigate experimentally the role of scalar diversity and question under discussion for implicature rates of sentences with multiple scalar terms such as *Some meals are adequate* with embedding scale ⟨*all, some*⟩ and embedded scale ⟨*good, adequate*⟩. These sentences can trigger different types of scalar implicatures. We modified the inference task by van Tiel et al. (2016) and tested the 43 scales studied by them in a position embedded under *some* and *possible*. We were particularly interested in whether implicatures involving embedded scales can be boosted if made relevant by *Questions under Discussion* (QUDs). Our results showed that all tested types of implicatures are sensitive to QUDs. Most interestingly, the contrast between *bounded* and *unbounded* scales, which was a strong predictor in previous studies, no longer correlates with rates of implicatures once a QUD is added. We argue that our findings support a version of the Alternatives-based Account (the Contextual Alternatives and Scalar Distinctness Account) where contextual availability of alternatives is more important than lexical availability, and where, additionally, the (lexical/contextual) distinctness of the scales plays a role.

Keywords: experimental pragmatics, scalar diversity, embedded implicatures, questions under discussion.

1. Introduction

1.1. On scales and scalar implicatures

Scalar implicatures represent inferences that we draw in conversation when conversational maxims have not been observed (Grice, 1989). According to Grice (1989), in a context where a speaker knows that all of the roses in the garden are red, producing the sentence in (1a) instead of the sentence in (1b) is pragmatically underinformative, as is producing (2a) instead of (2b) in a context where the speaker knows it is hot outside: the speaker has failed to abide by the Maxim of Quantity, flouting the submaxim 'Make your contribution as informative as required'.

(1) a. Some roses are red.
b. All roses are red.

(2) a. It is warm outside today.
b. It is hot outside today.

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The notion of **scale** is particular important to understand the failure in informativeness. According to Horn (1972), a scale represents a range of items ordered in terms of informational strength. Languages showcase an impressive number of scales: the quantifier scale ⟨*all, some*⟩, the numeral scale ⟨*..., two, one*⟩, modal scales such as ⟨*necessarily, possibly*⟩, ⟨*must, may*⟩, connectives such as ⟨*and, or*⟩, adverbs such as ⟨*always, often, sometimes*⟩, degree adjectives such as ⟨*hot, warm*⟩, or degree verbs such as ⟨*know, believe*⟩ or ⟨*love, like*⟩. Scales involve at least two terms: a strong scalar term like *all* and a weak scalar term like *some*, such that the utterance employing the strong scalar term, i.e. S(all) or S(hot) entails the utterance employing the weak scalar term, i.e. S(some) or S(warm), but not the other way round. While both the strong scalar term and the weak scalar term express the same property, for instance, warmness, they express it to a different degree (Kennedy and McNally, 2005). Importantly, there must be some distance between the lower bounds of the two scalar terms, otherwise the two terms could be considered synonyms (see recently Orr et al., 2024). When a speaker produces (1a) instead of (1b) or (2a) instead of (2b) in a situation optimally described by (1b) or (2b) , they are failing to make their communicated utterance adequately informative because they are employing the weak scalar term instead of the strong scalar one.

1.2. Do implicature rates vary with scale type?

1.2.1. Implicatures with one scale

A question that has been the focus of many studies has been whether the rate of implicatures varies with the type of scale and in what way. While the most investigated scale has been the ⟨*all, some*⟩ scale starting with Noveck (2001); Pouscoulous et al. (2007); Foppolo et al. (2012); Bleotu (2021), other scales such as the modal scale, the numerical scale, disjunction or ad-hoc implicatures have also been the object of linguistic scrutiny (Noveck, 2001; Papafragou and Tantalou, 2004a; Huang and Snedeker, 2009; Bleotu et al., 2021a, 2022b, 2023; Tieu et al., 2017) It has thus been shown that the rate at which weak scalar items give rise to scalar implicatures is not uniform across scale types (van Tiel et al., 2016; Kuppevelt, 1996; Zondervan et al., 2008; Degen, 2013; Degen and Tanenhaus, 2015; Cummins and Rohde, 2015; Yang et al., 2018; Ronai and Xiang, 2020).

In an influential study, van Tiel et al. (2016) investigated 43 different scales with an inferencing task. For instance, for the scale ⟨*good, adequate*⟩, participants had to read an utterance and give a 'Yes' or 'No' to the question in (3):

(3) John says: *The food is adequate.*
Would you infer from this that, according to John, the food is adequate?

If they answered 'Yes', it was inferred that the participant strengthened *adequate* to *adequate but not good*.

1.2.2. Implicatures with multiple scales. Local implicatures.

In two experiments, we tested van Tiel et al. (2016)'s 43 scales when embedded under *some* and *It is possible that*, probing into the rates of various types of implicatures (see Table 1), including embedded/local implicatures, i.e. implicatures with the scales embedded under other scales, such as those in (4).

(4) Mary says: *Some meals are adequate.*
Would you infer from this that, according to Mary, some meals are adequate but not good?

There has been a long debate whether local implicatures can occur when scales are embedded under other scalar items (Geurts and Pouscoulous, 2009; Clifton and Dube, 2010; Chemla and Spector, 2011; Bill et al., 2021; Bleotu et al., 2022b). Solving this debate has been regarded in the literature as a way to better understand how implicatures are derived. Assuming local implicatures share the same derivation mechanism with implicatures derived with one single scale, the grammatical account (Chierchia, 2004; Chierchia et al., 2012) predicts the existence of local implicatures via exhaustification, a mechanism by which a weak scalar term is strengthened to the negation of its stronger alternative scalar term. In contrast to the grammatical account, the pragmatic-Gricean account (Grice, 1989; Horn, 1972) predicts that participants should derive no local implicatures in principle, given that Gricean reasoning applies to whole utterances not parts of utterances.[2] Experimental evidence was thus crucial in settling the debate straight. Geurts (2009) argued on the basis of various experimental methods (inference task, verification tasks) that local implicatures are very rare in both upward entailing and downward entailing contexts, and consequently, they argued in favour of pragmatic account for implicature derivation. Subsequently, using a picture selection task, Clifton and Dube (2010) showed that participants would often pick both pictures corresponding to local implicatures and global implicatures, thus arguing that local implicatures are in fact possible. Additionally, by means of a rating task, Chemla and Spector (2011) showed that adults do derive local implicatures for a sentence such as (5):

(5) Every letter is connected to some of its circles.

However, their results were criticized by van Tiel (2014) who argued that typicality plays an important part in picture-selection. Nevertheless, local implicatures have been shown to occur at ceiling if supported by a pragmatic task. In an interactive game–theoretic reward task set-up which satisfies Grice's conversational requirements for implicature generation (a specific purpose of the conversational exchange), Gotzner et al. (2018) showed that adults can draw local implicatures to a very high degree. Recent research by Bill et al. (2021) found that, when deriving implicatures, English adults preferred global implicatures over local implicatures, while children preferred local implicatures. Moreover, a recent study by Bleotu et al. (2022b) employing a Shadow Play Paradigm, building on Bleotu et al. (2021b, c) found that, when deriving implicatures, both Romanian children and adults preferred global implicatures and derived almost no local implicatures. These findings keep the debate about local implicatures alive. As in

[2]Nevertheless, if one assumes that local implicatures are derived via a different mechanism than global implicatures, such as in virtue of a special stress pattern (Geurts and van Tiel, 2013) or in special pragmatic contexts (Geurts and Pouscoulous, 2009), then local implicatures could be expected.

the case of un–embedded weak scalar terms, this research has almost exclusively concentrated on the ⟨*all, some*⟩ and ⟨*and, or*⟩ scales (see also van Tiel, 2014; Crnič et al., 2015; Benz and Gotzner, 2017; Gotzner et al., 2018; Franke et al., 2017; Bill et al., 2021). Exceptions are Geurts and Pouscoulous (2009) who also tested for implicatures of *some* embedded under *think*, *want*, and *has to*, and Bleotu et al. (2022b) who studied *some* embedded under ⟨*certain, possible*⟩. This research showed that the rates with which local implicatures occur depend on the type of verb or operator under which *some* is embedded. To the best of our knowledge, no study has looked at different types of scales in the embedded position.

In our current experiments, we investigate different types of implicatures involving the embedded scale (see Table 1), once in a setting where they are not supported by a question introducing the Question under Discussion, i.e. the QUD (Experiment 1), and once in one with QUD support (Experiment 2). The rationale was that if local implicatures are not present in pragmatically unsupported contexts, then we should not see an effect of scalar diversity in Experiment 1. Moreover, if implicatures depend on the activation of alternatives, then activating the alternatives by a QUD should increase the rates of local implicatures in Experiment 2. We were also interested to what extent different scales are sensitive to QUDs, and if these can be predicted by grammatical features, in a similar fashion to van Tiel et al. (2016).

2. Research questions

2.1. Implicature rates and scalar diversity

A first question (Q1) we ask is whether implicature rates vary with implicature type. Given that previous studies show that participants generally tend to derive fewer local implicatures than global implicatures, we would expect to see a similar overall pattern in Experiment 1 and, possibly, in Experiment 2.

2.2. Predictors of implicature rates

A second question (Q2) is what predicts rates of implicature for different scales, i.e. scalar diversity. While we are nevertheless aware that other studies have considered factors such as homogeneity, local enrichment in Sun et al. (2018) or question availability in Ronai and Xiang (2020), we here considered the factors discussed by van Tiel et al. (2016): the availability of the lexical scales and the distinctness of scale-mates. The availability of lexical scales was evaluated by van Tiel et al. (2016) through association strength, grammatical class, frequency and semantic relatedness. We briefly define each of these subfactors. Association strength represents the strength of association between the scalar expression used in the speaker's utterance. van Tiel et al. (2016) hypothesized that the greater the association strength between the weak and the strong scalar terms, the more available the scale should be. Association strength was measured by van Tiel et al. (2016) through a cloze task, either in a neutral version containing pronouns (*he/she*), or in a non-neutral version containing nouns (e.g., *this student*). The neutral version of the cloze is exemplified in (6):

(6) In the following you will see 43 sentences. In every sentence, one word will be highlighted, like this:

She is angry.

Which words could have occurred instead of the highlighted one? Some of the alternatives that may come to mind are *beautiful, happy, married*, and so on. We ask you to tell us the first three alternative words that occur to you when you read these sentences.

Association strength was calculated by van Tiel et al. (2016) based on whether participants mentioned a stronger scale in their answers (in the lenient coding).

Grammatical class refers to whether the scale under consideration belongs to an open class or a closed class. For instance, the closed class can be exemplified by quantifiers and modals. van Tiel et al. (2016) hypothesized that, given that the search space of alternatives is much smaller for closed grammatical classes than for open ones, scales belonging to closed classes should be more available.

van Tiel et al. (2016) also considered the frequency of the strong scalar term compared to the weaker one. van Tiel et al. (2016)'s hypothesis was the the more frequent the strong term relative to the weaker one, the more available the scale consisting of both members. After extracting the frequencies of the scalar expressions in the materials from the Corpus of Contemporary American English (Davies 2008), van Tiel et al. (2016) calculated the relative frequency by dividing the frequency of the stronger scalar term by the frequency of the weaker one, and logarithmising the outcome.

van Tiel et al. (2016) also looked at semantic relatedness, i.e. the relatedness of the scale-mates, measured by how often a strong scalar term and a weak scalar term occur in similar linguistic environments. The expectation was that, if the two scale-mates are more likely to co-occur with the same words, the scale would be more available. To measure semantic relatedness, they used Latent Semantic Analysis (Landauer and Dumais, 1997; Landauer et al., 1998), which constructs a matrix with words from a corpus as rows and columns and computes a value in the interval [0, 1] that denotes the extent to which the words at issue occur with the same words.

Importantly, van Tiel et al. (2016) found that no measure of lexical availability showed any correlation with rates of implicatures in their experiment. Consequently, we expect that they should also not correlate with implicature rates of embedded scales in complex sentences.

We also investigated the role of the distinctness of the scale-mates, evaluated through semantic distance and boundedness. For both factors, we adopted the same measurements/decisions used by (van Tiel et al., 2016: see also Zevakhina 2012).[3] Semantic distance, the distance

[3]While in our current paper, we have adopted van Tiel et al. (2016)'s measurements/judgments, it is worth mentioning that more recent studies such as Orr et al. (2024) have tried to improve the manner in which semantic distance and boundedness are measured. With respect to semantic distance, for instance, Orr et al. (2024) replaced the question *Is statement 2 stronger than Statement 1* with (i):

(i) Is statement 2 interchangeable with statement 1?

With respect to boundedness, as an alternative to an intuitive definition, Orr et al. (2024) proposes the use of the comparative as a test for boundedness, as in (ii).

(ii) John says: *The assistant is brilliant.* In principle, is it possible for someone, for example, an assistant, to

between the bounds of the weak and the strong scalar term, was measured by van Tiel et al. (2016) through ratings of statements containing strong/weak scale-mates such as exemplified in Figure 1.

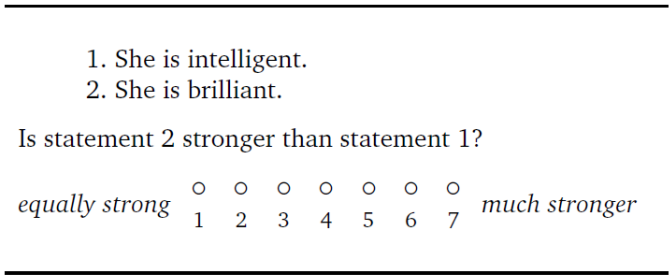

Figure 1: Example of experimental item from the Semantic Distance Task in van Tiel et al. (2016)

van Tiel et al. (2016) hypothesized that more semantically distinct scale-mates would correlate with higher implicature rates, and his findings supported this hypothesis. We also entertain a similar hypothesis for the different types of implicatures in our experiment.

Regarding boundedness, bounded scales represent scales where the stronger scalar term denotes an endpoint (e.g. *free* in ⟨*cheap, free*⟩), in contrast to unbounded scales like ⟨*content, happy*⟩, which refer to intervals. van Tiel et al. (2016) establishes whether a scale is bounded or unbounded on an intuitive basis. van Tiel et al. (2016) hypothesized that bounded scales would give rise to more implicatures, and, indeed, this was found to be the case both in their experiment, as well as in Sun et al. (2018). Based on van Tiel et al. (2016)'s findings, we also expect to find a correlation between boundedness and higher implicature rates of various types.

While our general expectation is that van Tiel et al. (2016)'s findings should carry over to multiple types of implicatures, it might be that this will be more apparent for global implicatures rather than local ones, if participants struggle with the mechanism of deriving local implicatures.

2.3. Question Under Discussion and (local) Implicature Rates

A third question we address is whether explicit questions introducing the Question Under Discussion lead to a boost in (local) implicature rates. Previous research has shown that the Question Under Discussion does lead to an increase in implicatures in utterances containing a single weak scalar item in both adult and child language (Degen, 2013; Zondervan et al., 2008; Yang et al., 2018; Ronai and Xiang, 2020; Papafragou and Tantalou, 2004b; Skordos and Papafragou, 2016). This has been demonstrated for both explicit Questions Under Discussion (Zondervan et al., 2008; Yang et al., 2018; Ronai and Xiang, 2021, 2020) and implicit ones accommodated via a story (Degen, 2013; Guasti et al., 2005) or through various cues (Skordos and Papafragou, 2016). Importantly, the QUD makes the stronger alternative contextually relevant, and it often makes use of the stronger scale-mate. This can be explained within an Alternatives-Based

be even more brilliant?

Account of implicatures (Barner et al., 2011; Tieu et al., 2017), where implicatures depend on the activation of alternatives, and explicit access to the stronger alternatives makes implicature derivation easier.

(7) Sue: *Is the movie excellent?*
Mary: *It is good.*
Would you conclude from this that Mary thinks the movie is not excellent? Yes/No
(Ronai and Xiang, 2021)

(8) *Are all shapes blue?*
Some shapes are blue. (Ronai and Xiang, 2020)

Importantly, access to the stronger alternatives increases not only adults' but also children's ability to derive implicatures (Guasti et al., 2005; Foppolo et al., 2012; Skordos and Papafragou, 2016). However, what seems to matter even more than the presence of the stronger alternative is the contextual relevance contributed by the Question Under Discussion: children are able to derive implicatures to a high degree in a context approximating naturalistic conversation (Papafragou and Tantalou, 2004b) or in situations where the stronger alternative becomes relevant (Skordos and Papafragou, 2016):

(9) Experimenter: Did you color the stars? Elephant: I colored some.

While most previous research focused on implicatures with utterances containing a single weak scalar item, recent studies have also started looking at the effect of QUD on implicatures in utterances containing two scalar terms. (Gotzner et al., 2018) showed that, in an interactive game-theoretic reward task set-up satisfying Grice's conversational requirements for implicature generation (i.e., a talk exchange with a specific purpose/direction), adults showed high rates of local implicatures. However, recent findings from (Bleotu et al., 2022a) seem to suggest that the QUD may sometimes increase global implicature rates only to a limited extent. (Bleotu et al., 2022a) probed into the role of a scalar question introducing a QUD upon Romanian adults' and children's interpretation of utterances such as those in (10) embedding a scalar term belonging to the scale ⟨*all, some*⟩ under a scalar term belonging to the scale ⟨*certain, possible*⟩.

(10) Poate că unii câini sunt albaștri.
maybe that some dogs are blue
'It is possible that some dogs are blue.'

In one experiment, Experiment 1, the question involved the ⟨*certain, possible*⟩ scale, and, in another experiment, Experiment 2, the question involved the ⟨*all, some*⟩ scale (see (11)).

(11) a. ⟨*certain, possible*⟩ QUD
The wizard asks: *Is it possible or certain that there are blue dogs in the spotlight?*
b. ⟨*all, some*⟩ QUD
The wizard asks: *Are some or all of the dogs in the spotlight blue?*

While the two experiments were expected to lead to increases in different implicature rates, both adults and children derived more global implicatures of the type *It is not certain that some dogs are blue* ($GI_{NotCertainSome}$) in the ⟨*certain, possible*⟩ QUD experiment than in the ⟨*all, some*⟩ QUD one. Nevertheless, there was a QUD effect upon implicature rates.

Thus, there is reason to expect that an explicit QUD might lead to an increase in implicature rates.

3. Experiment 1

3.1. Aim

In Experiment 1, we extend (van Tiel et al., 2016)'s investigation to multiple scalar sentences, targeting a richer array of implicatures: global implicatures, local implicatures, and double implicatures, i.e., implicatures strengthening both scales (Table 1).

Implicature type	Mary: *Some meals are adequate.* Would you infer from this that, according to Mary:	
Global implicature (1st type)	some, but not all meals are adequate?	Yes/No
Global implicature (2nd type)	no meal which is adequate is good?	Yes/No
Local implicature	some meals are adequate but not good?	Yes/No
Double implicature	some but not all meals are adequate but not good?	Yes/No

Figure 2: Example of an item in Experiment 1

We ask which implicature types participants derive more and inquire into the best predictors for rates of different implicatures (the availability of the lexical scales or the distinctness of the scale-mates).

3.2. Participants

We tested 60 American English native speakers recruited via Prolific.

3.3. Predictions

Based on the previous findings in the literature related to generally lower rates of local implicatures compared to global implicatures (Geurts and Pouscoulous, 2009; Clifton and Dube, 2010; Chemla and Spector, 2011; Bill et al., 2021; Bleotu et al., 2022b), we expect to find lower rates of local implicatures and double implicatures compared to global implicatures.

Based on the findings in (van Tiel et al., 2016), we expect the distinctness of the scale-mates to explain scalar diversity best.

3.4. Materials and Methodology

We employed a similar inference task to that in (van Tiel et al., 2016). We embedded the 43 scalar terms in (van Tiel et al., 2016) under *some* and *possible*. For each sentence, participants answered four randomized questions targeting four implicature types (see 2).

While our task was overall quite similar to (van Tiel et al., 2016), we made some important modifications to the presentation of weak and strong scalar items compared to (van Tiel et al., 2016). Their study employed instructions which used a negated scalar term, as in (12):

(12) Mary says: *This meal is adequate.*
Would you infer from this that, according to Mary, the meal is not good?

However, (Benz et al., 2018) have shown that an utterance containing a negated strong scalar item can sometimes give rise to negative strengthening interpretations of negated adjectives, such that *not good* is interpreted as 'totally bad' rather than as 'adequate'. In order to avoid such an interpretation, we constructed our statements by also mentioning the weak scalar term before the negated strong scalar term (see (13) and 2)[4].

(13) Mary says: *Some meals are adequate.*
Would you infer from this that, according to Mary, some meals are adequate but not good?

We combined the test items with seven attention checks containing antonyms (*clean-dirty*) and unrelated properties (*sleepy-rich*).

3.5. Results

We find that participants derive different types of implicatures at different rates: global implicatures involving the 1st scale at a rate of 94.47%, followed by local implicatures at a rate of 68.78%, followed by double implicatures at a rate of 67.59%, followed by global implicatures involving the 2nd scale at a rate of 28.87%. To exemplify, the rates for the different implicature types are represented graphically in Figures 3, 4, 5, and 6.

The scalar terms *some* and *possible* give rise to similar global implicatures with the 1st scalar item. Overall, we notice considerable variation in rates of implicature types for different lexical scales.

We expected factors involving the 2nd scale to be correlated with a higher rate of local implicatures, 2nd global implicatures, and double implicatures. We ran multiple correlation tests between each type of implicature and each predictor in van Tiel et al. (2016). Similarly to van Tiel et al. (2016)'s findings about implicatures with weak scalar terms in utterances involving one single scale, we found that local implicatures and double implicatures were impacted by the distinctness of the scale-mates of the 2nd scale, as can be seen in Figure 7.

[4]Similarly, in a recent study, (Orr et al., 2024) also addressed this potential difficulty, changing the materials in (van Tiel et al., 2016) by modifying the strong scalar term by means of *possibly*, as in (i):
(i) John says: *The assistant is intelligent.*
Would you infer from this that, possibly, according to John, he is possibly brilliant?

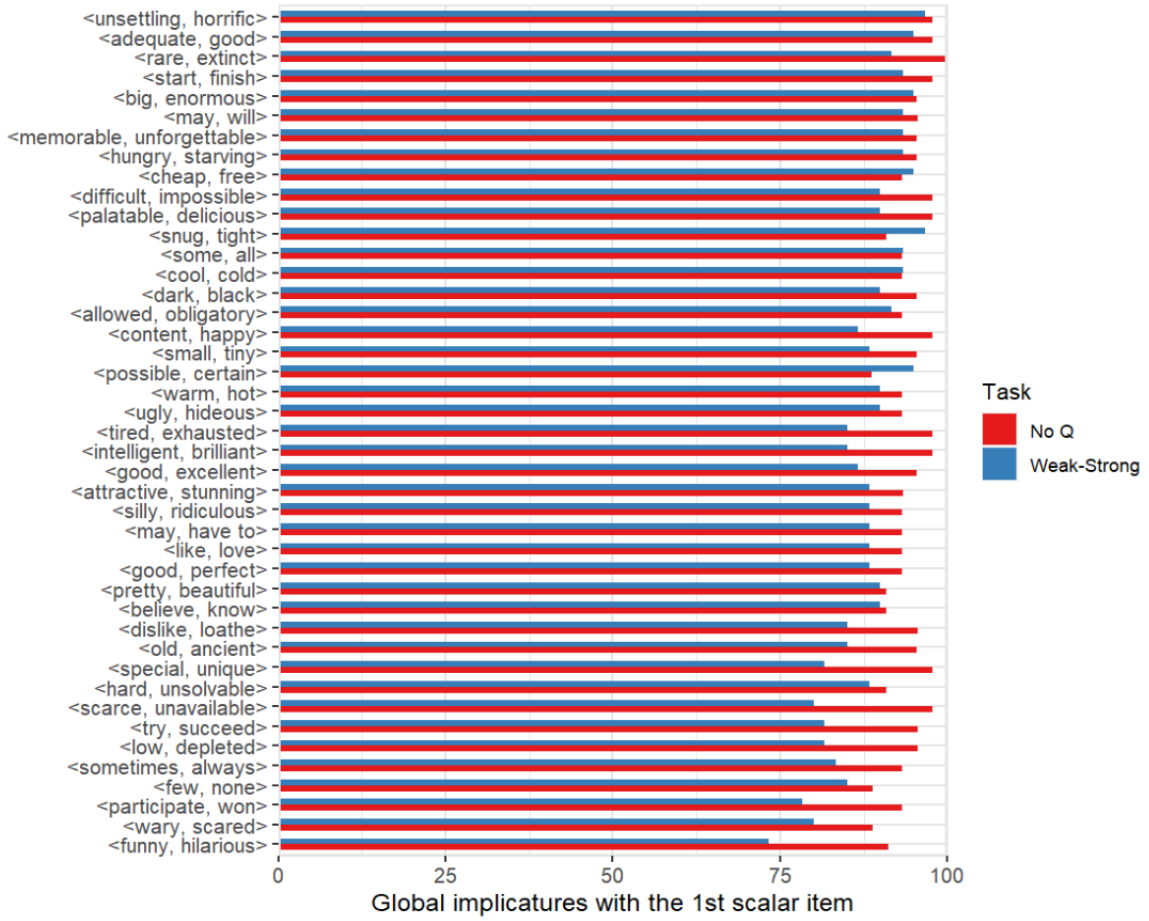

Figure 3: Global implicature rates involving the 1st scale

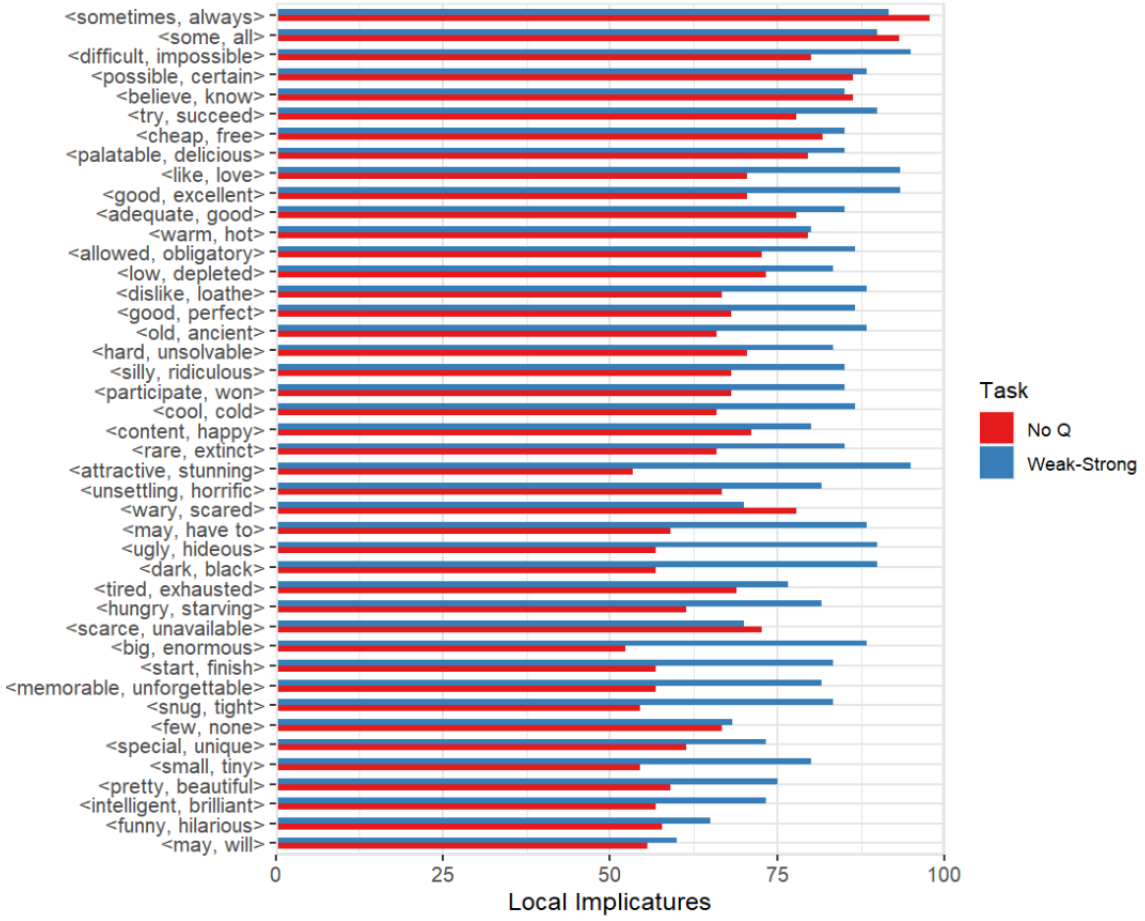

Figure 4: Local implicature rates in our experiments

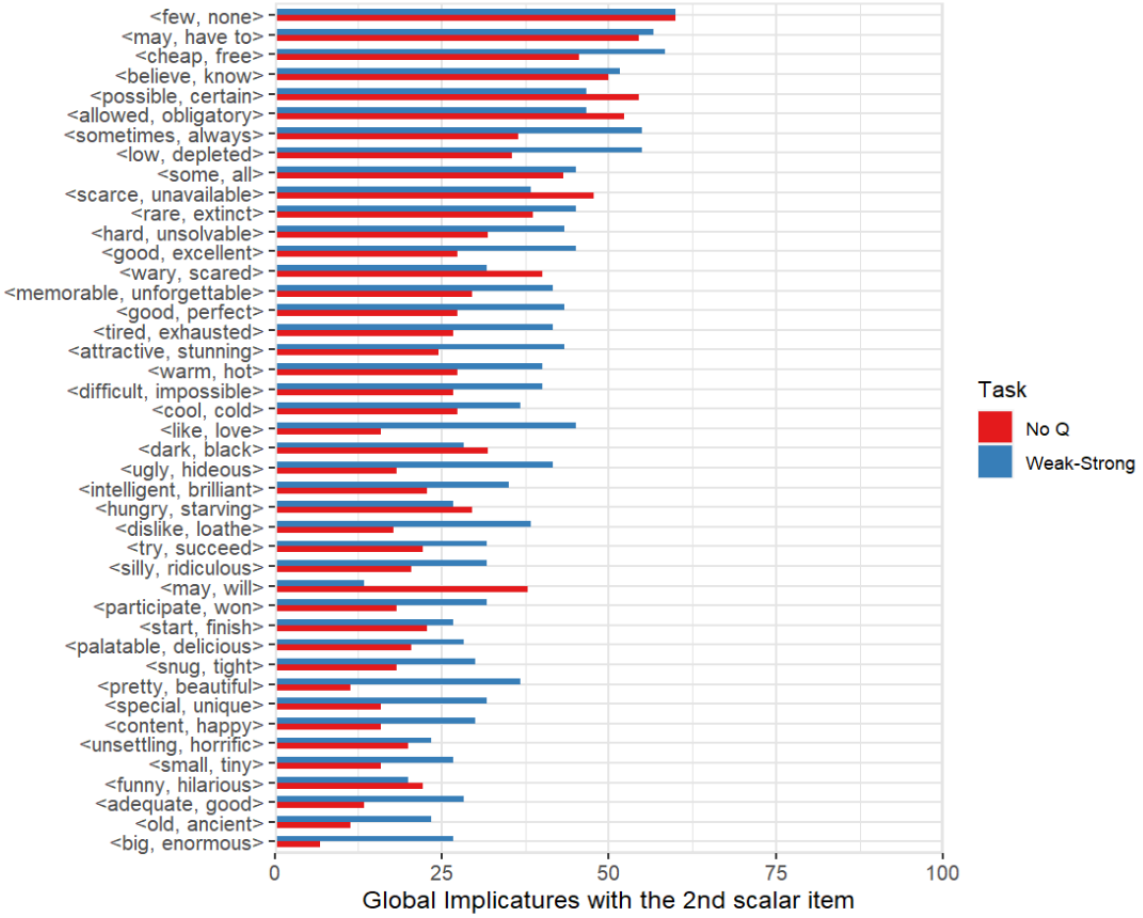

Figure 5: Global implicature rates involving the 2nd scale

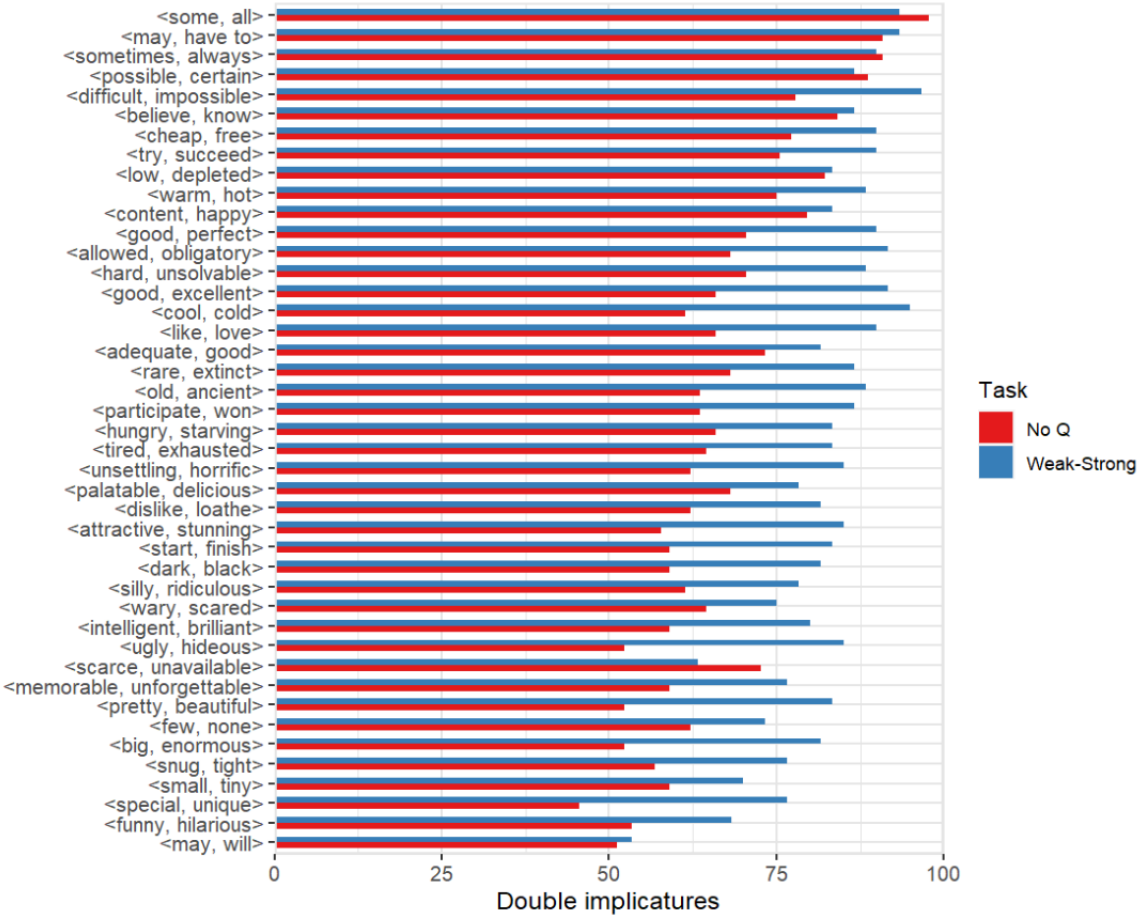

Figure 6: Double implicature rates

Implicature rates	Association strength(+N)		Association strength(−N)		Grammatical class		Word frequency		LSA		Semantic distance		Boundedness	
Exp	E1	E2	E1	E2	E1	E2	E1	E2	E1	E2	E1	E2	E1	E2
GI (1st type)	✗	✗	✗	✗	✗	✗	✗	✗	✗	✓	✗	✗	✗	✗
GI (2nd type)	✓	✗	✗	✗	✓	✗	✗	✗	✗	✗	✗	✓	✓	✓
Local implicature	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✓	✓	✓	✗
Double implicature	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✓	✓	✓	✗

Figure 7: Correlations between different implicature rates and the grammatical factors in van Tiel et al. (2016) in our experiments

4. Experiment 2

4.1. Aim

In the second part of our study, we investigated the role of Question Under Discussion in implicature derivation. As already mentioned, previous research shows that implicatures are derived at higher rates and in a less costly manner if the topic of discussion is supportive of implicatures (Kuppevelt, 1996; Zondervan et al., 2008; Degen, 2013; Degen and Tanenhaus, 2015; Cummins and Rohde, 2015; Yang et al., 2018; Ronai and Xiang, 2021, 2020) or if the QUDs make use of the stronger term of a scale rather than the weaker term (Zondervan et al., 2008; Degen, 2013; Ronai and Xiang, 2021, 2020). However, most of these conclusions have been reached by investigating implicatures with utterances which contain one single scalar item, while the effect of QUD on implicatures in sentences involving multiple scales has received little attention: (Bleotu et al., 2022b) have shown that QUD may boost global implicatures in utterances such as *It is possible that some As are B*. Our second experiment addresses this gap in the literature by looking at how an explicit question containing two scalar items belonging to two scales may affect rates of implicatures.

4.2. Participants

We tested 60 American English native speakers recruited via Prolific.

4.3. Materials and methodology

The experiment investigates whether QUD impacts multiple implicature types for 43 scales embedded under the scales ⟨*all, some*⟩ and ⟨*certain, possible*⟩. The design is similar to Experiment 1 but, taking inspiration from Ronai and Xiang (2020), the sentence giving rising to implicatures now represents an answer to a question introducing the QUD. This question involves the weak scale mate of the 1st scale ⟨*all, some*⟩ and the strong scale mate of the 2nd scale ⟨*good, adequate*⟩.

(14) Bill: Are some meals good?
Mary: *Some meals are adequate.*
Would you infer from this that, according to Mary, some meals are adequate but not good?

4.4. Predictions

We predict that a QUD employing the strong scale mate of the 2nd scale should lead to more implicatures involving the 2nd scale (Local implicatures, Double Implicatures and Global Implicatures involving the 2nd scale) than in Experiment 1. Since the QUD uses the weak member of the 1st scale, we expect no increase for implicatures with the 1st scale.

4.5. Results

In Experiment 2, we found that implicature rates vary with implicature type. Thus, overall, participants derived global implicatures involving the 1st scale at a rate of 88.45%, local implicatures at a rate of 83.14%, double implicatures at a rate of 83.14%, followed by global implicatures involving the 2nd scale at a rate of 37.67%. To exemplify, the rates for the different implicature types are represented graphically in Figures 3, 4, 5, and 6.

Taking the ⟨*all, some*⟩ as a baseline, we conducted an ANOVA with the dependent variable number of Yes implicature answers (coded as 1) and the fixed effects Interpretation (global implicature with the 1st scalar item, local implicature, double implicature, global implicature with the 2nd scalar item) and 2nd Scale. Interpretation demonstrated statistically significant effects, as evidenced by its F value of 971.005 (p <2e-16 ***). Similarly, the 2nd Scale factor exhibited significant effects with an F value of 5.893 (p <2e-16 ***). The interaction between Interpretation and 2nd also showed a statistically significant F value of 1.838 (p = 4.1e-08 ***). While scalar diversity does not go away, 23 scales show no difference in implicature rates (e.g. ⟨*hot, warm*⟩, ⟨*finish, start*⟩).

We then compared the rates of implicatures in Experiment 2 to Experiment 1. We conducted an ANOVA with the dependent variable number of Yes answers (coded as 1) and the fixed effects Task (Experiment 1: no QUD vs. Experiment 2: QUD) and Interpretation (global implicature with the 1st scalar item, local implicature, double implicature, global implicature with the 2nd scalar item). The analysis of variance revealed significant main effects for both Task ($F(1, 17930) = 189.66$, p <2e-16) and Interpretation ($F(3, 17930) = 1686.31$, p <2e-16), as well as a highly significant interaction effect between Task and Interpretation ($F(3, 17930) = 68.16$, p <2e-16). These results suggest that both individual factors and their interaction have a substantial impact on the dependent variable. As expected, posthoc Tukey tests reveal no significant difference in the rates of global implicatures with the 1st scalar item. Moreover, the rates of local implicatures, global implicatures involving the 2nd scale and double implicatures are overall significantly higher in Experiment 2: between the two experiments, there is a substantial difference in the rates of local implicatures, (with a mean difference of 0.1469 (95% CI: [0.1099, 0.1837], p <.001)), global implicatures involving the 2nd scale (with a mean dif-

ference of 0.3849 (95% CI: [0.3453, 0.4245], p <0.001)) and double implicatures (with a mean difference of 0.1591 (95% CI: [0.1222, 0.196], p <.001)). However, the rate of global implicatures involving the 1st scale is overall significantly smaller in Experiment 2 (with a mean difference of -0.0599 (95% CI: [-0.0968, -0.0230], p <.001)).

We see lexical scale variation in the rates of local implicatures. An ANOVA with acceptance rates for local implicatures as the dependent variable and the fixed effects Task and 2nd scale reveals significant main effects for both Task (F(1, 4399) = 141.685, p <2e-16) and 2nd Scale (F(42, 4399) = 3.422, p = 8.63e-13), as well as a highly significant interaction effect between Task and 2nd Scale (F(42, 4399) = 2.146, p = 2.66e-05). Posthoc Tukey tests reveal that this significant interaction is due to the scales ⟨*hot, warm*⟩, ⟨*hideous, ugly*⟩, ⟨*black, dark*⟩, ⟨*enormous, big*⟩ and ⟨*stunning, attractive*⟩. Other scales do not manifest significant difference in the rates of local implicatures in Experiment 2 compared to Experiment 1. A similar scalar diversity effect can be seen in the rates of double implicatures. An ANOVA with acceptance rates for double implicatures as the dependent variable and the fixed effects Task and 2nd scale revealed significant main effects for both the Task (F(1, 4398) = 165.645, p <2e-16) and 2nd Scale factors (F(42, 4398) = 4.633, p <2e-16). Additionally, there was a significant interaction effect between Task and 2nd Scale (F(42, 4398) = 1.713, p = 0.00291). The interaction suggests that the effect of Task on the dependent variable may vary across different levels of the 2nd Scale. Posthoc Tukey tests reveal that there is a significant difference between the two experiments for the scales ⟨*beautiful, pretty*⟩, ⟨*cold, cool*⟩ ⟨*unique, special*⟩ and ⟨*ugly, hideous*⟩. In the case of global implicatures with the 2nd scalar item, an ANOVA with acceptance rates as the dependent variable and the fixed effects Task and 2nd scale reveals significant main effects for both the Task (F(1, 4398) = 41.330, p = 1.42e-10) and 2nd Scale factor (F(42, 4398) = 5.675, p <2e-16). Additionally, there was a marginally significant interaction effect between Task and the 2nd Scale (F(42, 4398) = 1.375, p = 0.0547): a significant difference between experiments can be seen for the scales ⟨*will, may*⟩, ⟨*certain, possible*⟩, ⟨*unavailable, scarce*⟩ and ⟨*scared, wary*⟩.

Additionally, an ANOVA with with acceptance rates for implicatures as the dependent variable and the fixed effects Task, 1st scale and Interpretation reveals significant main effects for both the 1st Scale Factor (F(1, 4481) = 137.571, p <2e-16) and Task(F(1, 4481) = 4.371, p = 0.036615), as well as a significant interaction between Task and the 1st Scale Factor (F(1, 4481)= 12.958, p = 0.0003). In Experiment 2, participants tend to derive a similar rate of local implicatures, as well a similar rate of double implicatures with scales embedded under ⟨*certain, possible*⟩ and under ⟨*all, some*⟩, whereas in Experiment 1, local and double implicature rates tend to be lower for scales embedded under ⟨*all, some*⟩ than for ⟨*certain, possible*⟩. Interestingly, global implicatures involving the first scale tend to be quite high for scales embedded under either *some* and *possible*. Global implicatures involving the second scale tend to be derived at lower rates for scales embedded under either *some* and *possible* in both experiments.

Regarding the predictors of scalar diversity in van Tiel et al. (2016), we find that the rates of implicatures with the 2nd scale item correlate more with semantic distance than with boundedness or other factors (see Figure 7). The addition of the QUD thus results in an important difference concerning the relation between predictors and implicatures rates compared to Experiment 1.

5. Discussion

With respect to Q1, the question regarding the extent to which various implicatures types are derived across different scales, our study has shown that rates of local implicatures, double implicatures and global implicatures involving the 2nd scale vary with scalar diversity in multiple scalar item utterances. Overall, there seems to be a general preference to derive global implicatures with the 1st scalar item, followed by local and double implicatures, and a general dispreference for global implicatures with the 2nd scalar item. The high rates of global implicatures with the 1st scalar item compared to the lower rates of other types of implicatures suggest that the order of appearance of scalar items matters: the scalar item which appears first gives rise to more implicatures than the scalar item which appears second, regardless of scale type. However, we do find non-negligeable rates of local implicatures with the 2nd scalar item, as well as double implicatures (higher than 50%). These results go against a gricean view which assumes that local implicatures cannot be derived given that the mechanisms of deriving implicatures target whole utterances. Instead, they suggest that it is possible to derive implicatures in embedded contexts. This is further supported by the existence of double implicatures, where both weak scalar terms are strengthened to the negation of their stronger alternatives. Nevertheless, the first scalar item seems to be privileged with respect to the second, which may be taken to suggest either that the mechanisms of deriving implicatures with the first vs second scalar item are different (pragmatic vs grammatical, for instance) [5], or simply that the first position is more accessible or available to participants.

Interestingly, we find that participants tend to generally derive more local and double implicatures with scales embedded under *possible* than under *some*. This goes against the findings of Bleotu et al. (2022b), who found that participants derived very few local implicatures under *possible*. It is unclear why this contrast arises, but in the current experiments, when deriving local implicatures, participants may treat *possible* as a *think* predicate, which they could potentially even ignore. This matter is in need of further exploration.

Additionally, as an answer to our second research question (Q2), we find that, in both experiments, implicature rates for different lexical scales correlate with semantic distance: the more semantically distinct the scale-mates of the 2nd scalar item are, the more local implicatures and double implicatures we find. The availability of lexical scales had no effect. Thus, the findings of van Tiel et al. (2016) seem to carry over to implicatures with utterances containing multiple scalar terms. The absence of a correlation between lexical availability of scales and rates of implicatures with the 2nd scalar item does not seem to support an Alternatives-Based Account where implicatures depend on lexical availability. Instead, the correlation between scalar distinctness and higher implicature rates suggests that a theory of implicature is needed which takes into account the contrast between the two scale-mates. We shall refer to such an account as the *Scalar Distinctness Account* of implicatures.

Finally, regarding the third question (Q3), addressing the role of QUD on implicature derivation, we find that local implicatures, double implicatures and global implicatures involving the 2nd scale are also sensitive to a complex QUD which employs the weak scalar term of the 1st scale and the strong scalar term of the 2nd scale. The findings of Experiment 2 support the

[5]The considerable rates of double implicatures, comparable overall to local implicature rates, suggest that exhaustification can apply locally, to parts of utterances, thus supporting the Grammatical account.

idea that access to the stronger alternative of the 2nd scale boosts implicatures involving the 2nd scale. The results are thus in line with the Alternatives-Based approach and research on alternatives for single scale utterances (Gotzner and Romoli 2022; Tieu et al. 2016; Skordos and Papafragou 2016). However, it is worth mentioning that, while in Experiment 1, the lexical availability of the 2nd scale was not a predictor of derivation of implicatures employing the 2nd scale, in Experiment 2, the contextual discourse availability of alternatives seems to impact implicatures more than their lexical availability. Our results thus highlight that there is an noteworthy difference between the lexical availability of alternatives and their contextual availability: implicatures seem to depend on how easy it is for participants to retrieve a stronger alternative in a given context rather than in general.

Another important observation we can make is that the QUD seems to reduce scalar diversity to a significant extent: most of the scales show high rates of implicatures employing the 2nd scalar term. Moreover, context reduces the effect of boundedness on implicature-derivation, possibly because the strong scale-mate of the 2nd scale acts as an upper bound. This is also expected in a theory which assumes that implicature derivation depends on the discourse availability of the scale. Once a stronger alternative is made available in the discourse by means of a question containing the weak scale mate of the 1st scale and the strong scale mate of the 2nd scale, participants no longer need to go through the effort of retrieving the strong scale mate of the 2nd scale, they will simply strenghten the embedded term by negating the upper bound and thus deriving an implicature.

The QUD findings complement the findings related to the predictors of scalar diversity, suggesting that an explanatory theory of implicature derivation should consider (at least) two components: (i) scalar distinctness, and (ii) contextual availability of the scale in the discourse. We thus embrace a specific version of the Alternatives-Based Account, which we refer to as **the Contextual Alternatives and Scalar Distinctness Account**. Overall, participants tend to derive more implicatures when they are aware of a (lexical/contextual) contrast between the two scale-mates, and when the stronger scale-mates is made available in the discourse context, but not when the scale is generally more lexically available to them.

6. Conclusion

In the current paper, we have extended van Tiel et al. (2016)'s inference task to investigate various implicature types (global, local and double) in utterances embedding scalar terms belonging to multiple scales under *some* and *possible*. We noticed an overall pattern: global implicatures involving the 1st scale tend to be derived at higher rates than implicatures involving the 2nd scale (local and double implicatures or global implicatures involving the 2nd scale). We showed that all the types of implicatures we tested increase in the presence of an explicit question introducing the QUD. Moreover, while in the absence of a QUD, implicatures involving the 2nd scale are correlated with semantic distance and with boundedness, once a QUD is added, boundedness no longer predicts implicature rates. We have suggested that this can be taken to support a version of the Alternatives-based Account (**the Contextual Alternatives and Scalar Distinctness Account**) where contextual availability of alternatives is more important than lexical availability, and where, additionally, the (lexical/contextual) distinctness of

the scales matters. We are currently extending our investigation to other types of QUD, further manipulating the strength of the scalar terms.

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On the conjunctive interpretation of the disjunction *fie…fie* in child Romanian[1]

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Abstract. Previous studies show that adults tend to interpret sentences involving unembedded complex disjunctions (*The mouse carried either the apple or the orange*) exclusively ('The mouse carried one or the other but not both'), while children tend to interpret them either inclusively ('The mouse carried one and possibly both') or conjunctively ('The mouse carried both') (Paris 1973; Braine and Rumain 1981; Chierchia et al. 2001; Guasti et al. 2005; Singh et al. 2016; Nicolae and Sauerland 2016; Tieu et al. 2017; among others). We conducted a set of experiments investigating children's and adults' interpretations of different kinds of simple and complex disjunctions in Romanian, with the goal of probing whether children's conjunctive interpretation of disjunction is an experimental artifact, as argued by Huang and Crain (2020) and Skordos et al. (2020). Specifically, we investigated whether contexts where the disjunctive statement exhaustively mentions all objects in the display are more likely to elicit the conjunctive interpretation. While the majority of the disjunction types were interpreted inclusively by children, there was one disjunction that appeared to differ from the rest: the complex disjunction *fie…fie*, which children tended to interpret conjunctively, whether there were two or four objects in the context. In this paper, we focus on this particular finding, and discuss possible sources of children's conjunctive interpretations: (i) a derived meaning via an implicature within an alternatives-based account, (ii) a primary meaning alongside inclusivity, (iii) syncretism with the present subjunctive of the verb *a fi* ('to be').

Keywords: disjunction, first language, Romanian, conjunctive interpretation, experimental pragmatics, ambiguity, alternatives, subjunctive.

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1. Introduction

A disjunctive statement such as (1) can be interpreted in multiple ways: (i) exclusively as 'The mouse carried one but not both', (ii) inclusively as 'The mouse carried one and possibly both,' and (iii) conjunctively as 'The mouse carried both.'

(1) The mouse carried an apple or an orange.

Previous studies show that adults tend to interpret disjunctions inclusively or exclusively (Chierchia et al. 2001; Guasti et al. 2005; Nicolae and Sauerland 2016; Nicolae et al. 2023), while children interpret them inclusively, exclusively or conjunctively (Paris 1973; Braine and Rumain 1981; Singh et al. 2016; Tieu et al. 2017; Sauerland and Yatsushiro 2018; Huang and Crain 2020; Skordos et al. 2020). While children's inclusive interpretations have been explained as a logical interpretation of disjunction, the source of children's conjunctive interpretations of disjunction has been a matter of debate. According to Singh et al. (2016), the conjunctive interpretation arises as an implicature, with children accessing a different set of alternatives than that of adults. According to Sauerland and Yatsushiro (2018), the conjunctive interpretation corresponds to a basic meaning of disjunction, alongside inclusivity. For Skordos et al. (2020) and Huang and Crain (2020), the reading is an experimental artifact, a repair strategy not grounded in grammar. They argue that conjunctive behavior arises when the disjunctive statement mentions both objects in the display, thus rendering the disjunction either infelicitous as a guess or uninformative in the discourse. In the presence of additional objects, they argue, the disjunctive guess becomes felicitous and informative, and children should no longer give conjunctive responses.

In this paper, we contribute further data to this ongoing debate by discussing one finding from our larger study of disjunctions in Romanian, namely that children appear to interpret the complex disjunction *fie…fie* conjunctively, despite interpreting other simple and complex disjunctions inclusively. Although we focus here on *fie…fie* (given its divergent behavior compared to other disjunctions), the findings of the larger study can be consulted here: `https://osf.io/preprints/psyarxiv/bywj2`.

2. Disjunction in Romanian: On *fie…fie*

Romanian has many commonly used disjunctions: the morphologically simple disjunctions *sau* and *ori*, as well as the morphologically complex disjunctions *sau… sau*, *ori… ori*, and *fie…fie*. Here we highlight the disjunction *fie…fie*, which is interesting in a number of respects. First, it is not as frequent as the complex disjunction *sau… sau*, as shown by a corpus study (see Bleotu et al. 2023 for more details). This may make it more difficult for children to acquire. Second, unlike *sau… sau*, which consists of the reduplication of the simple counterpart *sau* (similarily to Japanese *ka…ka* or French *ou…ou*), *fie…fie* lacks a simple counterpart (making it more similar to the French complex disjunction *soit…soit*). This means that while children might overgeneralize the interpretation of *sau* to the interpretation of *sau… sau*, they are unlikely to do the same in the case of *fie…fie*, since there is no simplex disjunctive counterpart to generalize from. These properties make *fie…fie* an interesting test case for the interpretation of disjunction in child Romanian.

3. The experiments

In the larger study, we conducted two experiments: Experiment 1, involving two objects in each pictured context, and Experiment 2, involving four pictured objects in the context, in order to test whether any observed conjunctive behavior would persist in the presence of additional unmentioned objects in the background. Here we present the experiments in the context of the complex disjunction *fie...fie* (but see our manuscript for details pertaining to the other disjunctions).

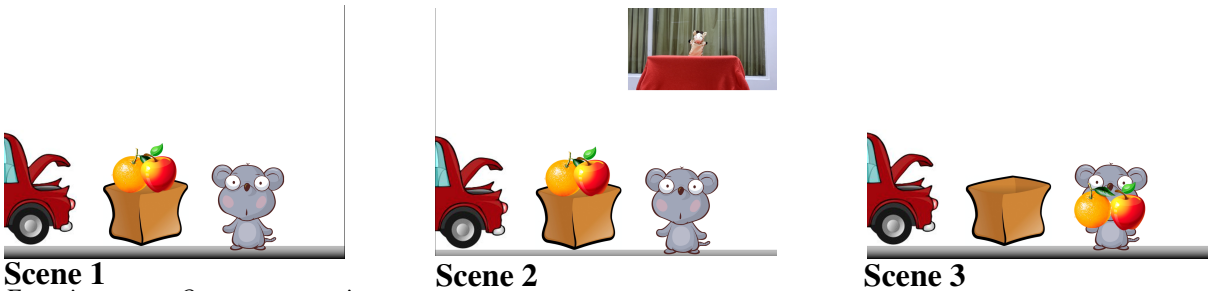
If the conjunctive interpretation of disjunction is an experimental artifact related to the infelicity of disjunction when there are only two relevant alternatives in the context, then we predicted that any conjunctive interpretations observed in Experiment 1 should disappear in Experiment 2, where the two additional pictured objects should render the disjunctive statement more felicitous (as per the discussion in Skordos et al. 2020 and Huang and Crain 2020).

In Experiment 1, we tested 15 monolingual Romanian-speaking, typically-developing children (age range 4-6 years, mean age 5;03) and 30 adult native speaker controls. In Experiment 2, we tested a different group of 14 Romanian-speaking children (age range 4-6 years, mean age 5;05) and 23 adult controls.

Both experiments employed a Truth Value Judgment Task (Crain and Thornton 1998) presented in Prediction Mode rather than Description Mode (following Tieu et al. 2017 and subsequent work). Such a task licenses ignorance inferences, which often characterize disjunctive statements. Participants had to evaluate whether a puppet called Bibi made correct guesses about the outcome of a situation. The guesses were in the form of disjunctive sentences (see example (2)):

(2) Şoricelul a cărat **fie** un măr **fie** o portocală.
mouse.DEF has carried either an apple or an orange
'The mouse carried either an apple or an orange.'

The translated scenes in Figure 1 illustrate how trials in Experiment 1 proceeded.



Scene 1
Experimenter: Once upon a time there was a little mouse who liked to help his mother with her shopping. One day, his mom bought some fruit: an orange and an apple. Of course, the little mouse wanted to help his mommy with the shopping. Let's see if Bibi can guess what happened next!

Scene 2
Experimenter: Bibi, tell us what happened next.

Bibi: The mouse carried an apple or an orange.

Experimenter: Let's see if Bibi's right!

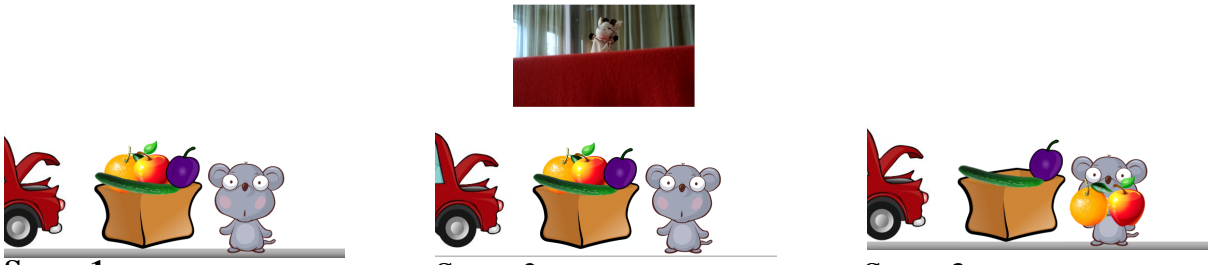
Scene 3
Experimenter: Look, the mouse carried this and this!

So was Bibi right?

Figure 1: Example of a critical item in the 2DT condition in Experiment 1

The target disjunctive sentences were presented in three kinds of contexts: (i) a 1-disjunct-true (1DT) condition (4 trials), where the situation was true of one disjunct only (for instance, the mouse carried only one fruit), (ii) a 2-disjunct-true (2DT) condition (4 trials), where the situation was true of both disjuncts (for instance, the mouse carried both), and (iii) a 0-disjunct-true (0DT) condition (2 trials), where the situation held of neither disjunct (for instance, an animal carried neither object mentioned in the two disjuncts, but instead carried something else). Note that with the exception of the two 0DT trials where three objects were pictured (one acted upon, two not), all other trials contained only two pictured objects.

While both Experiment 1 ('2 Objects') and Experiment 2 ('4 Objects') tested the same sentences (which mentioned two objects), in Experiment 2, two additional objects were included in each picture, such that each scene now contained a total of four objects. The translated scenes in Figure 2 illustrate how the trials in Experiment 2 proceeded.



Scene 1
Experimenter: Once upon a time there was a little mouse who liked to help his mother with her shopping. One day, his mom bought some fruit: an orange and an apple. Of course, the little mouse wanted to help his mommy with the shopping. Let's see if Bibi can guess what happened next!

Scene 2
Experimenter: Bibi, tell us what happened next.

Bibi: The mouse carried an apple or an orange.

Experimenter: Let's see if Bibi's right!

Scene 3
Experimenter: Look, the mouse carried this and this!

So was Bibi right?

Figure 2: Example of a critical item in the 2DT condition in Experiment 2

We excluded from our planned analyses participants who made errors on more than half of the three fillers and two controls. This led to the exclusion of two child participants (one in Experiment 1, one in Experiment 2); all adults passed the unambiguous controls and fillers. Figure 3 displays the mean rates of acceptance for the critical target conditions.

We used participants' responses to the 1DT and 2DT targets to categorize them as follows: INCLUSIVE if they accepted more than half of the disjunctive utterances in both the 1DT and 2DT conditions, EXCLUSIVE if they accepted more than half of the disjunctive utterances in the 1DT condition, while rejecting more than half of the disjunctive utterances in the 2DT condition, and CONJUNCTIVE if they rejected more than half of the disjunctive utterances in the 1DT condition, while accepting more than half of the disjunctive utterances in the 2DT condition. CONTRADICTORY participants were those who rejected more than half of the disjunctive utterances in both the 1DT and 2DT conditions, and MIXED participants accepted exactly half of the disjunctive statements in each of the two conditions. Table 1 schematizes this categorization; Table 2 provides the numbers of participants falling within each category.

In Experiment 1, adults were mostly exclusive with *fie…fie*, while children were mostly con-

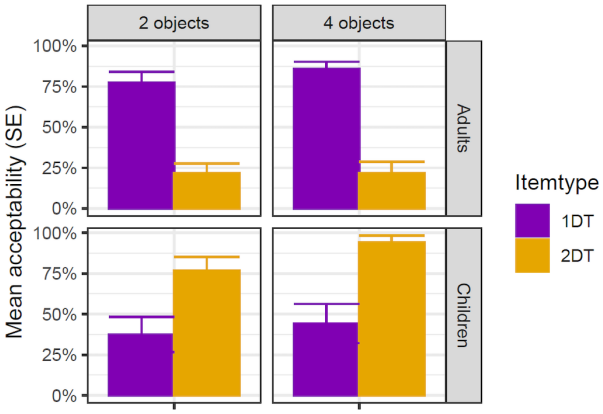


Figure 3: Mean rates of acceptance of *fie. . . fie* in target conditions

	1DT	2DT
INCLUSIVE	accept	accept
EXCLUSIVE	accept	reject
CONJUNCTIVE	reject	accept
CONTRADICTORY	reject	reject

Table 1: Possible participant types by interpretation

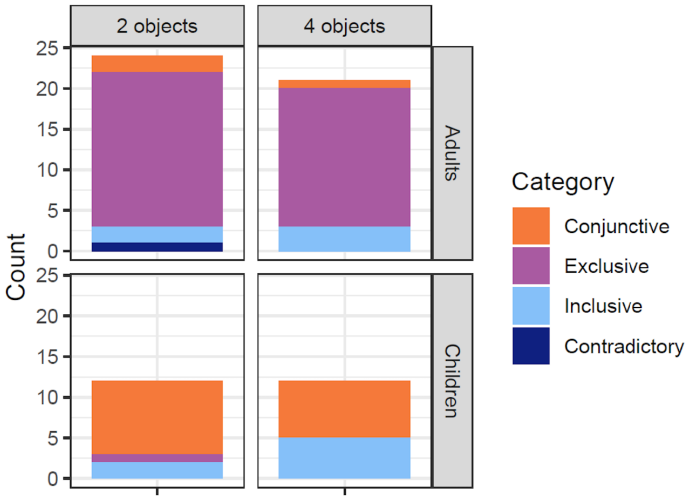


Figure 4: Distribution of participants across different interpretation types

junctive. In contrast, in Experiment 2, while adults remained exclusive, we observed more inclusive interpretations by children, as shown in Figure 4.

Interested readers can consult our larger paper for the statistical analysis of the full dataset, including *fie. . . fie*. Descriptively, we found that adults were exclusive with all disjunctions except for neutral *sau* in Experiment 2, which elicited more inclusive interpretations. In contrast, children were mostly inclusive with all *sau*-based disjunctions in both experiments. For *fie. . . fie*, however, they were mostly conjunctive in Experiment 1, while showing a mix of conjunctive and inclusive interpretations in Experiment 2.

	Inclusive		Conjunctive		Exclusive		Contradictory		Mixed	
	exp 1	exp 2	exp 1	exp 2	exp 1	exp 2	exp 1	exp 2	exp 1	exp 2
children	2	5	9	7	1	0	0	0	2	1
adults	2	3	2	1	19	17	1	0	6	2

Table 2: Numbers of participants falling into each interpretation category (total numbers of participants: Exp. 1 – 15 children, 30 adults; Exp. 2 – 13 children, 23 adults)

Our study reveals two main findings about *fie…fie*. On the one hand, the design of the materials seems to play a role in children's conjunctive interpretations of disjunction: children indeed became more inclusive and less conjunctive in Experiment 2 ('4 Objects'). On the other hand, the fact that the conjunctive interpretation of *fie…fie* persisted even in the presence of additional objects suggests that the presence of conjunctive interpretations cannot be wholly explained as a task effect.

4. Discussion

The results for *fie…fie* indicate that conjunctive interpretations cannot be wholly explained as an experimental artifact. We take the findings to suggest that there is some genuine semantic-pragmatic interpretation leading children to give conjunctive responses. In this section, we discuss three possible sources for the conjunctive interpretation of *fie…fie*, framing the possibilities within: the Alternatives-based Approach, the Ambiguity-Conjunctive Default Approach, and the Subjunctive Account.

4.1. The Alternatives-based Approach

The Alternatives-based Approach takes the conjunctive interpretation to be derived in the grammar (Singh et al. 2016; Tieu et al. 2017). Like adults, children take disjunctions to be inclusive at their core, and enrich meaning by negating relevant alternatives. Unlike adults, however, children do not consider conjunction to be a relevant alternative. Adults and children access different alternatives to *fie A fie B* statements. Adults access the set of alternatives {A, B, A & B}, of which only the conjunction can be negated. The negation of the conjunctive alternative leads to the exclusive interpretation. In contrast, children access the set of alternatives {only A, only B}, the negation of which leads to the conjunctive interpretation.

Given that we appear to have two subgroups of children in Experiment 2, we can extend the alternatives-based analysis by positing a difference among individual children. For some children, the alternatives considered for *fie A, fie B* are {only A, only B}, the negation of which results in the conjunctive interpretation. Other children, however, remain inclusive, choosing not to exhaustify.

A key aspect of this proposal is that the inclusive meaning is the semantic default, while the conjunctive meaning is derived pragmatically.

4.2. The Ambiguity-Conjunctive Default Approach

According to an ambiguity-based account (in the spirit of Sauerland and Yatsushiro 2018), *fie…fie* is ambiguous; some children might therefore entertain an inclusive reading and others a conjunctive reading. The Ambiguity Approach is thus also able to capture the fact that some children were inclusive while others were conjunctive. The conjunctive meaning would simply be taken as one of the possible basic meanings of disjunction, alongside inclusivity.

The low frequency of *fie…fie* could mean that (some) children do not know if this construction is meant to convey a conjunctive or a disjunctive meaning. For this reason, some children may assign a conjunctive interpretation. This possibility is supported by evidence from studies suggesting that children access conjunctive readings by default for other structures as well, for instance, in complex recursive constructions. Children have been found to sometimes interpret *small big flowers* as 'small and big flowers' instead of 'the subset of small flowers among the set of big flowers' (Roeper 2011; Bleotu and Roeper 2021). The idea of a conjunctive default is also supported by data in Bleotu et al. (2024), who report that when Romanian adults were tested on a variant of Experiment 1 in which disjunctive utterances contained the unknown nonce disjunction *mo…mo*, they defaulted to a conjunctive interpretation. Thus, the children who appear to interpret *fie…fie* conjunctively may do so by virtue of a conjunctive default.

4.3. The Subjunctive Account

Finally, another possible explanation for children's conjunctive interpretation of *fie…fie* is based on the syncretism between the disjunctive marker *fie* and the present subjunctive of the verb *a fi* 'to be', which is rather frequently used in Romanian.[2] The subjunctive is a dependent mood, and its modal force and flavor depend on the embedding element (Quer 1998). It can have existential (possibility) force if embedded under the possibility modal *poate* (see example (3)), or universal (necessity) force if embedded under the strong intensional verb *vrea* (see example (4)) (Farkas 1984; Giorgi and Pianesi 1997; Cotfas 2017).

(3) Poate să fie obosită, să fie supărată.
may.IND.3 MRK.SBJV be.PRS.SBJV.3 tired MRK.SBJV be.PRS.SBJV.3 upset
'She may be tired, may be upset.'

(4) Maria vrea să fie soare, să fie căldură.
Maria want.IND.3 MRK.SBJV be.PRS.SBJV.3 sun, MRK.SBJV be.PRS.SBJV.3 warmth
'Maria wants there to be sun and warmth.'

If children generalize the meaning of subjunctive *fie* and treat the construction *fie…fie* as the juxtaposition of two subjunctives, this may lead to different interpretive paths. One such path involves children analyzing the juxtaposition of the subjunctives as the conjunction of two modals, similarly to how Zimmermann (2000) accounts for conjunctive interpretations of disjunction. In essence, *'be it A, be it B'* would be interpreted along the lines of *Modal A and Modal B*, where *Modal* could correspond to either possibility or necessity. If the modal en-

[2]The French complex disjunction *soit…soit* is similarly related to the subjunctive form (*soit*) of the verb *être* 'to be.'

codes necessity, this gives rise to the conjunctive interpretation, whereas if the modal encodes possibility, children might subsequently pragmatically strengthen it, going from a possibility meaning to a necessity meaning (Deal 2011; Jeretič 2021).

Another interpretive path involves children simplifying the structure, ignoring *fie*, and thus ending up with *A & B*.

The idea that children might experience difficulties with the subjunctive is supported by recent corpus studies showing that children sometimes treat irrealis as realis (Tulling and Cournane 2022), denying the counterfactual, as in (5), for instance, or using the subjunctive for real facts, as in (6):

(5) Adult: What if you were a snake? (Reilly 1982: 116, ex. 57)
Janine (3;0): I'm not a snake. / I'm Janine.

(6) Laura (3;2): I wish you were my mommy. (Braunwald 1971)

Moreover, while some studies suggest that children are able to handle the subjunctive by the age of four (Riggs et al. 1998; Nyhout et al. 2019), other experimental studies (McCormack et al. 2013; Nyhout et al. 2019; Rafetseder et al. 2013) argue that counterfactual reasoning is not in place until age 6. There are thus reasons to believe that if Romanian 5-year-olds do treat *fie…fie* as the juxtaposition of two *be* subjunctives, they might struggle with its interpretation.

5. Conclusion

Our experimental study revealed evidence of both inclusive and conjunctive interpretations of the complex disjunction *fie…fie* in child Romanian. We have discussed a number of ways these results could be interpreted. In particular, the experimental data on *fie…fie* are compatible with (at least) three possible approaches: the Alternatives-based Approach, the Ambiguity-Conjunctive Default Approach, and the Subjunctive Account. The conjunctive interpretation could be derived through an implicature, through a conjunctive default, or on the basis of the syncretism with the present subjunctive of the verb *a fi* 'to be'. It is also conceivable that the conjunctive interpretation of *fie…fie* has multiple sources, rather than a single one. We aim to address this matter further in future studies.

In closing, our research suggests that the conjunctive interpretation is not always a task effect, challenging the claims in Huang and Crain (2020) and Skordos et al. (2020) that conjunctive interpretations arise as an experimental artifact. The present research also highlights the need for more fine-grained cross-linguistic investigations of disjunction, as the findings suggest that different disjunction types may exhibit different acquisition paths across languages.

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A Puzzle about 'if', Update and Compositionality[1]

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Abstract. According to dynamic approaches to meaning, meanings are context change potentials: ways in which an assertion of a sentence affects the context or the common ground of a conversation. In this paper I will argue that it is not straightforward to square the idea that meanings are context change potentials with an adequate theory of the discourse dynamics of conditionals and the idea that meanings are compositional. As I will argue, there is a tension between providing a prima facie plausible theory of the discourse dynamics of indicative conditionals while holding on to a popular and widespread notion of what it is for meanings to be compositional. The tension disappears, if we reject the view that meanings are context change potentials. That said, I will close the paper by discussing what I take to be the two most promising routes defenders of a dynamic approach to meaning could take in order to resolve the tension.

Keywords: Theories of meaning, compositionality, dynamic semantics, conditionals.

1. Introduction

Discourse dynamics is the study of the context change potentials of sentences: how assertions of sentences of a given fragment of language affect the context of a conversation. In this paper I wish to investigate the discourse dynamics of simple indicative conditional (henceforth just *conditional*) sentences, such as

(1) If tweety is a bird, tweety is able to fly,

(2) It is not the case that if tweety is a bird, tweety is able to fly.

I will focus on conditional sentences that are *simple* in the sense that all of them can reasonably be modelled by a formal language generated by the following BNF:

$$\begin{aligned} &\phi := \alpha \mid (\alpha \to \alpha) \mid \neg(\alpha \to \alpha), \\ &\alpha := p \mid \neg\alpha \mid (\alpha \wedge \alpha), \end{aligned} \qquad (\mathcal{L}_s)$$

where p is supplied by a countable set of atomic sentences, $\mathtt{At}$.[2] Notice that $\mathcal{L}_s$ neither contains nested nor compound conditionals. For my purposes, focusing on sentences in this small fragment will suffice.

While the study of the discourse dynamics of conditionals is interesting in its own right, I am ultimately interested in a foundational question: the question of what meanings are. According to a popular view, our approach to meaning should be *dynamic*: *meanings are context change*

[1]I would like to thank John MacFarlane, Sven Neth, Adrian Ommundsen, Seth Yalcin as well as audiences at HU Berlin, ECAP11 and SuB28 for discussion and comments.

[2]As usual I will take $\to$, to model english 'if ... then ...' statements in the indicative mood and take $\wedge$ and $\neg$ to model conjunction and negation respectively. $\mathcal{B}$ will be used to refer to the non-conditional fragment of $\mathcal{L}_s$.

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potentials.[3] This is what we may call *the guiding slogan of dynamic semantics*.[4]

The goal of my paper is to convince the reader that it is not straightforward to square the guiding slogan with an adequate theory of the discourse dynamics of the simple conditional sentences in $\mathcal{L}_s$ while respecting the idea that meanings are compositional. As I will argue, there is a tension between providing a prima facie plausible theory of the discourse dynamics for $\mathcal{L}_s$ while holding on to a popular and widespread notion of what it is for meanings to be compositional. The tension disappears, as we will see, if we reject the guiding slogan of dynamic semantics. That said, I will close the paper by discussing what I take to be the two most promising routes defenders of dynamic approaches to meaning could take in order to respond to the tension.

Some caveats before we move on. First, I mentioned above that we will focus on a small conditional fragment $\mathcal{L}_s$. Hence, in the following it will be helpful to keep in mind that constraints on the discourse dynamics for simple conditionals we put forward should not be read as constraints that carry over to theories that aim to provide approaches to larger conditional fragments or fragments of language that, in addition to conditionals, contain modal or other operators apart from conjunction and negation.

Second, the literature on both the semantics and the discourse dynamics of indicative conditionals is vast. Accordingly it will be impossible to do justice to the wide range of puzzles and views surrounding natural language conditionals. However, I will address what I take to be the most pressing objections to the views I am interested in.

2. Discourse Dynamics

2.1. Discourse Dynamics in General

Let me start by saying more about what it is to provide a theory of the discourse dynamics for a fragment of language as well as what it is to provide a dynamic theory of meaning.

Most of the notions we will be working with go back to Stalnaker (1999). According to Stalnaker, a conversation should be thought of as taking place on the background of a shared stock of information, the *context* or *common ground* of a conversation. To assert a sentences at a particular stage of the conversation is to contribute to that stock of information in a certain way. Such contributions may consist in information that is added to the context or help the discourse participants to coordinate on the context in some other way. A formal structure that helps to make this idea precise is what we may call a *model of conversation*.[5]

Definition 2.1 (Model of Conversation)**.** *A* ***model of conversation*** *for a fragment of language $\mathcal{L}$ is a pair $\langle C, \cdot[\cdot]\rangle$ where C is a set, the set of* ***contexts****, and $\cdot[\cdot]$ a function, the* ***update function****, that maps a context $c \in C$ and a sentence $\phi \in \mathcal{L}$ to a context $c[\phi] \in C$.*

[3] Such views were pioneered by Heim (1982) and Kamp (2013).

[4] This guiding slogan is found in many places (see Groenendijk and Stokhof, 1991; Veltman, 1996; Gillies, 2004: among many others).

[5] The notion is similar to what Bonnay and Westerståhl (2014) call an *abstract frame*. (Rothschild and Yalcin, 2016) and (Rothschild and Yalcin, 2017) discuss slightly more general structures.

The set of contexts corresponds to the context or the common ground at various possible stages of a conversation. The update function of such a model can be thought of as telling us how an assertion of a sentence at a context affects that context, how the conversation moves from one stage to another in light of an assertion. Note that the definition does not presuppose a particular notion of context. However, for the most part we will follow Stalnaker and think of contexts as sets of possible worlds: *ways the world might be in light of the information shared between the participants of the discourse*. Possible worlds, in turn, are taken to be functions from $\mathtt{At}$ to truth values in $\{1,0\}$. W will always denote a set of possible worlds and $\mathcal{P}(W)$ its power set. Let me also flag that, while it is natural to interpret such a structure as telling us about how the context of conversation evolves in light of assertions, this interpretation is not forced on us. Later on we will encounter a different, non-dynamic interpretation of an update function. For now, however, the way of looking at models of conversation just discussed will suffice.

The notion of a model of conversation puts us in a position to make the guiding slogan of dynamic semantics precise. Remember, according to the slogan, meanings are context change potentials. The context change potential of a sentence ϕ, in turn, is the way in which an assertion of ϕ would affect the context of conversation. Now, given a model of conversation, any sentences $\phi \in \mathcal{L}$ will induce a function from context to context $\cdot[\phi]$. Such a function can plausibly be take to model the context change potential of the sentences we are interested in. Accordingly, the following definition seems to adequately capture the guiding slogan.

Definition 2.2 (Dynamic approaches to meaning)**.** *According to a* ***dynamic approach to the meaning*** *of sentences in a fragment $\mathcal{L}$, meanings are modelled in terms of a recursively defined update function of a model of conversation for $\mathcal{L}$ which captures the context change potentials of the sentences in in the fragment.*

The term 'recursive' in the above definition should be read in a loose sense, as applying to any function that is defined by making use of the inductive structure of the fragment of language we are interested in. The notion is intended to capture the idea that on a dynamic approach to meaning an update function plays *two* roles. It is a model of the context change potentials of the fragment of language we are interested in *and* it describes its compositional structure. We will say more about what it is for a notion of meaning to be compositional later on, since typically our notion of compositionality is stronger than what we have so far. For now this more permissive way of capturing this notion will suffice.

Given this, let us contrast dynamic approaches to meaning to non-semantic approaches to discourse dynamics.

Definition 2.3 (Non-semantic approach to discourse dynamics)**.** *According to a* ***non-semantic approach to the discourse dynamics*** *for a fragment of language $\mathcal{L}$, a model of conversation for $\mathcal{L}$ is given in terms of a bridge principle that links a theory of meaning for $\mathcal{L}$, that does not provide the discourse dynamics of the fragment directly, to a theory about the context change potentials of the sentences in $\mathcal{L}$.*

Stalnaker's original proposal in (Stalnaker, 1999) is an example of such an non-semantic approach to discourse dynamics. His notion of update is determined via a bridge principle that links a theory of truth at an index (in the manner of Kaplan (1977)) to an appropriate model of

conversation. But note that the above definition does not require the input theory to be truth-conditional. What matters is that the system modeling the compositional theory of meaning does not deliver a theory of discourse dynamics directly. The latter is modelled via a bridge principle linking meanings to the update potentials of the sentences we are interested in.[6]

With these definitions in the back of our minds, let us turn to our first, concrete model of conversation for $\mathcal{L}_s$.

2.2. Heim's View

An early proposal for the discourse dynamics of indicative conditionals is found in Heim (2002). According to this view, we have the following model of conversation for $\mathcal{L}_s$.

Definition 2.4 (Heim's View)**.** *Heim's model is a pair* $\langle \mathcal{P}(W), \cdot[\cdot] \rangle$ *for some set of worlds* W *and for all contexts* $c \in \mathcal{P}(W)$*,* $p \in \mathtt{At}$ *and* $\alpha, \beta \in \mathcal{B}$*,* $\cdot[\cdot]$ *is recursively defined as follows:*

$$(p)\ \ c[p] = \{w \in c \mid w(p) = 1\}, \quad (\wedge)\ \ c[\alpha \wedge \beta] = c[\alpha][\beta],$$
$$(\neg)\ \ c[\neg\alpha] = c - c[\alpha], \quad (\rightarrow_h)\ \ c[\alpha \rightarrow \beta] = c - (c[\alpha] - c[\alpha][\beta]).$$

Note that this view satisfies our above definition of what it is for a theory of meaning to be dynamic. The theory is given in terms of a recursively defined model of conversation that is intended to capture the context change potentials of the sentences we are interested in. Let us check the view's predictions with respect to an example. Here is a vignette (slightly modified from Gillies, 2004) we may use to provide a context of conversation.

> **Crime at the Mansion:** A crime has been committed at the mansion. Ann and Bob are investigating the crime scene. It is common ground between Ann and Bob that the culprit acted alone and that there are three possible candidates. There is *the butler* (a member of the *house staff*), *the driver* and *the gardener* (both members of the *ground staff*).

Suppose Bob investigates the crime scene alone. Reporting back to Ann, he asserts:

(3) If a member of the ground staff did it, it was the driver.

A simplified but reasonable way of modeling the context of Ann and Bob's conversation is in terms of the set $\{w_b, w_d, w_g\}$, a set consisting of the three worlds in which the butler, the driver and the gardener are the sole culprits, respectively. Let g stand for 'a member of the ground staff did it' (a sentence true at w_g and w_d but false at w_b) and d for 'the driver is the culprit' (a sentence true at w_d only). Then, on Heim's view, we get

$$\{w_b, w_d, w_g\}[g \rightarrow d] = \{w_b, w_d\}.$$

This seems a reasonable prediction. Bob's assertion is predicted to be felicitous and informative. The butler is not ruled out as a candidate culprit for, after all, (3) does not seem to inform

[6] Dynamic approaches to meaning are sometimes contrasted to so-called *static* approaches. But there are different ways of making the notion precise. One way of contrasting dynamic and static approaches found in (Rothschild and Yalcin, 2016) and (Rothschild and Yalcin, 2017) is orthogonal to what I am interested in here. Hence, I will not use the notion in this paper.

us about the members of the house staff. However, Ann's assertion is predicted to rule out the gardener as a candidate culprit, a prediction that seems equally reasonable.

Unfortunately, Heim's view is faced with a well known objection (Gillies, 2004). It makes unwelcome predictions about negated conditionals. On her view, we have

$$\begin{aligned} c[\neg(\alpha \rightarrow \beta)] &= c - \big(c - (c[\alpha] - c[\alpha][\beta])\big), && \text{by } (\neg) + (\rightarrow_h) \\ &= c[\alpha] - c[\alpha][\beta], && \text{by set theory} \\ &= c[\alpha \wedge \neg\beta]. && \text{by } (\neg) + (\wedge) \end{aligned}$$

So an assertion of a negated conditional is predicted to convey both the antecedent and the negation of the consequent of the negated conditional asserted. To illustrate that this is an unwelcome consequence, consider (2) from above (repeated).

(2) It is not the case that if tweety is a bird, tweety is able to fly.

According to Heim's view (2) conveys both

(4) Tweety is a bird,

(5) Tweety is not able to fly.

But an assertion of (2) seems perfectly compatible with Tweety being a bat. Hence, intuitively, neither (4) nor (5) is conveyed. In a nutshell, the objection is that Heim's view is a dynamic version of the material conditional view, a view that is well known for its unwelcome predictions about negated conditionals.

2.3. The Dynamic Strict Conditional View

The problematic predictions of Heim's view about negated conditionals are typically taken to motivate a by now popular and widespread view in the dynamic semantics literature, the dynamic strict conditional view (Such a view is found in many places. For my purposes, the most relevant discussion is found in (Gillies, 2004) and Veltman (1985)).[7]

Definition 2.5 (The Dynamic Strict Conditional View)**.** *A dynamic strict model is a pair* $\langle \mathcal{P}(W), \cdot[\cdot] \rangle$ *where for any context* $c \in \mathcal{P}(W)$*,* $p \in \mathtt{At}$ *and* $\alpha, \beta \in \mathcal{B}$*,* $\cdot[\cdot]$ *is recursively defined as follows:*

$$\begin{array}{ll} (p)\ \ c[p] = \{w \in c \mid w(p) = 1\}, & (\wedge)\ \ c[\alpha \wedge \beta] = c[\alpha][\beta], \\ (\neg)\ \ c[\neg\alpha] = c - c[\alpha], & (\rightarrow_d)\ \ c[\alpha \rightarrow \beta] = \{w \in c \mid c[\alpha][\beta] = c[\alpha]\}. \end{array}$$

The view agrees with Heim's on how non-conditional sentences are treated. But it differs with respect to its entry for conditionals. The conditional operator is sometimes described as 'performing' a test, typically called the *Ramsey test*. According to this test we check whether the context at which the conditional is uttered has a certain global property: the property of being such that updating the context with the antecedent results in a context that accepts the consequent of the conditional. If the Ramsey test is passed, the context is left unchanged, and

[7] Many versions of the view agree about the context change potentials for $\mathcal{L}_s$ but differ on larger fragments of language such as (Willer, 2017), (Yalcin, 2012) and (Moss, 2018), to name a few.

the assertion is predicted to be felicitous at that context. If the Ramsey test is not passed, the context is 'crashed' to the empty set and the assertion is predicted to be infelicitous at that context.

This feature, together with Heim's entry for negation, leads to much more plausible predictions for negated conditionals.

$$\begin{aligned} c[\neg(\alpha \to \beta)] &= c - [\alpha \to \beta], && \text{by } (\neg) \\ &= c - \{w \in c \mid c[\alpha][\beta] = c[\alpha]\}, && \text{by } (\to)_d \\ &= \{w \in c \mid c[\alpha][\beta] \neq c[\alpha]\}. && \text{by set theory} \end{aligned}$$

For instance, an assertion of (2) can be thought of as a way for the speaker to point out that Tweety might be a bird that is not able to fly (a baby chick, for instance). So the effect it has on the common ground is not to add information to it, but rather to make sure it contains a certain possibility: in the case of (2) the possibility for Tweety being a bird that is not able to fly. Notice that since felicitous assertions of negated conditionals never change the original context, such conditionals do not share the unwelcome predictions of negated conditionals we observed for Heim's view.

Unfortunately, what we may take to be a feature of the dynamic strict conditional view with respect to negated conditionals is a bug with respect to assertions of plain conditionals. Consider the case from the previous section. We judged Ann's assertion of (3) as being felicitous and informative at the context in question. Heim's view leads to the reasonable prediction that the assertion will change the context to one which contains only the butler and the driver as candidate culprits. The strict conditional view, however, predicts

$$\{w_b, w_d, w_g\}[g \to d] = \varnothing.$$

For notice that our context does *not* pass the Ramsey test. It contains a world in which the anctecedent of our conditional is true but the consequent is false. Hence we have

$$\{w_b, w_d, w_g\}[g][d] = \{w_d\} \neq \{w_g, w_d\}\{w_b, w_d, w_g\}[g].$$

So Ann's assertion of (3) is predicted to be infelicitous. More precisely, the view predicts that Bob's assertion should be as infelicitous as any assertion that is either obviously false at the context or contradictory.

In light of this, choosing the dynamic strict conditional view over Heim's seems like an overreaction. We are trading in one inadequate prediction regarding negated conditionals for another inadequate prediction regarding plain conditionals.

The dynamic strict conditional view can, as we will see shortly, also be criticised for how it handles the context change potentials of negated conditionals, and I will comment on one such objection later on. However, assuming we agree that the dynamic strict conditional view makes superior predictions about negated conditionals while Heim's view does better with respect to plain conditionals, it seems that we should be aiming for a view that combines the benefits and rids us of the drawbacks of both views.

3. A Conflict with Compositionality

3.1. Constraints

Given the above discussion, let us put down some constraints a more adequate theory of the discourse dynamics for $\mathcal{L}_s$ should satisfy. Let us call any model of conversation that satisfies the constraints an *unorthodox model*:

Definition 3.1 (An unorthodox view)**.** *Let $\cdot[\cdot]$ be an update function that makes the same predictions as Heim's for atomic sentences, negation and conjunction. An **unorthodox model** for $\mathcal{L}_s$ is a pair $\langle \mathcal{P}(W), \cdot[\cdot]^* \rangle$ such that for all contexts $c \in \mathcal{P}(W)$, $p \in \mathtt{At}$ and $\alpha, \beta \in \mathcal{B}$, $\cdot[\cdot]^*$ satisfies the following constraints.*

***Conservativity**: $c[\alpha]^* = c[\alpha]$,*

***Materiality**: $c[\alpha \to \beta]^* = c - (c[\alpha] - c[\alpha][\beta])$,*

***Strict Negation**: $c[\neg(\alpha \to \beta)]^* = \{w \in c \mid c[\alpha][\beta] \neq c[\alpha]\}$.*

In light of the Conservativity constraint, an unorthodox model agrees with both Heim's and the dynamic strict conditional view on how to treat non-conditional sentences. In light of the Materiality constraint, such a model shares the predictions of Heim's view with respect to plain conditionals but, in light of the Strict Negation constraint, it sides with the dynamic strict conditional view for negated conditionals. Accordingly, an unorthodox model would combine the benefits and rid us of the drawbacks of both of the views discussed above.

Before we proceed, let me make two general remarks about the Materiality and the Strict Negation constraint. First, as mentioned above, the Materiality constraint tells us to treat assertions of (plain) indicative conditionals essentially as assertions of the material conditional, a view that has a bad reputation in the literature on the *semantics* of indicative conditionals. Hence, we may worry that well known objections to the view carry over to any view about the discourse dynamics of $\mathcal{L}_s$ that accepts Materiality. In response to this worry, note first that the arguably strongest objection against the view is related to its predictions about the interaction of conditionals and negation. That worry is circumvented by any unorthodox model, since negated conditionals are treated in terms of Strict Negation. Second, note that the constraint is formulated with respect to a small fragment of language and is not intended as a constraint that holds for fragments larger than $\mathcal{L}_s$. Hence, objections involving operators other than conditionals, negation and conjunction do not apply out of the box. Finally, let me highlight that semantic objections straightforwardly apply only if we adopt a dynamic approach to meaning. But this is a supposition we can reject (something we will come back to later).[8]

Let us turn to the Strict Negation constraint. One, general objection the dynamic strict conditional view faces is that felicitous assertions (assertions that do not crash the context) of simple conditional sentences are never informative. This objection is circumvented for plain conditionals, if an unorthodox model is assumed (remember, Heim's view predicts assertions

[8]It is interesting to note that recent work in bayesian epistemology has led to views according to which bayesian updating on conditional information should be spelled out in terms of updating on a the corresponding material conditional (see Eva et al., 2020; Günther, 2018). While these are not views about discourse dynamics, I take them to provide, at least, indirect evidence in favour of the materiality constraint.

of conditionals to be informative in appropriate contexts). However, it still holds for unorthodox models when focusing on simple, negated conditionals. In response to this worry, let me highlight that I do not think that the aim of asserting a sentence must be to contribute information to the context of conversation. Some assertions may just be ways of making sure that the context stays the way it is. That said, let me mention one unorthodox view that treats negated conditionals as informative in appropriate contexts.

Definition 3.2 (An unorthodox Boethian view)**.** *Let* $\cdot[\cdot]$ *be an update function that makes the same predictions as Heim's for atomic sentences, negation and conjunction. An* ***unorthodox Boethian*** *model for* $\mathcal{L}_s$ *is a pair* $\langle \mathcal{P}(W), \cdot[\cdot]^* \rangle$ *such that for all contexts* $c \in \mathcal{P}(W)$*,* $p \in \mathtt{At}$ *and* $\alpha, \beta \in \mathcal{B}$*,* $\cdot[\cdot]^*$ *satisfies the following constraints.*

Conservativity*:* $c[\alpha]^* = c[\alpha]$*,*

Materiality*:* $c[\alpha \to \beta]^* = c - (c[\alpha] - c[\alpha][\beta])$*,*

Boethian Negation*:* $c[\neg(\alpha \to \beta)]^* = c[\alpha \to \neg\beta]^*$*.*

Boethian Negation is a dynamic version of a claim sometimes referred to as Boethius' Theses: the claim that negated conditionals reduce to a corresponding plain conditionals with a negated consequent.[9] To illustrate, consider an assertion of

(6) It is not the case that if a member of the ground staff did it, it is the driver.

With respect to the context of our above vignette, the view predicts:

$$
\begin{aligned}
\{w_b, w_d, w_g\}[\neg(g \to d)]^* &= \{w_b, w_d, w_g\}[g \to \neg d]^*, && \text{by Boethian Negation} \\
&= \{w_b, w_d, w_g\} && \text{by Materiality} \\
&\quad - (\{w_b, w_d, w_g\}[g] - \{w_b, w_d, w_g\}[g][\neg d]), \\
&= \{w_b, w_d\}. && \text{by Conservativity}
\end{aligned}
$$

Hence, an assertion of (6) is predicted to be informative in this context. Whether this prediction is empirically adequate (or superior to Strict Negation) is a question I wish to leave open here. The key arguments presented below do not depend on whether an unorthodox or an unorthodox Boethian view is chosen.

3.2. Compositionality Conflicts

In light of the previous sections, it seems we should either opt for an unorthodox or an unorthodox Boethian model of conversation rather than Heim's or the dynamic strict conditional view. What are the prospects of providing such models in light of what we have called the guiding slogan of dynamic semantics? Let us turn to this question in this section.

According to the guiding slogan, meanings are context change potentials. As argued above, this entails that our notion of update plays *both* the role of modeling the context change potentials of the fragment we are interested in as well as the compositional mechanisms governing the meanings of that fragment. Above we thought of 'compositional' as 'recursively defined' in a loose

[9] (Wansing, 2023) contains a helpful discussion of Boethius' Thesis, albeit in a non-dynamic setting. See also (Santorio, 2022), for a more recent discussion. More on Santorio's view below.

sense. However, typically theories of meaning are taken to satisfy a stronger compositionality constraint.

To formulate the constraint let us adopt some notation. Let $\mathcal{L}$ be an arbitrary fragment of language and ϕ, ψ and χ sentences of that fragment. Then $\chi^{\phi/\psi}$ denotes that sentence in $\mathcal{L}$ that is just like χ except that any occurence of ϕ is replaced by ψ. Given this, the compositionality constraint I have in mind goes as follows:

Definition 3.3 (Compositionality (General))**.** *A theory of meaning for a fragment of language $\mathcal{L}$ is compositional, just in case for all $\phi, \psi, \chi \in \mathcal{L}$ our theory satisfies*

$$\textit{if } \textit{meaning}(\phi) = \textit{meaning}(\psi), \textit{ then } \textit{meaning}(\chi) = \textit{meaning}(\chi^{\phi/\psi}).$$

That is, if ϕ and ψ have the same meaning according to the theory, so do χ and $\chi^{\phi/\psi}$.

The constraint is motivated by a fairly standard approach to semantic theorizing. Typically, if a sameness in meaning for two sentences is postulated, this can be tested for by looking at what is called the *embedding behaviour* of the sentences in question. That is, we expect no difference in meaning to occur if we look at the sentences in embedded environments. The other way around, if two sentences differ in meaning at an embedded context, our principle tells us that they must differ in meaning when occurring unembedded.

While all of this is well known, let us illustrate the principle by looking at a classic argument from embedding behaviour, the argument for why Moore paradoxical sentences are not contradictions.

(7)	(ϕ)	It is raining but I do not believe it is raining,
(8)	(ψ)	I believe it is raining and I do not believe it is raining,Ê
(9)	(χ)	Suppose it is raining but I do not believe it is raining,
(10)	$(\chi^{\phi/\psi})$*Boethian*	Suppose I believe it is raining and I do not believe it is raining.

(7) and (8) sound equally infelicitous. But (9) seems felicitous while (10) is not. Hence, there is a difference in meaning between (10) and (9). So, by our principle, (7) and (8) must differ in meaning as well. Note that this argument in favour of a difference in meaning between (7) and (8) would not be valid without the just mentioned compositionality constraint.

What does the principle tell us about the guiding slogan? Since according to the guiding slogan meanings are context change potentials, and context change potentials of sentences are modelled with the help of an update function of a model of conversation, it seems reasonable to require a corresponding model of conversation to be compositional in the following sense (see also Rothschild and Yalcin, 2016: for a discussion of such a constraint in a dynamic setting):

Definition 3.4 (Compositionality (Dynamic))**.** *A model of conversation for a fragment of language $\mathcal{L}$ is compositional just in case for all $\phi, \psi, \chi \in \mathcal{L}$, its update function $\cdot[\cdot]$ satisfies*

$$\textit{if } \cdot[\phi] = \cdot[\psi], \textit{ then } \cdot[\chi] = \cdot[\chi^{\phi/\psi}].$$

Now, both Heim's view (Def. 2.4) as well as the dynamic strict conditional view (Def. 2.5), satisfy this compositionality constraint. However, given our above discussion, it should not come as a surprise that this compositionality constraint is in conflict with choosing an unorthodox or

an unorthodx Boethian model of conversation. To be precise, let us call a model of conversation *non-trivial*, if it can handle cases like the Crime at the Mansion example discussed above.[10] We then have the following proposition.

Proposition 3.1. *No unorthodox nor an unorthodox Boethian model of conversation that is non-trivial is compositional in the sense of Def. 3.4.*[11]

Hence, providing an unorthodox (Boethian) model of conversation for $\mathcal{L}_s$ is in tension with a popular and widespread notion of what it is for meanings to be compositional.

In the next section we will look at potential ways to resolve the tension. We first give the outlines of a radical solution, a solution that gives up on dynamic approaches to meaning by choosing a non-semantic approach to discourse dynamics. We close the paper by looking at the two most promising ways for fans of the guiding slogan to respond to the conflict.

4. Escaping the Conflict

4.1. Rejecting the Guiding Slogan

As mentioned above (Def 2.3), there are non-semantic approaches to discourse dynamics which distinguish between providing a theory of meaning that tells us about the compositional mechanisms governing the fragment of language we are interested in, and a theory of the discourse dynamics, telling us about the context change potentials of the fragment. On such a view theories of meaning are linked to a models of conversation capturing the discourse dynamics of the fragment of language via some bridge principle. But meanings do not provide a theory of the context change potentials directly. Distinguishing between meanings and context change

[10] Even more precisely, let us call a model of conversation non-trivial if we have a set of contexts $\mathcal{P}(W)$ based on a set W containing at least three possible worlds w, w' and w'' such that there are sentences α and β with α true at w', w'' and β true at w'' only.

[11] The proof basically mirrors the example we discussed above. But, for the sake of completeness, here are the details. Let W contain at least three worlds w and w' and w''. Then there is a context $c \in \mathcal{P}(W)$ such that $c := \{w, w', w''\}$. Now pick a sentence α that is true at both w' and w'' (and false at w) as well as a sentence β that is true at w'' only. Let us consider the conditional $\alpha \rightarrow \beta$. By Conservativity and Materiality we have for any context c,

$$c[\alpha \rightarrow \beta]^* = c[\neg(\alpha \wedge \neg\beta)]^*.$$

Moreover, by Conservativity we have $\{w, w', w''\}[\neg\neg(\alpha \wedge \neg\beta)] = \{w'\}$.
Now, Strict Negation entails

$$\{w, w', w''\}[\neg(\alpha \rightarrow \beta)]^* = \varnothing$$

and Boethian Negation entails

$$\begin{aligned}\{w, w', w''\}[\neg(\alpha \rightarrow \beta)]^* &= \{w, w', w''\}[\alpha \rightarrow \neg\beta]^* \\ &= \{w, w'\}\end{aligned}$$

Thus, in light of Materiality and Conservativity $\alpha \rightarrow \beta$ and $\neg(\alpha \wedge \neg\beta)$ have the same context potential. But the context change potentials of $\neg(\alpha \rightarrow \beta)$ and $\neg\neg(\alpha \wedge \neg\beta)$ come apart, no matter whether an unorthodox or an unorthodox Boethian model is chosen.

potentials in this way may help to marry our compositionality constraint with an unorthodox approach to the discourse dynamics of $\mathcal{L}_s$.

As a proof of concept, let us put one such approach on the table. The approach I have in mind can be developed in three steps.

Step 1. As noted above, there are many ways to interpret the kind of formal structure we called a model of conversation (Def. 2.1). In particular, if contexts are taken to be sets of possible worlds, they are the same kind of formal object we typically call a *proposition*. Hence, we may think of an update function, $\cdot[\cdot]$, as telling us about the proposition, $c[\phi]$, expressed by ϕ at c. Accordingly, an update function can be interpreted *non-dynamicaly*, as a theory of meaning according to which meanings are functions from contexts to propositions. A defender of a dynamic approach to meaning would, in addition, be committed to the claim that the proposition, $c[\phi]$, expressed by ϕ at a context c happens to be the context our context c will evolve to in light of an assertion of ϕ at c. On a non-dynamic interpretation of an update function, there is no such commitment. Let us refer to the update function from Def. 2.5 so interpreted as the *strict conditional view in its non-dynamic interpretation*.

Step 2. Contexts, as we have been using the term, are a special kind of state of information. Like other states of information, such as states of belief or knowledge, they settle some sentences about the world but not others. For instance, the context $\{w_d, w_g\}$ (consisting of the worlds in which the driver and the gardener are the sole culprits respectively) settles the sentence 'a member of the ground staff is the culprit' but it settles neither 'The gardener is the culprit' nor 'The gardener is not the culprit'. Any model of conversation for a fragment of language, whether interpreted dynamically or non-dynamically, induces a notion of of what it is for a sentence to be settled by a context, typically referred to as a notion of *support*.

The strict conditional view, for instance, gives rise to the following notion of support.

Definition 4.1 (Strict Support)**.** *Let $\cdot[\cdot]$ be the update function for the dynamic strict model of conversation $\langle C, \cdot[\cdot]\rangle$. For any context $c \in C$ and any $\phi \in \mathcal{L}^s$*

$$c \textit{ supports } \phi \textit{ iff } c[\phi] = c.$$

Such a notion of support is standard in the dynamic semantics literature and is typically used to define notions of semantic consequence. In this paper, however, we just take it as a claim about the conditions under which a state of information c settles a sentence ϕ.

Step 3. Let us take the strict conditional view in its non dynamic interpretation on board. Further, let us use its notion of strict support (Def. 4.1) to define the following notion of update:

Definition 4.2 (Informational Updating)**.** *Let a set of contexts $\mathcal{P}(W)$ be given and let our notion of support be defined as in Def. 4.1 . Then for any $c \in \mathcal{P}(W), \phi \in \mathcal{L}_s$, we define*

$$c[\phi]^{\ddagger} = \bigcup\{c' \subseteq c \mid c \textit{ supports } \phi\}. \qquad (\ddagger)$$

$\langle \mathcal{P}(W), \cdot[\cdot]^{\ddagger}\rangle$, so defined, is a model of conversation for our language $\mathcal{L}_s$. A notion of update similar to this one was recently put forward by Santorio (2022) (more on his account below) but

the idea of thinking about conversational update in terms of a notion of support, can be traced back to (Yalcin, 2007: p. 464).[12] The intuition behind the update function proposed in Def. 4.2 can be put as follows: From the perspective of the discourse participants, it is natural to assume that the speaker has information available to her that settles the sentence asserted and that she made her assertion with the aim of coordinating on a context that agrees with the information available to her. $\cdot[\cdot]^{\ddagger}$ models the idea that, in light of the just mentioned assumptions, discourse participants will rule out all those possibilities from the context that are incompatible with *any* way of coordinating on a context that settles the sentence asserted.[13]

While a thorough discussion of the predictions and consequences of the view is beyond the scope of this paper, let me highlight the following proposition.

Proposition 4.1. *The model of conversation* $\langle \mathcal{P}(W), \cdot[\cdot]^{\ddagger} \rangle$ *for* $\mathcal{L}_s$ *as defined in Def. 4.2, is an unorthodox model of conversation.*[14]

So, in terms of a discourse dynamics for $\mathcal{L}_s$, $\cdot[\cdot]^{\ddagger}$ gives us what we want. But notice that ($\ddagger$) can be thought of as a bridge principle, linking a theory of meaning (the strict conditional view in its non-dynamic interpretation) to a theory about the discourse dynamics of the sentences in $\mathcal{L}_s$. While, by proposition 3.1, our new notion of update is not compositional, the theory of meaning in terms of which it is defined satisfies our compositionality constraint from Def. 3.4. Hence, on this view we have a non-semantic approach to discourse dynamics (as in Def. 2.3), an approach according to which meanings are compositional but context change potentials are not.

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[12] The discussion in Yalcin's paper is kept informal and no concrete update function is proposed.

[13] Let me highlight a feature of the view that, at a first glance, may seem odd. For sentences in our small conditional fragment, $\mathcal{L}_s$, asserting a sentence will always result in a context that supports the sentence asserted (in the sense of Def. 4.1). What may seem odd, however, is that this is not the case for conditional fragments larger than $\mathcal{L}_s$. For instance, (assuming we treat disjunction in terms of conjunction and negation in the usual way) assertions of compound conditionals of the form $(\alpha \to \beta) \vee (\alpha \to \gamma)$ may result in an updated contexts that do not support the sentence asserted. This entails that if the information available to the speaker settles the sentence asserted, the speaker must have more information about the world than is conveyed by her assertion. While a thorough discussion of this consequence of the view is beyond the scope of this paper, let me note that I do not think that it constitutes a problem. What it shows is that at some contexts, some sentences are not particularly effective means to communicate the information available to the speaker, a consequence that should not come as a surprise.

[14] Here is a proof. It is well known that, given Heim's entries. $c[\alpha] = c \cap W[\alpha]$, for any $\alpha \in \mathcal{B}$. It is not difficult to check that for any context c and any $\alpha \in \mathcal{B}$, $c \cap W[\alpha]$ will be the unique largest sub-context of c that supports α. Hence, for all $\alpha \in \mathcal{B}$, $\bigcup\{c' \subseteq c \mid c' \text{ supports } \alpha\} = c \cap W[\alpha] = c[\alpha]$. So, *Conservativity* follows.

Materiality follows since

$$\begin{aligned} c[\alpha \to \beta] = c \text{ iff } & c[\alpha][\beta] = c[\alpha], && \text{by (SC)} \\ \text{iff } & c = c - (c[\alpha] - c[\alpha][\beta]). && \text{by set theory \& Def. 2.5} \end{aligned}$$

That is, a conditional is supported on c exactly when $c = c - (c[\alpha] - c[\alpha][\beta])$. But, since for all contexts c, $c - (c[\alpha] - c[\alpha][\beta]) = c[\neg(\alpha \wedge \neg\beta)]$, a conditional is supported on c if and only if $\neg(\alpha \wedge \neg\beta)$ is supported. Since, $\neg(\alpha \wedge \neg\beta) \in \mathcal{B}$, the claim follows from *Conservativity*.

Strict Negation holds, trivially, whenever $c = \varnothing$. For non empty context c, c either does contain an α-world that is not a β-world or it does not. In the first case Def. 4.1 tells us that c itself is the (unique) largest sub-context of c that supports $\neg(\alpha \to \beta)$ while in the latter it tells us that it must be $\varnothing$. Hence, in the former case we have $\bigcup\{c' \subseteq c \mid c' \text{ supports } \neg(\alpha \to \beta)\} = c$ while in the latter we have $\bigcup\{c' \subseteq c \mid c' \text{ supports } \neg(\alpha \to \beta)\} = \varnothing$. So *Strict Negation* holds in each case.

Two remarks before we move on. First, it may be helpful to note that our input notion of meaning (the update function of the strict conditional view in its non-dynamic interpretation) need not be given in terms of a model of conversation. There are many truth-conditional approaches which give rise to the exact same support relation between contexts and sentence in $\mathcal{L}_s$ as the one given in Def. 4.1 (see Yalcin, 2007; Kolodny and MacFarlane, 2010: among others). Second, we may wonder whether there is a similar way of generating unorthodox Boethian models. Above we mentioned Santorio's paper (Santorio, 2022) which develops a new approach to the semantics of conditionals he refers to as a *path-semantics*. Introducing this view is beyond the scope of this paper. However, his semantics gives rise to a notion of update which does satisfy an analog of our Materiality constraint and an analog of Boethius' Theses. Hence, fans of unorthodox Boethian models may look to Satorio's notion of update as an option. Moreover, his path-semantics is, at its core, truth-conditional. It does satisfy a truth-conditional version of our compositionality constraint from Def. 3.3. Hence, his approach can be interpreted as another view according to which meanings are not context change potentials. On Satorio's approach too, a non-compositional notion of update is defined in terms of a compositional notion of meaning.

4.2. Holding on to the Guiding Slogan

Now, from the perspective of dynamic semantics, the above mentioned approaches are radical. According to these views, meanings are not context change potentials. Hence, it is natural to ask whether there are ways to capture what is appealing about unorthodox models while holding on to the guiding slogan. Let me close the paper by saying something about the two most promising routes fans of the guiding slogan could explore.

The first route starts with the observation that the arguments we looked at above are not arguments about conditionals alone but arguments about the *interaction* of conditionals with negation. Accordingly, we may hope to arrive at an unorthodox view by treating negation more flexibly.

Indeed, there are views in the dynamic semantics literature which do just that. For instance, Malte Willer recently defended a so-called *bilateral* approach to updating (see Willer, 2022). Like the views discussed above, Willer treats contexts as sets of possible worlds. However, on his view, we have *two* notions of update to work with: we have one update function that governs *coming to accept* a sentence and one that governs a notion of *coming to reject* a sentence. The first notion is intended to tell us about how assertions affect the context of a conversation. The latter plays a special role in telling us about the update potentials of negated sentences. On his view, coming to accept a negated sentence, $\neg\phi$, is coming to *reject* the non-negated sentence ϕ. This allows for a much more flexible treatment of negated sentences. Unfortunately, Willer's own view gives rise to neither an unorthodox nor an unorthodox Boethian model of conversation. The reason is that his entry for plain conditionals does not satisfy the materiality constraint but mimics the entry of the dynamic strict conditional view. Hence, the view does not help us out of the box.[15] However, there may be a way of modifying the view so that we

[15]Moreover, the view is subject to the same objection we put forward against the dynamic strict conditional view above.

do arrive at an unorthodox (Boethian) model of conversation. While such a view would have the advantage of providing an update function that fits our needs *without* the help of a bridge principle, it would (in light of Proposition 3.1) violate the compositionality constraint form Def. 3.4. While there may be weaker compositionality principles such a view would satisfy, note that the compositionality constraint form Def. 3.4 straightforwardly explains the rationale behind arguments from embedding behaviour. Hence, rejecting the principle would force us to either reject such arguments as a guide to meaning or to come up with an alternative story about why such arguments work. Whether such a response is ultimately successful will have to be explored in future work.

The second route builds on the observation that, for the most part, we made use of a very simple notion of context. We only looked at contexts as modelled by sets of possible worlds. While simple possible worlds models are adequate for modeling information gain in light of assertions, we may wish to capture other discourse effects such as changes in the question under discussion (Roberts, 2012) or changes in what possibilities are taken to be salient at a conversational context (see Willer, 2013: for instance). Once, we switch to such a more involved, and maybe more adequate, notion of context, we may be in a position to capture what made unorthodox models appealing, while rejecting one of the core assumptions involved.

This is certainly an avenue we may want to explore. But note that changing our notion of context *may* but *need not* marry our compositionality constraint with what is appealing about unorthodox (Boethian) models. Moreover, at this point I do not see how modeling changes in the question under discussion or the introduction of a notion of salience will help to resolve the problem. Maybe a third, hitherto unexplored, parameter may help to marry the guiding slogan with the compositionality constraint from Def. 3.4. Whether there is such a parameter that resolves the above mentioned tension in a satisfying way has to be explored elsewhere.

5. Conclusion

I have argued that for a small fragment of language $\mathcal{L}_s$, we should choose an unorthodox model of conversation; a model that combines the benefits and rids us of the drawbacks of both Heim's as well as the dynamic strict conditional view. At a minimum such a view makes superior predictions to the dynamic strict conditional view, a view that is widespread in the dynamic semantics literature. But we have seen that if we assume a dynamic approach to meaning, any such view is in conflict with a popular and widespread notion of what it is for meanings to be compositional. The conflict disappears if we give up on the guiding slogan of dynamic semantics; the claim that meanings are context change potentials. We can, as we have seen, provide a non-compositional theory of the discourse dynamics of $\mathcal{L}_s$ in terms of a compositional notion of meaning. I pointed to two ways in which defenders of the guiding slogan could respond to the tension between our compositionality principle and unorthodox approaches to the discourse dynamics of $\mathcal{L}_s$. Both are interesting avenues to pursue. Deciding whether one of those avenues leads to an alternative answer to the puzzle presented in this paper, an answer which is more friendly to dynamic approaches to meaning, will have to be explored in future work.

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When the time of the story meets the time of the telling: On temporal metalepsis[1]

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Abstract. In literary studies, temporal metalepsis is defined as a seemingly inconsistent transgression between the time of the telling and the time of the told. For instance, the past time of the told story may appear to overlap with the present time of the telling, as in *Ada began to climb the mountain. While Ada is climbing the mountain, we have time for a digression*. This paper tackles temporal metalepsis from a primarily linguistic point of view. It first draws attention to unexplored semantic properties of temporal metalepsis, focusing on the grammar of time (subordinators, tense, and aspect) and on anaphoric relations. This shows that the phenomenon deserves linguistic scrutiny. Second, a pretense-based analysis is proposed. Specifically, the temporal entanglement between narrative layers is argued to result in an ontological conflict that licenses the accommodation of an event in pretense at the actual layer. The proposal is spelled out in terms of a dynamic semantics that factors a game of pretense into transgressions between story worlds and actuality as known from para- and metafictional discourse.

Keywords: metalepsis, narrative discourse, tense, aspect, fiction, parafiction, metafiction, dynamic semantics.

1. Introduction

In literary studies, narrative metalepsis is defined as a "deliberate transgression between the world of the telling and the world of the told"; see Pier (2016: Sec. 1), who follows the original introduction of the term into narratology by Genette (1983). That is, in words by Martínez and Scheffel (2016: 219), metalepses suspend the border between intra- and extradiegetic position, contrary to their principled distinction by definition. The example in (1), which is cited in Genette (1983: 235) from Balzac's *Illusions perdues*, is a famous case in point: the past time of the told story is said to overlap with the present time of the telling.

(1) While the venerable churchman climbs the ramps of Angoulême, it is not useless to explain …

In a made-up example such as (2), the relevant temporal transgression is made even more obvious.

(2) Ada began to climb the mountain. While Ada is climbing the mountain, we have time for a digression.

Most notably, both examples can be interpreted easily although, on the face of it, the transgression results in an inconsistent temporal entanglement between fiction and (some layer of) actuality.

[1]Parts of this work were presented at "Fiction and narrative across media" in Groningen (September 2022), at "Sprachwissenschaftlich-sprachdidaktisches Kolloquium" in Siegen (November 2022), at "Semantik-Kolloquium" in Frankfurt (February 2023), at "Interdisziplinäres Linguistisches Kolloquium" in Augsburg (June 2023), and at "Sinn und Bedeutung 28" in Bochum. I thank the audiences for their helpful feedback. In particular, I owe thanks to Carolin Gerwinski, Emar Maier, Cécile Meier, Merel Semeijn, Carla Umbach, and Sonja Zeman.

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Metalepses of various kinds have received considerable attention in literary studies and related fields such as media and cultural studies; see Kukkonen (2011) and Pier (2016) for overviews and Martínez and Scheffel (2016: 83-85) for a textbook introduction. However, these studies do not focus on linguistic details, but on more general issues such as the classification of metalepsis types, their effects on recipients, or their role in different media. Further famous examples include so-called *mise en abyme* (that is, some narrative x contains another narrative y which, paradoxically, again contains x) or breaking the fourth wall in theatre (that is, actors address the actual audience from within the play). In this paper, I will take a different route and tackle metalepsis from a primarily linguistic point of view, focusing on temporal metalepis. As far as I see, this is a desideratum. Two main goals will be pursued.[2]

First, I will draw attention to unexplored semantic properties of temporal metalepsis and thereby argue that it deserves linguistic scrutiny. For instance, the inconsistency in (2) cannot be expressed by past tense in the *while*-clause, as shown by its ungrammatical counterpart in (3). That is, the tense in the metaleptic *while*-clause is not determined by the statement about the story before, but by its contribution to the actual telling. This calls for a better understanding of how temporal metalepsis and grammar interact.

(3) *Ada began to climb the mountain. While Ada was climbing the mountain, we have time for a digression.

Furthermore, the semantic point of view suggests comparing temporal metalepsis with transgressions between actual and fictional worlds that lack the impression of inconsistency. Much discussed are parafictional statements such as (4a) and metafictional statements such as (4b).

(4) a. In *Emil and the detectives*, Emil travels to Berlin.
b. Emil is a fictional character invented by Kästner.

The former inform about the truth in fiction from the perspective of the actual world, while the latter treat fictional entities according to their fictional status in the actual world; see, among many others, the more recent discussions in Maier (2017) (and the comments on it), Recanati (2018), Semeijn (2021), or Stalmaszczyk (2021) and canonical papers such as Lewis (1978) or Zucchi (2001). For instance, the intuitive coreference of Ada's fictional climb and her climb at the actual layer in example (2) seems to correspond to the puzzling coreference of proper names such as Emil across para- and metafiction.

Second, I will outline a pretense-based account of temporal metalepsis that integrates facets of para- and metafictional discourse. Specifically, I propose that the ontological conflict resulting from the temporal entanglement between fiction and (some layer of) actuality licenses the accommodation of an event in pretense at the actual layer. According to this proposal, the example in (2) conveys that having time for a digression is temporally included in Ada's climb, where this climb is conceived of as if it were an actual event. The implementation builds on two formal ingredients in particular, namely, the integration of the 'In-story' operator from Lewis (1978) into a dynamic semantics in Semeijn (2021), and the idea in Recanati (2018) that fictional names introduce multiple aspect objects that are referred to under their abstract

[2]I am not interested in the literary interpretation of specific temporal metalepses, but in the linguistic basis of temporal metalepses and their modeling. Therefore, I will use constructed examples such as (2) for the exemplification of relevant linguistic properties.

fictional aspect in metafiction and under their physical non-fictional aspect in parafiction. Most crucially, Recanati's semantics allows entities to instantiate inconsistent types of objects.

I conclude this introduction with a note of clarification. According to the given definition, metalepses involve a narrating instance that is extradiegetic and, thus, not part of the told story. Correspondingly, one cannot conceive of this instance as a narrator that talks about her own (past) world.[3] In fact, metalepses are often related to the distinction between story worlds and actuality in the sense of our real world (or a world presented as our real world). This is why, typically, metalepses concern authors or readers that enter or address story worlds, or characters that enter or address the actual world; see Kukkonen (2011: 1) for such a take. For ease of presentation, I follow this simplified picture here. However, I also believe that the present approach to temporal metalepsis can be applied to any kind of layering as long as this layering involves a principled distinction between story worlds and some extradiegetic stance.

The paper is organized as follows: In Section 2, I will discuss semantic properties of temporal metalepsis, focusing on grammar and the comparison to para- and metafiction. Section 3 will introduce a pretense-based account of temporal metalepsis and outline its formal implementation. Section 4 offers a conclusion.

2. Survey of semantic properties of temporal metalepsis

2.1. Tense and temporal subordinators in metaleptic temporal clauses

In the introduction, I have already pointed out that the tense in the metaleptic *while*-clause must correspond to the present tense in the matrix clause instead of the past tense in the textual statement before; see (5) (= (2)/(3)).

(5) Ada began to climb the mountain. While Ada {is / *was} climbing the mountain, we have time for a digression.

That is, the relevant temporal inconsistency is rather based on a seeming temporal relocation of Ada's climb than on a temporal conflict within the complex clause. The metaleptic temporal clause thus obeys a grammatical constraint imposed by *while*-clauses in general, namely, their requirement for temporal overlap between the event given by the *while*-clause and the event given by the matrix clause (see, e. g., Sæbø 2011). This indicates that the choice of tense is not arbitrary, but it follows the narrator's intention to provide a referential link between the fictional event and the actual situation of narrating in accordance with grammatical rules.

The given pattern can be observed for other metaleptic temporal clauses as well. Consider the metaleptic *before*-clause in (6).[4]

(6) Peter lived in Vienna and Paul in Berlin. They were brothers, but they had never met. Before they {get / *got} to know each other, a few comments on brothers in general are

[3]There are several linguistic and philosophical approaches to fictional narratives that proceed from assuming narrators that tell a story from within the story; see, for instance, Eckardt (2014) for linguistics and Predelli (2021) for philosophy.

[4]I thank Merel Semeijn for having inspired me to this kind of example.

in order. [...few comments ...] But now back to Peter and Paul. They got to know each other as the result of a series of barely possible coincidences.

As with the *while*-clause, the use of present tense in the *before*-clause deviates from the use of past tense in the textual statements that tell the story. Again, the tense choice complies with the grammar of *before*-clauses, in this case with the effect that the narrator refers to the fictional encounter as if it followed his actual commenting on brothers in general. The same reasoning applies to the *once*-clause in (7): in virtue of using future perfect here, the prospective return to the story about Ada is said to coincide with the prospective post state of Ada having reached the summit.

(7) Ada began to climb the mountain. Once she will have reached the summit, we will get back to her. However, before, we turn to her wife Erin.

It is also instructive to consider temporal clauses that are known to be subject to general referential restrictions. Temporal clauses introduced by *als* 'when' (lit. 'as') and *wenn* 'when' in German are cases in point.[5] As argued, for instance, by Löbner (2002: 267), *als*-clauses prohibit reference to the present. This predicts that *als*-clauses cannot be used for relating a fictional event to a present narrating situation. In fact, corresponding metalepses with present tense in the *als*-clause such as (8) and (9) are clearly odd.

(8) *Ada begann, den Berg hochzusteigen. Als sie den Berg hochsteigt, haben
Ada began the mountain to climb as she the mountain climbs have
wir Zeit für einen Exkurs.
we time for a digression
'Ada began to climb the mountain. When she climbs the mountain, we have time for a digression.'

(9) *Adas Aufstieg war beschwerlich. Als sie schließlich den Gipfel erreicht, wenden
Ada's climb was arduous as she finally the summit reaches turn
wir uns ihrem Bruder zu.
we REFL her brother to
'Ada's climb war arduous. When she finally reaches the summit, we turn to her brother.'

Notably, *als*-clauses can be used with present tense if present tense is used for reference to the past (so-called historic present). For instance, the non-metaleptic example in (10) is fine, as it preserves the narrative retrospection despite the tense variation. *Als*-clauses can also support a metalepsis, as in (11). However, in contrast to (5)-(7), this has the effect that the surprise is conceived of as if it were co-temporal with the time of the told story. As specified by the grammar of *als*-clauses, the transgression to the extradiegetic narrating stance does not come with a referential shift to the present telling situation.

(10) Adas Aufstieg war beschwerlich. Als sie schließlich den Gipfel erreicht, ist Erin
Ada's climb was arduous as she finally the summit reaches is Erin
schon wieder auf dem Rückweg.
already again on the way back

[5]The temporal subordinators *als* and *wenn* from German are usually both translated to English *when*. Correspondingly, I will be agnostic as to the question of how to judge the English translations of the following examples from German.

'Ada's climb war arduous. When she finally reaches the summit, Erin is already heading back.'

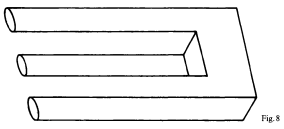
(11) Adas Aufstieg war beschwerlich. Als sie schließlich den Gipfel erreicht, sind auch
Ada's climb was arduous as she finally the summit reaches are also
wir überrascht: Erin ist nicht da.
we surprised Erin is not there
'Ada's climb war arduous. When she finally reaches the summit, we are surprised as well: Erin isn't there.'

Temporal *wenn*-clauses provide a final example. They only license reference to the future; see Löbner (2002: 267). This predicts correctly that metaleptic *wenn*-clauses can be used for relating a fictional event to a prospective telling situation instead of a present one, as shown by the contrast in (12).

(12) Ada begann, den Berg hochzusteigen. Wenn sie schließlich den Gipfel erreicht,
Ada began the mountain to climb when she finally the summit reaches
{werden wir ein anderes Thema haben / *haben wir jetzt ein anderes Thema}.
{will we a different topic have / have we now a different topic}
'Ada began to climb the mountain. When she will finally reach the summit, {we will have a different topic / we have now a different topic}.'

The upshot of this discussion is that temporal metalepses do not build on arbitrary temporal inconsistencies, but on a close alignment of intended temporal reference with grammatical rules. From a semantic point of view, this is not a minor result. For one, it argues against an account of temporal metalepsis in terms of structured propositions that conjoin inconsistent propositions as it is proposed for the formal semantics of inconsistent pictures by Cresswell (1983); see, for instance, (13).

(13) a. $<p, \wedge, q>$

b. 

[copied from Cresswell (1983: 71)]

In a nutshell, Cresswell argues that a picture such as (13b) should be analyzed along the lines of a structured proposition such as (13a). The propositions p and q represent the meaning of consistent parts of the picture in terms of regular sets of worlds. Their inconsistency is reflected in the fact that the conjunction cannot be resolved by intersection of both sets, as this would result in the empty set. That is, the use of structured propositions protects possible world semantics from the undesirable prediction that inconsistent pictures are synonymous in virtue of denoting empty sets. However, as just discussed, temporal metalepses are not based on a simple juxtaposition of inconsistent propositions, but on a systematic interaction of the meaning components involved. A simple structured conjunction such as (13a) does not seem to provide the right tool in order to capture this interaction.[6]

[6]It could very well be that more involved structured propositions can solve this problem. In fact, the discourse representation structures that are proposed in Section 3.2 provide such a further development.

The observations made so far are semantically revealing in yet another sense. In light of the alignment between grammatical form and intended reference, the behavior of temporal metalepses resembles the behavior of well-known cases of deferred reference in the non-temporal domain as discussed by Nunberg (1995); see (14), where the indexical *this* does not refer to the key, but to the car the key belongs to.

(14) Context: A hands a key to B.
a. This is parked out back.
b. *The key I am holding is parked out back.
[= Nunberg (1995), (1), (10)]

As with temporal metalepsis, the grammatical behavior of deferred indexicals such as *this* is determined by the intended reference. Therefore, the deferred indexical complies with coordination of a predicate for cars instead of keys, as shown by (15). Furthermore, grammatical number depends on the number of cars instead of keys, as shown by (16).[7]

(15) This is parked out back and {may not start/??fits only the left front door}.
[see Nunberg (1995), (4), (5)]

(16) [Context: 1 key, >1 cars] {These are/*This is} parked out back.

However, there is also a principled difference between both kinds of referential shifts. In Nunberg's examples, deferred reference yields reference to an entity that is clearly distinct from the entity the indexical originally refers to. That is, the car and the key are conceived of as distinct objects in the world. Temporal metalepsis, by contrast, results in a more puzzling kind of distinction. On the one hand, the transgression between fiction and actuality seems to require reference to a new entity, simply because the same event cannot reasonably belong to both the fictional and the actual world. On the other hand, metalepses are based precisely on the contrary intuition that textual statement and metaleptic temporal clause are about the very same event. This puzzle will be pursued further in the next section.

2.2. The relationship of temporal metalepsis to para- and metafiction

Recall from the introduction that parafictional statements inform about fictional truths from the perspective of the actual world, as in (17a) (= (4a)), while metafictional statements inform about what is actually true of fictional entities, as in (17b) (= (4b)).

(17) a. In *Emil and the detectives*, Emil travels to Berlin.
b. Emil is a fictional character invented by Kästner.

[7]Notably, this does not apply to all types of meaning adaptations. Specifically, the example in (i) does not build on deferred reference, but on so-called predicate transfer. Correspondingly, the type of further predicates and the grammatical number are determined by the non-deferred literal reference of the indexical, as shown by the examples in (ii) and (iii).

(i) [Context: A hands a key to B.] I am parked out back. [= Nunberg (1995), (2)]
(ii) I am parked out back and {have been waiting for 15 minutes / *may not start}.
[= Nunberg (1995), (8), (9)]
(iii) [Context: 1 speaker, >1 cars] {I am/*We are} parked out back.

In the following I will argue that temporal metalepses integrate facets of both para- and metafictional statements. However, I will also argue that this integration leads to crucial deviations from standard para- and metafiction.

2.2.1. Temporal metalepsis and parafiction

Temporal metalepses such as (2) share with a corresponding explicit parafictional statement such as (18) that they both rely on story content. This kinship suggests to simply integrate an implicit 'In story' operator in the spirit of Lewis (1978) into the interpretation of temporal metalepsis, as sketched in (19).

(18) In the story, Ada climbs the mountain.

(19) While Ada climbs the mountain, we have time for a digression.
≈ While, in the story, Ada climbs the mountain, we have time for a digression.

One might even argue that the restriction to present tense in the metaleptic clause is rooted in the well-known more general preference for the present in parafiction; see (20) for ilustration and Zucchi (2001) and Semeijn (2021: ch. 7.3.3) for discussion.

(20) In *Emil and the detectives*, Emil {travels / #traveled} to Berlin.

However, this line of argument does not consider the following clear difference between standard parafiction and temporal metalepsis. The present in standard parafictional statements such as (20) is usually taken to convey an atemporal truth; see Zucchi (2001) and Semeijn (2021: ch. 7.3.3) for different accounts of this atemporality. Temporal metalepses, by contrast, build on an actualization of the transgressing event. Grammatical evidence for this claim can be drawn from aspectual contrasts such as (21).

(21) a. #In *Emil and the detectives*, Emil is traveling to Berlin (now).
b. While Emil is traveling to Berlin (now), we have time for a digression.

The standard parafiction in (21a) does not support progressive aspect. Plausibly, the progressive requires a temporal link to the given now, which is at odds with an atemporal interpretation of tense. The temporal metalepsis in (21b) is fine with progressive aspect. In fact, the use of the progressive seems to even facilitate the temporal entanglement between the fictional event and the actual situation of having time for a digression. Furthermore, recall from Section 2.1 that the choice of tense in metaleptic temporal clauses covaries with the alignment of the intended reference and the type of temporal clause. This is also at odds with an account of temporal metalepsis in terms of atemporal parafiction.

Interestingly, Zucchi (2001) also draws attention to non-standard parafictional examples such as (22).

(22) [Context: A is reading Sherlock Holmes, with B in the room.]
a. B: What is Holmes doing?
b. A: He is playing the violin. A murder took place and he is thinking about the evidence. He will soon discover the murderer.
[see Zucchi (2001), (26), due to p. c. by Martin Stokhof]

Zucchi is only concerned with the tense use in this example. Specifically, the past, the present, and the future seem to be used here for arranging the fictional events along the timeline of the story, which challenges his assumption that tense is generally atemporal in parafictional statements. Zucchi meets this challenge by proposing that tenses can have scope over an implicit intensional operator that factors the reading time into the interpretation, as sketched in (23).[8]

(23) *In the part of the text that I am reading now*, Holmes is playing the violin. *In the part that I read before*, a murder took place and he is thinking about the evidence. *In the part that I'll read*, he will soon discover the murderer.
[= Zucchi (2001), (27), my emphasis]

According to this proposal, the tenses in (22) relate the reading times of parts of the text to the time of utterance of the parafictional statements. The temporal relations between the fictional events then just follow from correlating the temporal order of the reading times with the one of the events. Correspondingly, the potential conflict of (22) with Zucchi's original assumption is avoided.

I agree with Zucchi that temporal examples such as (22) should be distinguished from atemporal parafictional statements. However, I suggest a different analysis. As will become clear shortly, this analysis is inspired by relating temporal parafiction to temporal metalepsis.

For one, the variant of the parafictional example (22) in (24) is at odds with factoring the reading time into the interpretation.

(24) A: He is playing the violin. That is, a murder took place. The text hasn't said so yet, but, you know, Holmes only plays the violin in case he thinks about how to discover a murderer.

The past tense in the second clause is felicitous here although there is no previous reading time that could be correlated with the murder. This argues against a complex implicit operator and in favor of a more direct link between the fictional event and the actual time of utterance. Furthermore, Zucchi does not pay attention to the fact that the example in (22) licenses progressive aspect; see the present progressive in both B's question and A's answer. This also indicates that the temporal parafictional statements provide an actualization of fictional events at the layer of the utterrance situation.

In light of these observations, temporal parafiction and temporal metalepsis bear intriguing similarities. Both types of transgressions build on actualizations of fictional events. More specifically, I claim that these actualizations involve a comparable game of pretense: For (23), A pretends that her time of utterance is included in the time of Holmes playing the violin, as the narrator in (2) pretends that the time of having time for a digression is included in the time of Ada's climb. This claim accounts easily for the given use of tense and aspect. Furthermore, it suggests that temporal parafiction is a more general colloquial equivalent of temporal metalepsis, which broadens the empirical scope of the phenomenon under discussion considerably. The difference is that temporal metalepsis is built into a fictional text, while

[8]Zucchi (2001) anyway assumes that parafictional statements can involve high scope of tenses, as in (i).

(i) In Patrick O'Brian's first novel, Jack Aubrey was a post captain, in his new novel, he is a commodore, in the next novel he will be an admiral. [= Zucchi (2001), (10), taken from Katz (1996)]

temporal parafiction is bound to talk about a fictional text. The upshot for the semantic analysis of both cases is that it should integrate some game of pretense into an otherwise direct link between fictional events and the respective relevant layer of actuality above.

2.2.2. Temporal metalepsis and metafiction

Standard metafictional statements such as (25) (= (4b)) ascribe abstract properties to fictional entities. This agrees with their status in the actual world, which is why metafictional statements can inform about what is true about fictional entities in the actual world.

(25) Emil is a fictional character invented by Kästner.

In principle, the ascription of abstract properties is feasible for the temporal domain as well. In particular, events can be described as fictional, as in the metafictional statements in (26). The same holds for even more abstract time specifications, as in (27).

(26) a. Emil's journey to Berlin is invented by Kästner.
b. Ada's climb is a fictional event.

(27) Rainday, May 15, 2000 before Sol does not exist.

Temporal metalepses share with standard metafictional statements that they aim at the truth on the actual layer. Recall, for instance, that in (28) (= (2)), the story content provides a temporal frame for the actual telling and thus contributes to a predication that applies to the actual world of telling.

(28) Ada began to climb the mountain. While Ada is climbing the mountain, we have time for a digression.

However, there is also a very obvious difference. In temporal metalepses, the ascription of abstract properties such as *not exist*, *fictional*, etc. are missing. By constrast, the time of the fictional event is used as if the event were not abstract, but actual. In other words, temporal metalepses are metafictional in a peculiar sense, the key difference from standard metafiction being that the fictional events are pretended to be actual rather than abstract. This ties in nicely with the result from Section 2.2.1, where a game of pretense has been motivated from the perspective of the relationship between temporal metalepsis and parafiction.

It is noteworthy that the given reasoning sharpens our understanding of metalepses more generally. Recall from the introduction that definitions of metalepses usually foreground their transgressive nature. However, standard metafictional statements such as (25)-(27) involve transgressions between fiction and (some layer of) actuality as well. In order to capture the peculiarity of metalepses, one needs to consider the ontological consequences of the transgression. In standard metafiction, the entities under discussion change their ontological status from, for instance, human to abstract or eventive to abstract. While this change results in the puzzling situation that the very same entity can be both concrete and abstract (see Section 3), it does not come along with the impression of inconsistency. In metalepses, by contrast, the entities under discussion do not change their basic ontological status. For (28), Ada's climb is an event at both the fictional and the actual layer. The same holds for other types of metalepses not dis-

cussed here. For instance, if Emil in *Emil and the detectives* spoke to the book's author Erich Kästner, this would count as a metalepsis precisely because Emil crosses the border between fiction and non-fiction as the human he is within the fiction. It is therefore the preservation of ontological traits across narrative layers that is constitutive for metalepsis and the impression of inconsistency it creates. In the following I will outline a pretense-based account of temporal metalepsis that relies on ontological distinctions and thereby keeps an eye on the similarities with meta- and parafiction and the differences from them.

3. Outline of a pretense-based account of temporal metalepsis

3.1. Introduction to the formal framework

The integration of para- and metafiction within one model is usually discussed for fictional names and their coreferential anaphora; see the example in (29) for illustration and Semeijn (2021: ch. 6) for a survey of prominent approaches and their evaluation.

(29) Emil$_i$ is a fictional character. In *Emil and the detectives*, he$_i$ travels to Berlin.

The basic challenge can be summarized as follows. Intuitively, the name *Emil* in the metafictional statement and the pronoun *he* in the parafictional statement refer to the same entity. This intuition is in line with the reasonable more general hypothesis that a pronoun can be anaphoric to a name only if the pronoun and the name corefer. However, this coreference results in a contradiction. The very same entity would be said to not exist (namely, to be fictional, as in the metafictional statement) and to exist (namely, to travel to Berlin, as in the parafictional statement). The challenge seems almost trivial, but the analysis is not. It is probably tempting to pursue some anti-realist approach to the interpretation of fictional names. For instance, one could introduce existential binding of a variable x for Emil as part of the story content and allow x to be accessible outside of the story, independently of the story-internal existence claim. However, this runs into at least two major problems. For one, according to standard constraints for anaphoric relations, variables that are introduced at a local embedded layer are not accessible at global layers above. Furthermore, even if this can be fixed, the approach still leads to what Semeijn (2021) calls 'the problem of the wrong kind of object'. Specifically, x would be native to the story and therefore count as a physical object. Correspondingly, it cannot be an abstract object invented by Kästner. Obviously, pursuing an opposing realist approach to fictional names leads to the flip side of the same ontological problem: x would be native to the actual world and therefore count as an abstract object. Correspondingly, it cannot travel to Berlin in a physical sense.

In order to avoid the given problems and the ontological dilemma on which they are based, it seems necessary to give up on a simple picture of ontology and coreference. Meaning adaptations such as ambiguity phenomena and type coercion provide independent evidence for the integration of relatively fine-grained ontological distinctions into the semantics-pragmatics interface; see the plea for qualia structures in, for instance, Pustejovsky (1995) or the plea for rich typing systems in Type Composition Logic (e. g., Asher 2011, Bücking 2014, Bücking and Maienborn 2019) and Modern Type Theory (e. g., Luo 2012, Chatzikyriakidis and Luo 2020). Specifically, it is argued that there are natural language expressions for objects that bear

types for multiple aspects, so-called dot-types. For instance, the noun *book* introduces objects that are both physical and informational objects, as a consequence of which they bear both a physical and an informational aspect, type PHYS • INFO. It is then the predicational context that determines whether the complex type or one of the aspect types is chosen; see (30) for illustration.

(30) Ada read the book$_{\text{PHYS}\bullet\text{INFO}}$, understood it$_{\text{INFO}}$, liked it$_{\text{INFO}}$, and put it$_{\text{PHYS}}$ on the shelf with her favorite novels.

The modeling in terms of multiple aspects reconciles two otherwise incoherent intuitions. On the one hand, the relevant aspects are co-present for the same object. This is why the predications in (30) are conceived of as being about the same book, and why the use of coreferential anaphora is licensed. On the other hand, this co-presence does not require both types to be compatible with each other. In fact, it is typical for multiple aspect objects that their aspects are ontologically distinct and thus do not have a common meet.[9]

Against this background, Recanati (2018) suggests that fictional names such as *Emil* introduce objects that bear two aspects, namely, an abstract and a physical one. Correspondingly, the name *Emil* refers to the abstract aspect of Emil in metafiction, while it refers to his physical aspect in parafiction. I implement this idea by integrating the typing system proposed by Asher (2011) into the dynamic take on fiction in Semeijn (2021). The former facilitates a transparent representation of ontological types and their relations to each other in the case of multiple aspect objects, the latter facilitates the integration of a standard 'In story' operator in the spirit of Lewis (1978) into a Discourse Representation Structure (= DRS) as used in Discourse Representation Theory (see Kamp and Reyle 2011 for an overview). As I am merely interested in the exposition of core ideas in this paper, I will not go into the formal details of type composition and dynamic semantics here. Notably, Semeijn (2021: ch. 6.4.4) already proposes an integration of Recanati's idea into her framework. While our proposals do not differ substantially, my use of typing information in the sense of Asher (2011) provides a particularly clear representation of the underlying ontological structure.

For the example (31) (= (29)), the approach just outlined leads to the DRS in (32). In this DRS, $\Box_{story}$ symbolizes the relevant 'In story' operator, v: TYPE says that v bears type TYPE, and o-elab(v′, v) says that v′ is object v under a given aspect, that is, that v′ elaborates on v by specifying the conceptualization under which v is referred to.

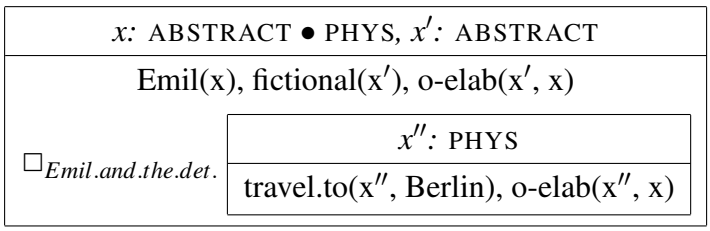
(31) Emil$_i$ is a fictional character. In *Emil and the detectives*, he$_i$ travels to Berlin.

[9]For our purposes, this very rough introduction into multiple aspect objects should suffice. However, I would like to point out that type-based approaches usually distinguish between different kinds of types and different modes of their interaction. For instance, the co-presence of incompatible types as motivated for *book* needs to be distinguished from the ambiguity of homonyms such as *bank*. As shown by (i), *bank* does not license coreferential anaphora across meanings.

(i) The bank of the river were lined with trees. #It managed the money of the rich.

In Type Composition Logic, the ambiguity of *bank* between 'river bank' and 'financial institution' is therefore not modelled in terms of multiple aspects, but in terms of disjunctive types. For disjunctive types, the choice of one type blocks access to the other type in the further context.

(32)



This analysis solves the problems that arise for the analysis of fictional names as follows. The name *Emil* introduces an object x that bears the multiple aspect type ABSTRACT • PHYS. Therefore, the name can refer to an abstract or physical aspect of this object, where the choice between both options depends on the predicational context. The metafictional predicate *fictional* can thus apply to the abstract elaboration of Emil x′, while the parafictional predicate *travel to* can apply to his physical elaboration x″. That is, although meta- and parafiction are about the same object x, the respective statements relate to mutually exclusive aspects of this object, as a consequence of which no problem of the wrong kind of object arises. Furthermore, the accessibility problem does not arise either because the multiple aspect object x is introduced at the global actual layer. This predicts x to be accessible for elaborations within the local context of the story content.

3.2. Analysis of temporal metalepsis: Accommodation of an event in pretense

In order to apply the framework outlined in Section 3.1 to temporal metalepsis, I propose two extensions.

First, multiple object types are generalized to all types of fictional entities, including events. The examples in (33) provide independent evidence for the assumption that fictional events can be conceived of as coreferential abstract and spatio-temporal entities.

(33) a. Ada is fictional, and so is her leaving$_i$ her wife. In "Ada and the detectives", it$_i$ causes much trouble.
b. In the story, Ada leaves$_i$ her wife. The author describes this$_i$ in harsh terms.

In (33a), Ada's leaving her wife is introduced as an abstract entity in the metafictional statement and then taken up by *it* as a spatio-temporal entity in the following parafictional statement. In (33b), the order is reversed, that is, the metafictional anaphor *this* corefers with the spatio-temporal event introduced in the parafiction before. It is noteworthy that events can also participate in multiple aspect objects that are introduced by lexical means. A prominent instance is the noun *lunch*, which can introduce lunches as physical objects and as events. Furthermore, Bücking (2014) argues that English *by* and German *indem* 'in that' lead to multiple aspect events; see (34) for exemplification.

(34) Ada kept a promise by dancing with Cem.

In this example, Ada's keeping a promise and her dancing with Cem are perceived as two facets of the same event. This intuition can be captured in a straightforward way by assuming that *by* introduces a multiple aspect object. Specifically, the multiple aspect combines the fine-grained

verbal predications that are linked by *by*, as a consequence of which (34) is about an object of type KEEP PROMISE • DANCE WITH CEM.[10]

Second, I suggest that in addition to aspects for abstract and spatio-temporal events, an aspect for pretense events can be accommodated. Pretense events are events that are treated as if they were spatio-temporal events although they are not. As a result of this game in pretense, the very same event can bear three different aspects, namely, the usual spatio-temporal type EVENT, the abstract type ABSTRACT EVENT, and the type for pretense PRETENSE EVENT.

With these two extensions to the formal framework in place, I propose the analysis in (36) for the temporal metalepsis in (35), repeated from (2) above. For ease of presentation, the typing of Ada, the mountain, and the digression is ignored here.

(35) While Ada is climbing the mountain, we have time for a digression.

(36)

e: EVENT, e'*:* ABSTRACT • EVENT • PRETENSE-EVENT, e''*:* PRETENSE-EVENT
have.time.for(e, we, d), digression(d) climb(e', a, m), Ada(a), mountain(m), o-elab(e'', e') τ(e) $\supset$ now, τ(e) $\subseteq$ τ(e'') $\Box_{story}$ | e'''*:* EVENT o-elab(e''', e') |

In prose: At the actual layer, there is a spatio-temporal event of the narrator and her addressee having time for a digression. There is also an event of Ada climbing the mountain that can be referred to under its abstract aspect, its spatio-temporal aspect, and its pretense aspect. The spatio-temporal aspect of Ada's climb exists in the story, while the pretense aspect exists at the actual layer. Furthermore, the runtime of the pretense aspect includes the present runtime of having time for a digression. In a nutshell, (35) thus receives the interpretation that the narrator and her addressee have time for a digression, where the digression time is temporally framed by Ada's climb conceived of as if it were actual.

The merits of the proposed analysis are the following: For one, the multiple aspect conception of the fictional event complies with the intuition that the climbing introduced in the *while*-clause corefers with the climbing introduced within the story. This is confirmed by the observation that temporal metalepsis is also licensed by anaphors, as in (37).

(37) Ada began to climb$_i$ the mountain. Meanwhile$_i$ we have time for a digression.

Furthermore, the representation is ontologically sound. On the one hand, there is not need to say that the spatio-temporal aspect of Ada's climb of the mountain actually exists. In lieu thereof, it is the pretense aspect that is native to the actual layer and thus exploitable for actual reference. On the other hand, the pretense aspect is still conceived of as a spatio-temporal particular and thereby differs from abstract aspects as used in standard metafiction. This is why the pretense aspect has a runtime relative to which the digression time can be located temporally. Finally, the choice of tense and aspect has a reason. Given the goal of contributing an actualization in pretense, the time of the climbing in pretense should include the present digression time,

[10]The *by*-locution has received considerable attention in philosophy and linguistics; see, for instance, Bennett (1994), Sæbø (2008), and Schnieder (2009) for discussion and different solutions to the puzzle posed by *by*.

which calls for present tense and imperfective aspect in this specific case. The more general prediction is that the grammar of temporal metalepsis depends on which temporal relations the narrator intends to establish between the actual timeline and pretense aspects of story-based events. This is in line with the upshot of Section 2.1, according to which the narrator uses standard grammatical rules for linking the fictional event to the actual situation of narrating.

The proposed analysis suggests some further issues worth discussing. Let me start by considering how the accommodation of an event in pretense is licensed. I assume that this accommodation is licensed by the threat of an ontological conflict. That is, in order to obtain a consistent interpretation of temporal metalepsis, the event on which the temporal metalepsis is based needs to be adapted. Conversely, the need for conflict resolution is reflected in the intuition that the metalepsis brings with it a light form of inconsistency. I speculate that the inconsistency is perceived as light because recipients are familiar with the relevant game of pretense and, thus, also with the accommodation that it supports; see below for the role of pretense in conversations about fictional contents more generally. However, to avoid misunderstandings, I should add that the proposed analysis of temporal metalepsis does not suggest a pretense-based approach to standard parafictional statements as well, rather the opposite. Contents in the scope of the 'In story' operator should not be adapted. It is crucial for Ada's climb of the mountain that it inhabits the story worlds as an ordinary spatio-temporal particular. The same holds for the ontological type of Ada, the mountain, etc. The additional game of pretense is only licensed in those cases where entities that exist in the fiction seem to transgress the border established by the 'In story' operator. It is therefore the actualization built into temporal metalepsis that results in the accommodation of an event in pretense.[11]

It is also worth taking a brief look at a more general consequence of the proposed multiple aspect conception of events. The analysis builds on the assumption that the multiple aspect event is assigned to the actual global layer. As already motivated for the corresponding treatment of fictional characters in Section 3.1, the assignment to the global layer enables the fictional event to be accessible at the local layer for the story content as well. As a consequence, the representation of the story content is based on object elaborations across the entire range of fictional entities. While this may seem counterintuitive at first, I consider it plausible upon closer inspection. The type-based representations merely capture a defining trait of fictional entities. Arguably, fictional entities come with at least two aspects, one for the type of entity they are within a fiction, and one that identifies them as fictional at a fiction-external layer. In other words, once representations are sensitive to the different aspects fictional entities can instantiate, they can, or even must, be said to exist in both fictional and actual worlds, with the overarching complex type being assigned to the actual layer.

[11] Semeijn (2021: ch. 7) distinguishes between *In s,* ϕ and *According to s,* ϕ. She argues that the 'In' operator treats *s* as a fictional text, as a consequence of which ϕ is not about what is actually true. This is fully in line with my argument above. The 'According to' operator receives a different analysis. Specifically, it is argued that statements of the form *According to s,* ϕ are about what is actually true according to what is expressed by *s*. Therefore, the 'According to' operator treats *s* as a non-fictional text. The distinction between both operators accounts for the preference of the 'In' operator for fiction, and the preference of the 'According to' operator for non-fiction. However, the 'According to' operator can also be used with a fictional text *s*. In this case, it suggests the pretense that *s* is non-fictional and, thus, also the pretense that the fictional events might be non-fictional; see Semeijn (2021: 165-166) in particular. I will leave to further research how this game of pretense relates to the pretense involved in temporal metalepsis. There is at least one main difference, namely, in temporal metalepsis, the pretense of actual events is not relativized to what is expressed by the fictional text.

Finally, I would like to address the transfer of the given analysis of temporal metalepsis to temporal parafiction; recall (38) (= (22)) from Zucchi (2001).

(38) [Context: A is reading Sherlock Holmes, with B in the room.]
   a. B: What is Holmes doing?
   b. A: He is playing the violin. A murder took place and he is thinking about the evidence. He will soon discover the murderer.

In Section 2.2.1, I have argued that temporal parafiction is a colloquial equivalent to temporal metalepsis, where the former differs from the latter by being bound to the text-external talk about a fictional text. More specifically, I have claimed that temporal parafiction also builds on an actualization of fictional events at the actual layer and thus shares a comparable game of pretense with temporal metalepsis. This kinship can be captured in a straightforward way by applying the key ingredients of the analysis in (36) to temporal parafiction. For instance, A's first parafictional statement in (38) can be given the representation in (39).

(39)

e: ABSTRACT • EVENT • PRETENSE-EVENT, e': PRETENSE-EVENT
play(e, h, v), Holmes(h), violin(v), o-elab(e′, e) τ(e′) ⊃ now $\Box_{story}$ [e'': EVENT | o-elab(e″, e)]

In prose: The actual layer provides an event of Holmes playing the violin that can be referred to under its abstract aspect, its spatio-temporal aspect, and its pretense aspect. The spatio-temporal aspect only exists in the story, while the pretense aspect exists at the actual layer. Furthermore, the runtime of the pretense aspect includes the actual now. As desired, the now of the given conversation between A and B is thus temporally framed by the pretense aspect of Holmes playing the violin. The choice of present tense and progressive aspect follows smoothly from A's intention to convey precisely this temporal relationship. The same reasoning can be applied to the further event descriptions. Specifically, the murder under its pretense aspect should precede the now of the conversation, which accounts for the use of past tense in this case, and the discovery of the murderer under its pretense aspect should follow it, which accounts for the use of future tense. Notably, this pretense-based analysis can dispense with the accommodation of complex operators that factor the reading time into the interpretation; recall *in the part of the text that I am reading now*, *in the part of the text that I read before*, etc. from Zucchi's analysis in (23). The intuitive relation to reading times is merely a byproduct of contextual information. As the conversation between A und B is bound to a situation where A is reading Sherlock Holmes, the reading times of parts of the text can be correlated with the given now and thus also with the different fictional events under their respective pretense aspect.

4. Conclusion and outlook

This paper has been concerned with temporal metalepsis from a linguistic point of view. As a first step, I have examined its semantic properties. This has shown that temporal metalepses are subject to grammatical constraints. Specifically, the choice of tense, aspect, and temporal

subordinators depends on the narrator's intention to actualize story-internal fictional events at a story-external actual layer. Furthermore, anaphors indicate identities across narrative layers. Temporal metalepses thereby intertwine facets of parafictional and metafictional statements. On the one hand, content from within the story is used for predications at a narrative layer above; on the other hand, the relevant content is not conceived of as abstract, but as real. As a second step, I have proposed a pretense-based account of temporal metalepsis that builds on a dynamic semantics for para- and metafiction. According to this proposal, the temporal entanglement between narrative layers results in an ontological conflict that is resolved by the accommodation of an event in pretense at the actual layer. This accommodation leads to a multiple aspect object that can be referred to under its spatio-temporal aspect, its abstract aspect, or its pretense aspect, where the choice between these options depends on the layer at which the fictional event is accessed. In addition, I have suggested that temporal metalepsis has a colloquial variant that can be exploited in the talk about fictional texts while reading them. This, then, broadens the empirical scope of the phenomenon considerably.

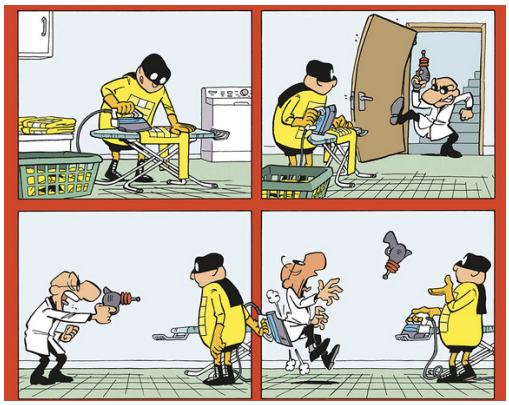
I conclude with a brief outlook for two issues that may be worthy of discussion in future research. For one, in Section 2.1 I have pointed out that temporal metalepsis shares features with the deferred reference of non-temporal indexicals. This begs the question of how temporal metalepsis relates to potential cases of deferred reference in the temporal domain. A candidate for such a case is given in (40), which follows Welke (2005: 338-339).

(40) Wer bekam die Linsensuppe?
who got the lentil soup
'Who did get the lentil soup?'

Let (40) be uttered by a waiter in a restaurant. In this case, the verbal content relates to the actual event of getting the lentil soup, which is at odds with reference to the past as indicated by the preterit. This conflict can be resolved by the accommodation of another event, namely, by assuming reference to the order of the lentil soup. The example, then, shares the accommodation-based resolution of an impending ontological conflict with temporal metalepsis. However, there is also a principled difference between both cases. This difference is fully analogous to the difference that has already been established between temporal metalepsis and non-temporal deferred reference. In contrast to temporal metalepsis, the conflict in (40) concerns times alone, not worlds. Correspondingly, a cross-world game of pretense for the same event is no help. In lieu thereof, the accommodation results in a sortally different event (namely, the order of the meal) that is related to the given event (namely, the reception of the meal) merely indirectly. As a consequence, the order and the reception of the meal are not conceived of as different aspects of the same event, but as different events.

The second issue relates to the question of how the proposed pretense-based approach to temporal metalepsis fits into the analysis of metalepses more generally. A satisfying answer to this question is certainly beyond the scope of this paper, given the wide range of metalepses possible. I will just mention one intriguing case in point for a metalepsis in comics, namely (41), which is copied from the back cover of Jousselin (2018).

(41)



This comic strip is interesting for at least two reasons. First, a simple conjunction of propositions as proposed for inconsistent pictures by Cresswell (1983) does not seem to be enough for its analysis. In particular, the transgression of the iron between the panels three and four is crucial to the narrative progression at hand and to the causal relations on which this progression is based. Notably, the position of the iron is not arbitrary. Rather, it follows rules of spatial contiguity and, thus, the "grammar" of common pictorial representations. This suggests a link to the more general question of how to account for narrative progression in pictorial narratives as opposed to linguistic narratives; see Abusch (2014) and Altshuler and Schlöder (2021) for discussion. Second, the example is also challenging for a simple pretense-based approach to metalepses. It is not just pretended that the iron is part of the actual world represented by the gutter. Instead, the interpretation seems to build on the pretense that the structure of the gutter is relevant to the events and their causal relations within the fiction. This, then, calls for factoring a game of pretense into the story content that is in the scope of the 'In story' operator. I will leave to future research whether such a complex approach can be upheld upon closer scrutiny.

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Indexical binding, presuppositions and agreement[1]

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Abstract. This paper focuses on bound readings of first and second person pronouns, which challenge Kaplan's (1977/1989) fixity theory of indexicals. It first reviews the virtues and problems of the two main previous analyses: morphosyntactic approaches exploiting binding and agreement, and semantic approaches exploiting focus and presupposition. Next, it proposes a novel account combining all these ingredients based in part on new French data.

Keywords: indexical, binding, presupposition, agreement, focus, ellipsis.

1. Introduction

The goal of this paper is to provide a novel account of indexical binding illustrated in (1)-(2).

(1) a. Only I did **my** homework. (Heim 1991)
Intended: the others didn't do **their** homework.
b. I did **my** homework, but my classmates didn't. (Heim 1991)
Intended: … but my classmates didn't do **their** homework.

(2) a. Only you eat what **you** cook. (Kratzer 2009: 188)
Intended: the others do not eat what **they** cook.
b. ?You are the only one who has brushed **your** teeth. (Kratzer 2009: 202)
Intended: the others haven't brushed **their** teeth.

In all these examples, the first or second person pronoun in boldface can induce a bound (or "sloppy") reading, whether it appears in a focal construction (involving e.g. *only*) as in (1a) or (2a), in an elliptical construction as in (1b), or in a relative clause as in (2b). Such cases famously challenge Kaplan's (1977/1989) fixity theory that treats indexicals as expressions whose interpretation directly depends on the context of utterance: under this approach, *I* and *you* rigidly refer to the speaker and addressee of the current context, and are thus expected to trigger only referential (or "strict") readings (see details in section 2.1).

As we will review in section 2, two main solutions have been proposed to this problem. Morphosyntactic approaches (Heim 2008, Kratzer 2009, Wurmbrand 2017a, i.a.) analyze bound indexicals as fake indexicals, i.e., as pronouns that exhibit the form of indexicals (at PF), but are not interpreted as such (at LF), due to a mechanism of feature transmission (or feature deletion, depending on implementations) under binding. Semantic approaches (Jacobson 2012, Sauerland 2013, i.a.) treat bound indexicals as real indexicals whose indexicality can be ignored in focus alternatives because it is coded as a presupposition that can disappear in such alternatives.

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Both approaches face outstanding empirical and theoretical problems. Morphosyntactic analyses, which focus on relative clause cases (see (2b)), overlook the role of focus. Conversely, semantic approaches, which concentrate on focal constructions (see (1a) or (2a)), overlook the role of verbal agreement. Instead, we propose a novel, semantic solution incorporating the role of both focus and agreement (see section 3). The key innovations consist in treating verbal agreement as presuppositional (at least in some cases) and binding and predication as inducing presupposition unification. These hypotheses have general consequences for both the theory of indexicals, on which we focus here, and the theory of agreement, which is not discussed in this paper.

2. Previous approaches to indexical binding and their problems

2.1. Kaplan's fixity theory

Under Kaplan's (1977/1989) theory, first and second person pronouns are treated as indexicals, that is, as directly referential expressions whose meaning rigidly depends on the context of utterance: *me* refers to the speaker *s*, and *you* to the addressee *a*, of the actual speech act *c*.

(3) a. $[\![me]\!]^{g, w, t, \mathbf{c}} = s_{\mathbf{c}}$
b. $[\![you]\!]^{g, w, t, \mathbf{c}} = a_{\mathbf{c}}$

Under this analysis, the interpretation of first and second person pronouns is only relativized to a context parameter *c* (which cannot be manipulated by any operator[2]): unlike definite descriptions, *I* and *you* do not depend on the world and time parameters *w* and *t*; unlike third person pronouns, *I* and *you* do not depend on the assignment function *g* which provides values to individual variables. The former point is mainly motivated by the insensitivity of indexicals to world and time operators illustrated in (4): unlike the description *the speaker*, *I* cannot be interpreted in the scope of the time quantifier *always* or the world quantifier *necessarily* (and thus induce reference to multiple individuals varying depending on times or worlds), but must rigidly refer to the actual speaker.

(4) a. **I** am {**always**/**necessarily**} boring.
b. **The speaker** is {**always**/**necessarily**} boring. (Schlenker 2018: 299)

The latter point (independence of the assignment function) is partly motivated by the referential constraints of indexicals: while the reference of *I* in, e.g., (5a) has to depend on who utters the sentence and thus vary across contexts, the reference of *she* in, e.g., (5b) can be the same in different contexts of utterance involving different speakers.

(5) a. **I** am a linguist.
b. **She** is a linguist.

[2] According to Kaplan, the fixed reference of indexicals also derives from the hypothesis that operators manipulating the context parameter are claimed not to exist in natural languages (prohibition against monsters). This claim has been famously challenged by the observation that indexicals can shift in some attitude contexts in some languages (see, e.g., Deal 2020 for a review). Although this problem of the Kaplanian theory is independent of the problem of indexical binding (and will thus not be treated in this paper), any solution to one of these problems must of course be compatible with potential solutions to the other problem.

Crucially for our purposes, the hypothesis that indexicals do not depend on the assignment function (i.e., they are not treated as variables) predicts that they cannot be bound. Given that sloppy readings (require binding, Kaplan's analysis implies that (1)-(2) exhibit only strict readings, contrary to facts. For instance, (1a) (repeated in (6)) is predicted to contrast with (7) involving a third person pronoun, because the property α predicated of the subject (and quantified over by *only*[3]) can be reflexive only in (7): only *her* (vs. *my*) can be construed as a bound variable.

(6) a. Only I [$_{\alpha}$ did **my** homework].
b. $[\![\alpha]\!]^{g, w, t, c} = [\![1\ t_1 \text{ did } \mathbf{my} \text{ homework}]\!]^{g, w, t, c} = \lambda x_e.$ x did $\mathbf{s_c}$'s homework

(7) a. Only Anna [$_{\alpha}$ did **her** homework].
b. $[\![\alpha]\!]^{g, w, t, c} = [\![1\ t_1 \text{ did } \mathbf{her_1} \text{ homework}]\!]^{g, w, t, c} = \lambda x_e.$ x did **x**'s homework

Bound readings of 1st and 2nd person pronouns in (1)-(2) thus seem to challenge a fundamental aspect of the Kaplanian approach: indexical binding is an oxymoron under this theory, since indexicals cannot be construed as variables in a given context of utterance. In the next two sections, we review the two main approaches that have been adopted in order to reconcile the bindability of indexicals revealed by (1)-(2) and their context dependency supported by the Kaplanian arguments.

2.2. Morphosyntactic approach

The core idea of the morphosyntactic approach to indexical binding is to distinguish between indexical form and indexical interpretation: bound indexicals only exhibit the former. In other words, bound indexicals are fake indexicals whose indexical features are only present at the morphosyntactic level of the derivation, due to binding, but absent at the semantic level.

Two main types of mechanisms have been proposed to derive this mismatch between form and interpretation. First, von Stechow (2003) hypothesizes that it is the result of obligatory feature deletion under semantic binding. According to this analysis, semantic binding, which requires agreement of φ-features between binder and bindee, induces deletion of the bindee's features at LF. In (1a) repeated in (8), the 1st person feature of the possessive is thus deleted because *my* is semantically bound by *only I* (which is assumed to inherit its 1st person feature from *I*). Under the assumption that φ-features restrict the denotation of variables (cf. semantic approach in section 2.3), such feature deletion gives rise to the sloppy reading.

(8) a. Surface Structure: [$_{DP}$ only I_5]$_8$ did my$_8$ homework.
b. Logical Form: [$_{DP}$ only I_5]$^{\mathbf{1st}}$ $\boldsymbol{\lambda_8}$ t_8 did $\mathbf{8^{1st}}$'s homework.

Von Stechow's system is intended to derive indexical binding, indexical shift and sequence of tenses in a uniform way: indexical shift (e.g., in Amharic) results from person feature deletion, and sequence of tense (e.g., in Russian) from tense feature deletion, under binding by some attitude verbs. Thus, the traditional Kaplanian theory can be largely preserved: the reason why indexicals can be bound (or shifted) despite their (rigid) context dependency is that their indexical features can be ignored in the interpretation because they match those of their binder. Note though that von

[3] This holds whether *only* is treated as a generalized quantifier or a propositional focus sensitive operator.

Stechow implicitly abandons the Kaplanian indexical independence of the assignment function, since *I* and *you* can be bound once their features are deleted.
As noted by von Stechow, the hypothesis that features of semantically bound variables are not interpreted is due to Heim who proposes a different mechanism to account for it, i.e., feature transmission. In Heim 2008, she hypothesizes that at PF, all features of a DP must be copied onto all variables it binds. Under the assumption that pronouns may be base-generated featureless and remain so at LF, the bound reading of (1a) derives from transmission of the 1st person feature from *only I* (inherited from *I* by feature percolation at PF) to the featureless possessive it binds (see (9)).

(9) a. Base generation: [only 1st-sg$_5$] did **Ø**$_4$'s homework.
b. Phonetic Form: 1st-sg [only 1st-sg$_5$] **λ$_4$** [**1st-sg$_4$** did **1st-sg$_4$**'s homework.

Kratzer (2009) also adopts the mechanism of feature transmission under binding, but modifies it in two crucial ways. First, binders are not DP antecedents, but "functional heads" such as verbs. Second, features are not just transmitted to bindees, but are shared between binders and bindees (unification). Under the bound interpretation of (1a) repeated in (10), it is thus the 1st person feature of the verb (inherited from the subject *I* by predication, i.e., specifier-head agreement under binding) that is transmitted to the possessive pronoun born as a minimal pronoun.

(10) a. Base generation: only I[1st-sg$_5$] did **Ø**$_4$'s homework.
b. Phonetic Form: only I[1st-sg$_5$] T[past] **v[1st-sg$_4$] λ$_4$** do **[1st-sg$_4$]**'s homework.

Kratzer's main motivation for these new hypotheses is the observation that verbal agreement seems to play a role in indexical binding, at least in some relative clause constructions in some languages. For instance, the sloppy reading is available in German only in the plural in (11b), not in the singular in (11a). This correlates with the fact that unlike the singular form, the plural form is syncretic, thus allowing matching features between the verb and the bound pronoun.

(11) a. # Ich bin die einzige, die **meinen** Sohn versorg-**t**.
1SG be.1SG the.FEM.SG only.one who.FEM.SG **1SG**.POSS.ACC son take.care-**3SG**
'I am the only one who take**s** care of **my** son.'
b. Wir sind die einzigen, die **unseren** Sohn versorg-**en**.
1PL be.1/3PL the.PL only.ones who.PL **1PL**.POSS.ACC son take.care.of-**1/3PL**
'We are the only ones who **take** care of **our** son.'

Specifically, Kratzer assumes that in relative clauses, the verb can start the derivation with 1st person features given that both its subject (the relative pronoun) and its bindee (the possessive) are minimal pronouns without features. Due to feature transmission, the possessive ends up acquiring these features at PF and thus taking the form of an indexical. But crucially, the relative pronoun also inherits gender features (which are assimilated to 3rd person features by Kratzer) from the head of the relative clause (i.e. *the only one*), which are transmitted to the verb and the possessive pronoun. All members of the agreement chain thus end up with the set of features {[female], [1st], [singular]} in the singular, and {[female], [1st], [plural]} in the plural. The association of gender (3rd person) and 1st person features gives rise to a spellout dilemma for the verb in the singular (where verbal forms are all specified differently), but not in the plural (due to 1st person/3rd person

syncretism).[4] This is why binding is licensed in the plural, but not in the singular. In other words, Kratzer derives the correlation between syncretism and bound readings from the hypothesis that features are shared between bound pronouns and verbs, which are thus treated as binders.

In English, however, verbal agreement does not seem to play any role in indexical binding: even when the verb has a non-syncretic, 3rd person marking (as in (2b)), indexical binding remains available (although Kratzer reports a slight degradation in judgments in such cases). Kratzer derives this fact from a crosslinguistic difference in the treatment of spellout dilemmas: unlike German, English can resolve some spellout dilemmas due to the markedness of certain features. For instance, Kratzer assumes that person features are marked in the verbal domain in English, because except for the verb *be*, 1st and 2nd persons are not distinguished morphologically; in the feature set {[female], [1st], [singular]}, [female] thus wins over [1st] without giving rise to ungrammaticality.[5]

Like von Stechow's feature deletion rule, feature transmission is thus intended to reconcile the (anti-Kaplanian) bindability of indexicals with their (Kaplanian) context dependency: given that bound indexicals are fake indexicals (minimal pronouns not interpreted as indexicals, but only acquiring their person features at PF), they do not challenge Kaplan's fixity theory. Kratzer (2009) nevertheless proposes an additional mechanism challenging the Kaplanian theory, in order to treat long distance bound indexicals illustrated in (12b).

(12) Du bist der einzige, der …
2SG be.2SG the.MASC.SG only.one who.MASC.SG
a. # **deinen** Aufsatz versteh**t**.
2SG.POSS.ACC paper understand.**3SG**
'You are the only one who understand**s your** paper.'
b. glaubt, dass jemand **deinen** Aufsatz versteh**t**.
believes that someone **2SG**.POSS.ACC paper understand.**3SG**
'You are the only one who thinks that someone understand**s your** paper.'

Given the contrast in bound reading acceptability between (12a) and (12b), indexical binding in (12b) cannot result from feature transmission, but is hypothesized by Kratzer to derive from indexical abstraction (cf. Cable 2005). She assumes that an operator is inserted on the embedding verb (*glaubt* in (12b)), which manipulates the values of 1st and 2nd person pronouns in its scope by shifting the context parameter. Thus, verbal agreement does not play a role in such cases.[6]

[4] Kratzer also supposes that the same contrast between singular and plural holds for possessive pronouns: assuming that possessive pronouns are marked for both person and number in all singular cases, but only for person in the first two plural cases, she concludes that {[female], [1st], [singular]} gives rise to a spellout dilemma that cannot be resolved, while {[female], [1st], [plural]} does not, but induces the form *unser*. As for the relative pronoun, it is not subject to any spellout dilemma as it is never marked for person. Note that Kratzer implements these hypotheses in a framework using vocabulary insertion rules and the elsewhere/subset principle.

[5] Conversely, Kratzer assumes that gender features are marked in the nominal domain on the basis of agreement conflict resolutions with conjoined DPs (e.g. *the teacher and I* is resolved as *we*) and gender-neuter 3rd person plural form (as in, e.g., *nobody has lost **their** job yet*) in English (vs. German). In the feature set {[female], [1st], [singular]}, [1st] thus wins over [female] without creating any ungrammaticality in English.

[6] More precisely, indexical abstraction operators are defined as follows by Kratzer:

(i) a. $[\![\lambda[1^{st}]\ \alpha]\!]^{c,\,g} = \lambda x\ [\![\alpha]\!]^{g,c'}$, where c′ is like c, except possibly that speaker(c')=x
b. $[\![\lambda[2^{nd}]\ \alpha]\!]^{c,\,g} = \lambda x\ [\![\alpha]\!]^{g,c'}$, where c′ is like c, except possibly that addressee (c')=x

Furthermore, Kratzer stipulates that the person features they induce on the verb on which they are introduced are so marked that they do not give rise to spellout dilemmas. They thus do not affect verbal agreement.

The addition of this mechanism undermines Kratzer's approach. From the point of view of theoretical economy, the new feature transmission rule and distinction between fake and true indexicals is justifiable by the intention to preserve Kaplan's theory. The indexical abstraction hypothesis not only defeats this purpose, but also adds a new duplication in the system (not only between fake and true indexicals, but also between locally and long distance bound indexicals).

Beyond this problem of analytical parsimony, Kratzer's approach faces various challenges, some of which are explicitly mentioned in Wurmbrand 2017a. For example, Wurmbrand observes that 1/3 syncretism in the singular in other verbal paradigms (e.g., modal verbs such as *können*) or in other tenses (e.g., past tense) does not correlate with the availability of indexical binding. Furthermore, Wurmbrand reports some further crosslinguistic differences that cannot be captured by Kratzer's system without stipulations. For instance, Dutch behaves like English with respect to indexical binding (esp. concerning the lack of effect of verbal agreement), but does not exhibit the properties motivating the resolution of spellout dilemmas through markedness (e.g., poor verbal paradigm). All this reveals that the various types of spellout dilemma (non-)resolutions posited by Kratzer are hard to independently motivate.[7]

More generally, all implementations of the morphosyntactic approach are challenged by cases of partial binding of indexicals as pointed out in Rullmann 2004 and Heim 2008.[8]

(13) a. Only **you** remember **our** first appointment. [uttered by the adviser to an advisee]
Intended: my other students do not remember their first appointment with me.
b. Only **I** remember **our** first appointment. [uttered by an advisee to the adviser]
Intended: my peer students do not remember their first appointment with you.

For example, the contrast between Kratzer's (2009: 231) (13a) and (13b) (uttered in a scenario where an adviser meets with their former students) suggests that additional assumptions must be made to capture partial indexical binding. In (13a), the 1st person feature on *our* cannot be assumed to be inherited from its 2nd person binder (whether it is assumed to be the verb or its subject). Conversely, in (13b), the 1st person feature must be assumed to have been acquired through feature transmission (vs. to be interpreted) given that not all pairs of advisee-adviser contain the speaker. To solve the dilemma, Heim (2008) shows that it must be assumed that feature transmission can target only one part of the pronoun and features for a complex pronoun are computed on the basis of the features of its parts by a specific PF operation. For example, *our* in (13b) starts with a 2nd person specification for the second half of the bound pronoun; then, the first half of the pronoun acquires a 1st person feature by feature transmission; finally, the PF operation about complex

[7] Wurmbrand (2017a) further argues against Kratzer's hypothesis that binding is done by a functional head on the basis of word order restrictions in the cases of scrambling and specificational sentences. This part of Wurmbrand's argumentation is nevertheless more complex to evaluate as it ignores the potential role of Weak Crossover effects, and the conditions (to be further investigated according to Kratzer) under which person features can be inserted on verbs when the subject (e.g., relative pronoun) is underspecified. Wurmbrand instead argues for binding by a DP antecedent (cf. Heim 2008) and derives the effect of syncretism in German from a morphological analogue of Rule H. This analysis is not without its specific problems either. For example, it implies – controversially – that Agree must operate beyond phase boundaries. Moreover, the crucial role it attributes to gender marking on the relative DP (unmarked in English/Dutch vs. marked in German/Icelandic) seems challenged by other languages (such as French, as already noticed by Bassi 2018) that exhibit both gender marking on the relative DP and possible mismatch between verbal agreement and bound indexicals (see fn. 34).

[8] Besides indexicals, they are also challenged by crosslinguistic cases with gender and number features involving a difference between grammatical and semantic features (see e.g. Spathas 2007, Ke 2019).

pronouns states that if one of the parts is specified as 1st person, then the whole pronoun must be specified as 1st person. But as acknowledged in Heim 2008, it is unsatisfactory to posit a PF operation on complex pronouns that largely duplicates semantic theorems about sum formation and inclusion.[9] For example, we independently know that if at least one of two atoms is the speaker, then their sum includes the speaker. This type of theorem coupled with a semantics for person features suffices to deduce the person specification of standardly interpreted complex pronouns; only bound indexicals require the addition of a specific PF operation.

In sum, all versions of the morphological approach to bound indexicals require several stipulations that clearly go against analytical parsimony, in order to have a good empirical coverage.[10] Furthermore, they uniformly ignore the role of focus, even if indexical binding seems to be observed only in constructions involving focus: all examples discussed include a focus particle such as *only* (even in relative clauses, see, e.g., (2b)) or ellipsis (which is standardly analyzed as involving focus, see Rooth 1992, Merchant 2001, i.a.).[11] On the contrary, this observation lies at the heart of semantic approaches to indexical binding, which we review in the next section.

2.3. Semantic approaches

Unlike morphosyntactic approaches, semantic approaches treat bound indexicals as real indexicals, whose person features are interpreted (see Jacobson 2012, Sauerland 2013, i.a.). As reviewed below, their bindability derives from two hypotheses: the presuppositionality of person features and the blindness of focus values to some presuppositions.

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[9] Instead of assuming partial feature transmission, Kratzer posits the feature [sum] and modifies vocabulary insertion rules so that the combination of [1st] and [2nd] features yields a 1st person plural pronoun. These hypotheses are similarly unparsimonious.

[10] Furthermore, the empirical coverage remains imperfect. First, the reported relation between verbal agreement and indexical binding is only addressed in Kratzer 2009 and Wurmbrand 2017a (vs. von Stechow 2003 and Heim 2008). Second, the availability of agreeing verbs (in some conditions) in relative clauses in some languages (see, e.g., French facts in section 3.2) raises problems even for Kratzer and Wurmbrand. In fact, this point is already problematic for them in German (their main language of investigation), where it is partially attested: they observe that in the 2nd person plural, bound indexicals seem unavailable with the standard, 1st/3rd person syncretic verbal agreement, but available with the dialectal, 2nd person verbal agreement:

(i) Ihr seid die einzigen, die **euren** Sohn {# versorg-**en** / % versorg-**t** }
2PL be.2PL the.PL only_ones who.PL **2PL**.POSS.ACC son take.care.of-**1/3PL** take.care.of-**2PL**
'You are the only ones who **are** taking care of **your** son.'

Under Kratzer's system, the bound reading under dialectal agreement is straightforwardly derived (since all members of the agreement chain are endowed with the set of features {[female], [2nd], [plural]}, and [2nd][plural] is spelled out as *-t*), but it remains unclear why speakers of the standard dialect cannot use the agreeing form. Conversely, Wurmbrand seems to overgenerate the bound reading with standard agreement (which is not discussed), and can derive the dialectal agreement only by supposing the presence of a silent subject clitic (Wurmbrand 2017a: fn. 7). Finally, some specific predictions by Kratzer (vs. other morphosyntactic implementations) remain to be empirically checked (e.g. variable acceptability of indexical binding with ditransitive verbs depending on the type of verb; possibility of mixed readings only with two local – vs. two long distance – indexicals; impossibility of combining a locally and a long distance bound indexical).

[11] A potential exception is dependent plurals discussed by Heim (2008), which occur in non-focal constructions:

(i) They each believe that **they** are the only person in the room. (Heim 2008: 46)

Although (i) (cf. (18b) does not involve indexicals, it seems to present the same type of morphology-semantics mismatch as bound indexicals, given that the embedded *they* seems to be interpreted as a singular here. Heim thus proposes that feature transmission (under binding) also applies to such examples. An alternative approach is adopted by, e.g., Sudo (2014) that does not treat dependent plurals like bound indexicals partly because they do not in fact require binding. On that basis, we will tentatively ignore such examples in the remainder of this paper.

The first ingredient of semantic approaches consists in extending the presuppositional account of gender features (pioneered by Cooper 1983) to person (and number) features (see Heim & Kratzer 1998, Heim 2008, i.a.) as illustrated in (14) for *I* under Heim's 2008 implementation.

(14) a. LF: [1^{st} [singular [I_7]]]
b. $[\![I_7]\!]^{g, w, t, c} = g(7)$
c. $[\![1^{st}]\!]^{g, w, t, c} = \lambda x_e$: x includes s_c. x
d. $[\![$ singular $]\!]^{g, w, t, c} = \lambda x_e$: x is an atom. x

Under this approach, all pronouns, including indexicals, are treated as variables dependent on the assignment function (see (14b)), and the φ-features adjoined to them denote partial identity functions of type <e,e> (see (14c-d)). In general, the semantic role of φ-features consists in constraining the range of possible referents (or antecedents). In the case of indexical pronouns, this restriction is done with reference to the utterance context, potentially resulting in a restriction to a single possible referent (e.g., in (14), an atom including the speaker can only be the speaker herself). Note that the Kaplanian context dependency of indexical pronouns is thereby moved from the pronoun itself to its person features, i.e., to its presuppositional content.

The second ingredient relies on distinguishing between the meaning contribution of assertion and presupposition and assuming that the latter can be ignored under some conditions such as focus. Specifically, φ-features of bound pronouns are assumed – due to their presuppositional status[12]– to contribute to the regular meaning, but not to the focus meaning (see Spathas 2007, Jacobson 2012, i.a.). This hypothesis is applied to indexical binding in (15) (conflating person and number presuppositions) under Rooth's 1992 alternative semantics, where the ordinary semantic value is noted $[\![.]\!]^{\circ}$ and the focus semantic value $[\![.]\!]^{f}$.

(15) a. Only I_F [α did **my** homework].
b. $[\![\alpha]\!]^{\circ} = \lambda x_e$: **x is s**$_c$. x did x's homework
c. $[\![\alpha]\!]^{f} = \{\lambda x_e$. x did x's homework$\}$

In example (1a) repeated in (15a), the predicate containing the bound pronoun is restricted to combining with a speaker-denoting subject in the ordinary semantic value represented in (15b). This results from the interpretation of the presuppositions contributed by the person and number features on *my*.[13] However, the focus value represented in (15c) is a set of predicates with domains not restricted so. This derives from the hypothesis that the presuppositional contribution of φ-features on bound pronouns is ignored in focus values. These hypotheses correctly derive the sloppy reading of (15a) assuming that *only* quantifies over focus alternatives as is standard.[14]

[12] This can be taken as an argument for the presuppositional account of φ-features. Other, independent arguments involve projection behavior and judgments (of presupposition failure vs. falsity) when their information is not verified by the referent (see Sudo 2012, Charnavel 2019, i.a.).

[13] Adopting Heim & Kratzer's (1998) and Heim's (2008) implementations, the presupposition of the bound pronoun is coded on the predicate due to the following formulation of the rule of Predicate Abstraction:

(i) $[\![i\ \alpha]\!]^{g} = \lambda x_e$: $\alpha \in$ dom $([\![ ]\!]^{g\ x/i})$. $([\![\alpha]\!]^{g\ x/i})$

[14] This holds whatever exact lexical entry is chosen for *only* (see fn. 3). Specifically, the combination of (15b) with the subject *I* yields the proposition that the speaker did the speaker's homework as ordinary value (ultimately an

This semantic approach to indexical binding has been implemented in various ways on the basis of various data and motivations. Adopting a variable-free framework, Jacobson (2012) concentrates on person and gender features (vs. number features) of bound pronouns in the scope of focus-sensitive particles as in (1a)[15], and stipulates (as acknowledged in Jacobson 2012: fn. 12) that they are ignored in the computation of focus values. Her main argument against morphosyntactic approaches relies on the interpretation of paycheck pronouns such as *her* in (16) (roughly interpreted as *his spouse*): the gender restriction on *her* is ignored in focus computation even if it is not standardly bound by, and thus cannot acquire its features from the antecedent *Bill*[16] (see a similar argument in Bassi & Longenbaugh 2018[17]).

(16) For the departmental Christmas party, every faculty member was encouraged to bring their/his or her spouse. But only BILL brought **her**. (Jacobson 2012: 31)

Sauerland (2013) similarly proposes to derive bound readings of indexicals from a multi-tiered interpretation of focus, but extends the hypothesis to other presuppositions beyond gender and person features as shown in (17), and other constructions beyond focal ones as shown in (18).

(17) a. Sam only talked to **the** German$_F$ professor.
b. Only Mary is still a wait**ress**.
c. Only Romney expected him**self** to win.

(18) a. Lakoff dreamt that **he** was Brigitte Bardot.
b. The boys all were riding the bike **they** had recently bought.

Based on examples such as (17)a-c and (1a), Sauerland argues that presuppositions that can[18] be ignored in the interpretation of focus alternatives (i.e., that exhibit *weakened projection*, in Sauerland's terms) form a natural class: they are purely presuppositional triggers, that is, they contribute nothing but a presupposition.[19] According to Sauerland, this is mainly the case of φ-

assertion or a presupposition depending on the semantics adopted for *only*). Furthermore, following Rooth's hypothesis that the focus value of F-marked elements is a set of elements of the same semantic type (which can be pragmatically restricted), the combination of I_F with (15c) yields the set of propositions {x did x's homework, for $x \in D_e$} as focus value, which is ultimately quantified over by *only*.

[15] This encompasses constructions with bare contrastive stress, with focus particles like *only*, *too* or *also*, and – to some extent (due to speaker variation) – with ellipsis. However, Jacobson (2012) excludes from her investigation cases involving relative clauses because they contain no focal stress and because gender and person do not exhibit the same pattern depending on the order of the specificational sentence (see fn. 36).

(i) {a. **I** am / b. **Sue** is} the only one who handed in {a. **my** / b. **her**} homework on time.
(ii) The only one who handed in {a. **# my** / b. **her**} homework on time was {a. **me** / b. **Sue**}.

[16] Nevertheless, Jacobson (2012: 34) cannot explain why person features do not behave the same in this respect:

(i) # This year, everyone was supposed to bring their spouse, but only MICHAEL brought **me**.

[17] Bassi & Longenbaugh (2018) argue against morphosyntactic approaches on the basis of uninterpreted φ-features on donkey anaphora as in (i) where *I* can alternate with non-speakers (see discussion in section 3.1).

(i) Only the woman who is dating ME$_F$ says **I** make her happy.

[18] Unlike Jacobson, Sauerland considers focus values to be only optionally blind to the presuppositions contributed by φ-features. For instance, φ-features are interpreted in focus alternatives in *only Mary criticized HERself*.

[19] More precisely, Sauerland (2013: 162) first defines purely presuppositional triggers as identity functions on some domain that are a subset of the full set of entities of that type. As restricted identity functions of type <e,e>, φ-features fit this description. Sauerland (2013: 167) then adds a more general definition of pure presuppositionality that can apply to *self*, which is not a restricted identity function.

features (e.g., in (1a) and (17)a-b[20]) and *self* (e.g., in (17c)). For example, (17)a-b can involve alternatives including pluralities of professors or male waiters, respectively, because singular and feminine features need not be computed in focus values; as for (17)c, it exhibits a strict reading because the presuppositional contribution of *self* can be ignored in focus alternatives.[21]

Furthermore, Sauerland extends his approach to cases involving *de se* binding (e.g., (18a) where the referent of the *de se* pronoun *he* is female) and distributive binding (e.g., (18b) where all considered referents of *they* must be singular since each boy bought a different bike). His uniform account relies on the notion of pairs: just like focus alternatives can be conceived as a pair of the actual value and the focus alternative value, *de se* binding and distributive binding can be assumed to involve quantification over pairs: pairs of the real-world counterpart and the *de se* center on the one hand, and of the plurality and atomic parts thereof on the other hand. All interpretations in (17)-(18) derive from the hypothesis that presuppositions in some cases need only be verified for the first member of the paired evaluation. Thus, *he* and *they* are licensed in (18a-b) under a front-tier interpretation of the masculine and plural presupposition.

In sum, semantic approaches improve on morphosyntactic approaches by overcoming their main problems of parsimony. Instead of assuming both fake and real indexicals, they derive the uninterpretability of person features in bound indexicals from the constructions they appear in, which usually involve focus. Thereby, they can furthermore account for partial indexical binding without stipulation (see Bassi & Longenbaugh 2018). Nevertheless, semantic accounts also present some stipulative aspects. In particular, it remains unclear how to derive the blindness of focus values to the φ-features of bound pronouns. As we saw, while Jacobson (2012) stipulates it, Sauerland (2013) proposes to derive it from a general property of purely presuppositional triggers, which he claims need not be interpreted in all levels of multi-tiered interpretation.[22] But as discussed by McKillen (2016), several challenges are faced by Sauerland's hypothesis, which predicts that all and only purely presuppositional triggers can exhibit weakened projection in focus alternatives (and in the case of distributive and *de se* quantification[23]). First, examples like (17)a suggest that presuppositions of non purely presuppositional triggers such as the definite article (i.e.,

[20] In (17)a (from von Heusinger 2007; see also Walker 2012), Sauerland assumes that it is not the (uniqueness presupposition of the) definite article (which is not purely presuppositional), but a singular feature that exhibits weakened projection, based on the hypothesis that full DPs are always the complement of a φ-head. For cases where the plurality is not treated uniformly (e.g. Sam talked to some of the Japanese professors), Sauerland must further stipulate the existence of a fourth truth value to which *only* is sensitive.

[21] Sauerland (2013: 165) assumes that ⟦self⟧(P)(x)(y) presupposes that x = y and denotes P. In the ECM case in (17)c, Sauerland further assumes that the predicate for reflexive marking is created in the syntax by movement and λ-abstraction. Note that Sauerland claims that only ECM constructions trigger strict readings, which leads him to stipulate that the relevant level for projection weakening is the maximal syntactic head (since in Sauerland's account, *self* adjoins to different levels in ECM and simple transitive cases). But McKillen's (2016) experimental evidence shows that strict readings are in fact also available with simple transitive verbs.

[22] Several aspects of this hypothesis furthermore remain to be worked out. First, the formal definition of pure presuppositionality is not straightforward (see fn. 19; see also McKillen 2016: 114-115). Second, the notions of pair and front-tier interpretation on which Sauerland's analysis relies remain underspecified. In what exact sense do focus alternatives, distributive quantification and *de se* quantification involve the same notion of pair? From what general principle does the availability of a front-tier (vs. multi-tiered or rear-tiered) interpretation derive?

[23] The behavior of other presuppositional triggers in distributive and *de se* quantification is not examined by McKillen, nor by Sauerland, except for *self*. But note that Sauerland's general argumentation based on *self* is undermined by the problems raised by the underlying hypothesis that *self* involves predicate reflexivization: as shown by Sportiche (2023), this hypothesis is challenged by the fact that unlike predicates involving *herself*, overt *self*-predicates exhibit neither strict readings (see Charnavel & Sportiche 2021), nor *de se/de re* ambiguities.

its uniqueness presupposition) can be ignored in focus alternatives (see von Heusinger 2007). For that reason, Sauerland reanalyzes this example as involving weakened projection of a singular feature on the DP head (see fn. 20).[24] Even more problematically, some purely presuppositional triggers like *again*, *too*, *already* or *also*, can conversely be shown not to exhibit weakened projection (see Walker 2012, Bassi 2021: 51-53). For example, McKillen (2016: 117) argues that if the scope of *again* with respect to *only* is controlled for, the meaning of *again* (i.e., that an event satisfying the properties of its complement occurred previously) must be taken into account in focus alternatives: (19) is not felicitous if no one but John forgot their homework previously.

(19) Only JOHN$_F$ has **again** forgotten his homework.

Another generalization about weakened projection has been provided by Walker (2012) that attributes this property to soft presuppositional triggers, i.e., to triggers that can suspend their presupposition in some environments (such as disjunctions in which the presuppositions of the second disjunct are entailed by the negation of the first disjunct or contexts where the speaker is ignorant about the presupposition). For example, *again*, which behaves like a hard trigger in both contexts, does not weaken in focus alternatives; conversely, *stop* behaves like a soft trigger and does weaken. But as shown by McKillen (2016) (cf. Sudo 2012), this generalization cannot extend to φ-features, which do not pattern like soft triggers as shown by the contrast between *she* and *continue* in relevant disjunctions like (20).

(20) a. # Either this is a man or **she** has a really deep voice.
b. Either John went to the previous meetings or he will **continue** to miss meetings.

On the analytical side, the advantage of semantic approaches over morphosyntactic ones in terms of parsimony is thus reduced by the difficulty with defining the relevant class of presuppositional triggers subject to weakened projection. On the empirical side, the main advantage of semantic approaches consists in deriving cases of weakened projection in the absence of syntactic binding (see e.g. (16)). But the exact extent of relevant data remains controversial and poorly understood (see Jacobson 2012, Bassi & Longenbaugh 2018; see also section 3.1). Furthermore, semantic approaches do not seem to extend to relative clause constructions like (2b) (where focus prosody is absent, according to Jacobson) and cannot predict the role of agreement on indexical binding revealed by morphosyntactic analyses. Our goal in the next section is instead to propose an analysis that incorporates the insights of both approaches, i.e., that can derive the bindability of indexicals from the specificity of focus constructions while explaining agreement effects.

3. Proposal

On the one hand, our proposal adopts from semantic approaches the presuppositional account of person features and the hypothesis that focus plays a crucial role in indexical binding. But unlike semantic approaches, we propose to combine the two hypotheses not by assuming presupposition ignorance under some conditions, but by applying a general economy principle of presupposition

[24] McKillen (2016: 121) argues that the case of the definite article in (17)a does not in fact provide an argument about weakened projection because the interpretation of (17)a can be derived without supposing any kind of weakened projection: it can simply be assumed that the whole DP (instead of just the adjective) is F-marked despite the prosody (which seems reasonable since *professor* is given in the context).

unification as detailed in section 3.1. On the other hand, our proposal adopts from morphosyntactic approaches the hypothesis that relative clauses and focus constructions involving bound indexicals should be analyzed uniformly and verbal agreement plays a crucial role in indexical binding. But unlike morphosyntactic approaches, we propose to derive the relation between verbal agreement and indexical binding not from the uninterpretability of some person features, but conversely, by the interpretability of some verbal agreement as detailed in section 3.2.

3.1. Indexical binding in focus constructions: presupposition unification

As reviewed in section 2, all cases of indexical binding involve focus as long as we assume that ellipsis (see Rooth 1992, Merchant 2001, i.a.) and adjectival *only* (see Bhatt 2002, Bumford 2017, Bassi 2019 vs. Jacobson 2012, Coppock & Beaver 2013) also involve focus. Like semantic accounts, we thus hypothesize that focus plays a crucial role in licensing indexical binding. To specify it, we first capitalize on the uncontroversial assumption that the φ-features of F-marked elements are ignored in focus alternatives as shown in (21).[25]

(21) a. Only $\mathbf{I_F}$ left.
b. $[\![I_F]\!]^f = \{x \mid x \in D_e\}$

Example (21a) means that the other contextually relevant people did not leave. This interpretation implies that *only* quantifies over semantically unrestricted alternatives, i.e., that the person feature is not interpreted in the focus meaning of *I* (otherwise, it would be incorrectly predicted that it is a singleton set containing the speaker[26]) as shown in (21b) under a Roothian implementation. Coupled with the presuppositional account of φ-features, this observation suggests that the presuppositions of F-marked elements are ignored in focus alternatives.[27]

Second, we posit an economy principle enforcing presupposition unification in case of redundancy:

[25] This observation lies at the core of focus binding analyses of bound indexicals (see Bassi 2019, cf. Ke 2019). Like semantic accounts, this type of analysis assumes that person features are not fake; but instead of relying on weakened projection, it exploits the mechanism of focus co-indexation proposed by Kratzer (1991) to capture so-called Tanglewood sentences illustrated in (i).

(i) I only went to Tanglewood$_F$ because you did [~~go to Tanglewood~~$_F$]. (I didn't go to Block Island or Elk Lake Lodge because you did).

Thus, it is because bound indexicals are F-marked that their φ-features are not interpreted in focus alternatives. Although our proposal also exploits this idea, we do not review the focus binding account in detail here, because they face a fundamental challenge: focus co-indexation is conditioned by ellipsis in Tanglewood sentences, while bound indexicals in focal constructions are not elided. To reconcile the ellipsis condition with focus binding of indexicals, Bassi (2019) therefore has to stipulate that parts of bound indexicals are not pronounced.

[26] Unless we hypothesize that *only* quantifies over contexts, which is highly controversial (see Cable 2005, Charnavel 2023a for discussion). In any case, this hypothesis could not account for the general uninterpretability of φ-features of F-marked elements. For example, *only* ***she**$_F$ left* implies that all other contextually relevant individuals left (crucially, whether they are female or male).

[27] To our knowledge, this hypothesis has not been explored in depth: it is usually implicitly assumed without explanation that the focus meaning of F-marked elements is not constrained by φ-features. This is often implemented by the absence of φ-features on the trace left by movement of the focused element (e.g., *only I*).

(22) **Economy of Representation Principle (ERP)**: presuppositions must unify whenever possible, i.e., under binding or predication.[28]

This principle ensures that presuppositions are not coded more than necessary. Thus, when an indexical is bound by another indexical as in (23a), the indexical presupposition is represented only once.[29] The same holds of gender presuppositions under binding as in (23b) or in (23d) (thus, even in the absence of semantic effects) or under predication as in (23c).[30]

(23) a. Only **I** did **my** homework. [presupposition: the referent is the speaker]
b. Only **she** did **her** homework. [presupposition: the referent is female]
c. Only **Sue** is still a waitr**ess**. [presupposition: Sue is female]
d. No waitr**ess** did **her** job. [presupposition: all relevant waiters are female]

Under these hypotheses, bound readings of indexicals are directly derived: given that the indexical presupposition of the bindee (*my*) unifies with that of the binder (*I*) as schematized in (24), and that the binder is F-marked, the person feature is absent in focus alternatives.

(24) a. Only **1st-pro$_{1\text{-}F}$** did **1st-pro$_1$**'s homework.
b. only [[λx_e: **x is s$_c$**. x](g(1))]$_F$ did [[λx_e: **x is s$_c$**. x](g(1))]'s homework
c. only [[λx_e: **x is s$_c$**. x](g(1))]$_F$ [λx_e: **x is s$_c$**. x did x's homework] *predicate abstraction*
d. only [[λx_e: **x is s$_c$**. x](g(1))]$_F$ [λx_e. x did x's homework] *ERP*

This analysis presents the same advantages as semantic accounts over morphosyntactic accounts. First, it does not unparsimoniously distinguish between true and fake indexicals (as well as between locally and long distance bound indexicals[31]). Second, it derives partial indexical binding without stipulation. Third, it explains why indexical binding requires relevant placement of focus as observed by Bassi (2019, 2021) in (25) (see further discussion in section 3.2).

(25) a. *Why are they complaining?* **I$_F$** am the one who did not get {my / his} paycheck yet.
b. *I stop by at the HR lady's office. She doesn't recognize me and asks who I am.*
I am **[**the one who did not get {#my / his} paycheck yet**]$_F$**.

Furthermore, it does not present the stipulative aspect of semantic accounts: weakened projection of φ-features of bound pronouns (which we saw is hard to derived from a general, independently motivated principle of weakened projection) is here reduced to a principle of economy.

[28] Binding may be subsumed under predication under Heim & Kratzer's implementation of binding where the binder (e.g., *only I*) ultimately combines by functional application with the predicate created by its movement.
[29] This principle may be assimilated to a type of presupposition projection. Under Heim & Kratzer's implementation, it implies that the presupposition of a bindee not only projects under lambda abstraction (see fn. 13), but also under predication (see fn. 28) where it thus unifies with the presupposition of the binder.
[30] For simplicity, we here use the term *female* conventionally, but we do not mean to conflate sex and gender. Further note that we assume that not just pronouns, but also other DPs like some nouns (see e.g. Sudo & Spathas 2020) or proper names can carry gender presuppositions.
[31] It therefore predicts (contrary to Kratzer 2009, see fn. 10) that mixed readings are also available with long distance indexicals, and that locally and long distance bound indexicals can be combined. This seems promising:
(i) a. Only you know somebody who recommends **your** books to **your** librarian. (Kratzer 2009: (67))
b. You are the only one who bought **yourself** a suit that **you** don't like. (cf. Kratzer 2009: (63))

Finally, our account (like morphosyntactic accounts) does not make the same prediction as semantic accounts in the absence of binding: it only explains why person features are ignored when they can be unified, i.e. under binding or predication; on the contrary, semantic accounts predict the availability of weakened projection in the absence of binding or predication. As briefly mentioned, the data pertaining to this point remain empirically debated. As acknowledged by Bassi & Longenbaugh (2018), weakened projection overgenerates: the judgments of Jacobson's example in (26a) are controversial, and (26b) is clearly infelicitous.

(26) a. ? Only Bill brought her (i.e., his spouse). cf. (16)
b. # Only Michael brought me (i.e., his spouse). cf. fn. 16

But two further types of examples that are correctly predicted by semantic accounts seem to be undergenerated by ours (see Bassi & Longenbaugh 2018, Bassi 2021):

(27) a. Only the woman who is dating **ME$_F$** says **I** make her happy. cf. fn. 17
b. *Everyone was encouraged to bring their spouse.* But only Michael brought his **wife**.

As argued by Bassi & Longenbaugh (2018) and Bassi (2021), both types of examples are available even in the absence of focus on the bolded element (*pace* Jacobson 2012 for (27b)). This excludes an analysis in terms of complex focus. Additional principles (to be further investigated) are thus required under our approach: (27a) can be explained if we assume movement of *me* to a position c-commanding *I* capitalizing on island-violating movements being licensed under some conditions (cf. Sportiche 2020); (27b) may motivate projection weakening targeting not-at-issue content (here, the wife's gender), consistent with appositives as in (28) not being computed in focus alternatives.[32]

(28) But only Michael brought his spouse, **who by the way is a woman**.

3.2. Indexical binding in relative clause constructions: presuppositional agreement

Another crucial difference between morphosyntactic and semantic approaches in favor of the former pertains to the role of verbal agreement: as we reviewed in section 2, only (some) morphosyntactic accounts derive the observed partial correlation between indexical binding and verbal agreement. On the basis of novel French data, we here propose to derive it under a semantic approach by attributing semantic effects to some verbal agreement.

First, as discussed in Sportiche 2016, we observe that verbal agreement can have semantic effects independently of indexical binding as in (29) involving a quantitative subject triggering various agreement possibilities: syntactic agreement with the singular head DP (*une majorité* 'a majority') and semantic agreements with the plural embedded DP (*nous* 'us').

(29) Une majorité d' entre nous { est / sont / sommes } à Bochum.

[32] This principle does not equate with that of semantic accounts. First, φ-features of bound pronouns do not have the same not-at-issue status as gender inferences triggered by *wife* or *woman* in (27b) or (28), as suggested by the difference between (28) and (i). Second, not-at-issue content to be ignored in focus alternatives can be different from φ-features or independently known presuppositions (see (ii)).
(i) Only I did someone's homework, which by the way was mine.
(ii) Everyone was supposed to bring their pets. But only John brought his **dog**.

A majority of among us is are-3P are-1P in Bochum
'Most of us are in Bochum.'

Crucially, 1st person agreement in (29) induces an interpretation under which the speaker has to be included in the group in Bochum, while the speaker herself need not be in Bochum (but only her group, e.g., her colleagues) if 3rd person agreement is used. We therefore hypothesize that (at least in cases where there are several agreement possibilities) 1st person verbal agreement induces the presupposition that the referent of the subject includes the speaker. Furthermore, 3rd person plural agreement is dispreferred if the speaker is included in the group in Bochum. For that reason, we assume that 3rd person agreement triggers the anti-presupposition that the speaker is not included in the group in Bochum (see Sauerland 2008 on implicated presuppositions). As for 3rd person singular agreement, it is compatible with either interpretation and can thus be assumed to be the default, grammatical agreement.

Second, we observe that verbal agreement affects indexical binding in French, more clearly so than in German because French licenses two types of agreement in relevant relative clauses:

(30) a. Je suis le seul qui {i. **suis** /ii. # **est**} fier de **mes** enfants.
I am the only_one who am is proud of my kids
b. Je suis le seul qui {i. # **suis** /ii. **est**} fier de **ses** enfants.
I am the only_one who am is proud of his kids
'I am the only one who is proud of {my/his} children.'

Unlike German or English (but like Hebrew or Farsi, see Bassi 2019, Ivan & Mirrazi 2019), French allows for optional 1st (or 2nd)-person agreement in subject relative clauses such as (30). And crucially, the type of agreement correlates with the type of reading: bound readings are only available if the person agreement on the verb matches the person of the bindee.[33] These facts follow from our hypotheses: given that verbal agreement triggers presuppositions on the subject, binding (which requires match in presuppositions) by the subject (the trace of the relative pronoun) is only licensed if the bindee carries the same presupposition; and crucially note that under the relevant interpretation, direct binding by the matrix subject is banned by Rule H.

Now, what regulates the variation between 1st and 3rd person agreements here? We hypothesize that it results from a complex interaction between copular sentences, relativization and focus. 1st person agreement implies that the head of the relative clause (*le seul* 'the only one')[34] can carry a 1st person feature under some conditions (because of underspecification). This is possible only when it has no overt head noun (vs. (31a), cf. Bassi 2018) and (possibly due to binding conditions B or C) when it is predicated of a 1st person subject (vs. (31b), cf. Ivan & Mirrazi 2019).

(31) a. Je suis le seul **étudiant** qui {i. * **suis** / ii. est} content.
I am the only_one student who am is happy
b. Je **vois** le seul qui {i. * **suis** /ii. est} content.
I see the only_one who am is happy

[33] We here report our own judgments, but note that there seems to be some cross-speaker variation (possibly due to the prescriptive norm enforcing 1st person agreement) to be further investigated as planned in our SNSF project.
[34] Regarding gender agreement, note that the article (*le vs. la*) is marked for gender (the adjective *seul(e)* is not), but indexical binding is nevertheless licensed (cf. Bassi 2018) *pace* Wurmbrand's generalization (see fn. 7).

'I {a. am / b. see} the only {a. student / b. one} who is happy.'

Moreover, 1st person agreement obtains only in some copular sentences (cf. Bassi 2019 for Hebrew): unlike binding, predication does not require match in person features (cf. *Je suis Isabelle* 'I am Isabelle'), but the choice of person feature depends on the type of predication and information structure: 1st person features are only acceptable in cases of specificational (vs. predicational) structures (as for reasons that remain unclear, predicates cannot carry 1st feature as independently observed for adjectives) and when the subject is focused (for reasons to be elucidated).[35]

(32) a. *Who are you?* Je suis [celle qui {i. * **suis** / ii. **est**} française]$_F$
I am the_one who am is French

b. *Who is the one who is French?* Je$_F$ suis celle qui {i. **suis** /ii.? **est**} française.
I am the_one who am is French

Crucially, it is this focus on the subject that licenses indexical binding in (30a) (cf. (25)) under binding of the embedded subject (the trace) by the matrix subject, due to our ERP principle.[36]
Thus, focus also plays a crucial role in relative clause constructions just as in focal constructions. But the relation between focus, indexical binding and *only*, we assume, is here indirect. Adjectival *only* is focus sensitive in the same way as superlatives (see Bhatt 2002, Bumford 2017, i.a.). But following Charnavel (2023b), we assume that the domain of comparison in our relative clause constructions is not determined by focus, but by the subordinate clause (the DP in (30) roughly corresponding to *the only one among those that are proud of their children*; incidentally, this explains why 3rd person agreement is available despite its implicated presupposition, as alternatives do not involve the speaker[37]). Focus is induced by the specificational construction, which is favored by the presence of *only* (because it can provide the variable that needs to be specified).[38]

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[35] This last point is supported by the unavailability of 1st person agreement when the subject is unfocusable:

(i) Il **me** considère (comme) celle qui {* **suis** / est} française.
he me considers as the_one who am is French

Both points may be tied together as specificational sentences involve focus on the value element (Heycock 2012).

[36] The possibility of binding is supported by (ia), and the binding requirement by (i)b (cf. Jacobson 2012). Note that in (ib) (an inverted specificational construction), it may anyway be the case that *le seul* cannot carry 1st person features because the pre-copular constituent is not an individual (but a predicate or an intensional object, see Heycock 2012, i.a.). This hypothesis and the difference between person and gender features in this respect may explain the contrast with (ii), which does exhibit a sloppy reading (cf. Jacobson 2012, see fn. 15).

(i) a. Chaque mère est la seule qui est fière de **ses** enfants.
Each mother is the only_one who is proud of his kids

b. Le seul qui {i. * **suis** /ii. # **est**} fier de **mes** enfants, c' est moi.
the only_one who am is proud of my kids it is me

(ii) La seule qui est fière d' **elle**, c' est Marie.
the only_one who is proud of her it is Mary

[37] In this respect, note that several constructions exhibiting variable 1st or 3rd person agreement involve focus:

(i) a. Seul moi { suis / % est} fier. b. C' est moi qui { suis / % est} fier.
only me am is proud it is me who am is proud

Under our approach, this follows from the fact that focus alternatives do not involve the speaker, which satisfies the anti-presupposition of 3rd person. Also note that tonic (non-nominative) forms of the pronouns usually trigger 3rd (vs. 1st/2nd) person agreement (see Heycock 2012). This also holds for English (*me* vs. *I*).

[38] Alternatively, we could suppose that *only* induces focus within the relative head or on its trace of (as sometimes proposed for absolute superlatives – when analyzed like relative superlatives – see Bhatt 2002, Romero 2011; cf. Bassi 2019). But this analysis poses independent problems (see, e.g., Charnavel 2023b) and cannot derive (25).

In sum, French reveals that one condition for triggering indexical binding in relative clauses is the availability of indexical feature on the relative head, which depends on the type of head noun and copular construction.[39] But what regulates crosslinguistic variation in verbal agreement? It seems to rely on an independent difference (to be further understood) in the availability of person agreement in relative clauses in general: French *moi qui {suis/?est}* contrasts with English *I who {?am/is}* and German *ich die {*(ich) bin/*ist}* (see Ito & Mester 2000, Bassi 2021). Configurations under which indexical binding is possible, which require indexical agreement in French, thus involve 3rd person agreement in English. In German, they are precluded (which explains the unavailability of indexical binding) unless the pronoun is repeated in the relative (see Wurmbrand 2017b) or in the 1st person plural, which is remarkably the only pronominal form to license relatives without pronoun repetition (*wir, die sind*, Ito & Mester 2000).

4. Conclusion

Under our approach, indexical binding results from two independent principles: a principle of economy enforcing presupposition unification, and a principle of focus interpretation ignoring presuppositions of F-marked elements. Furthermore, correlations between indexical binding and verbal agreement follow from possible semantic (presuppositional) effects of agreement. We can thus maintain a uniform, semantic (presuppositional) analysis of 1st/2nd person pronouns mainly in line with Kaplan's theory of indexicals.

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[39] Under our approach, this should also hold for long distance bound indexicals (cf. fn. 31), which seems correct;

(i) Je suis le seul qui { suis/ ? est} content que ma mère vienne.
I am the only_one who am is happy that my mother come

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Varieties of indefinites in Cantonese[1]

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Abstract. We focus on the semantics of three types of Cantonese nominal constructions that can refer to indefinite referents. We argue that the indefinite interpretation is derived by a different semantic mechanism in each construction. The evidence for this claim comes from the different behavior of these constructions in terms of their scope-taking characteristics and their (in)compatibility with specific indefinite interpretations. Specifically, we make the following claims: (i) [BARE N] phrases denote type $\langle e,t\rangle$ properties, and get an indefinite interpretation via type-shifting, (ii) [CL N] and [*jat1* CL N] phrases are choice-functional indefinites, and (iii) the choice-function variable in [CL N] phrases can be left unbound, allowing for definite as well as (specific) indefinite uses, depending on context.

Keywords: Cantonese, Indefinites, Choice Functions, Type-Shifting, Bare Nouns, Bare Classifiers.

1. Introduction

This paper focuses on three types of nominal expression in Cantonese, which we refer to as *bare noun phrases* [BARE N], *bare classifier phrases* [CL N], and *jat1 phrases* [*jat1* CL N]. All three constructions are compatible with indefinite interpretations. We argue that each type of nominal gets an indefinite interpretation via a distinct semantic route, the details and motivations of which are spelled out in sections 3 and 4. In section 2, we begin by laying the empirical domain of our study and give more details about each construction, including other interpretations available to each. Section 5 situates the current work within the literature on Cantonese nominal expressions, especially in the light of the indefinite or definite interpretation allowed by those constructions. Section 6 concludes, notably by laying the ground for future work on non-indefinite interpretations of these constructions.

2. Empirical domain

The sentences in (1) form a minimal triplet exemplifying the three constructions whose interpretations are the focus of this paper. As indicated by their translations, each of the target structures, highlighted in bold in the examples, is compatible with an indefinite interpretation, though each construction allows for additional interpretations which we also indicate in the translations.

[1]We would like to thank the audiences at the Meaning & Grammar Research Group of University of Edinburgh and Sinn und Bedeutung 28 for their invaluable comments on this work, as well as Teddy Robin for inspiration.

(1) a. Bare noun phrase ([BARE N])
我 有 **扇** 呀
ngo5 jau5 **sin3** aa3
1SG have fan SFP
'I have a/some fan(s).'

b. Bare classifier phrase ([CL N])
我 有 **把** **扇** 呀
ngo5 jau5 **baa2** **sin3** aa3
1SG have CL fan SFP
'I have a/the fan.'

c. *jat1* phrase ([*jat1* CL N])
我 有 **一** **把** **扇** 呀
ngo5 jau5 **jat1** **baa2** **sin3** aa3
1SG have JAT1 CL fan SFP
'I have a fan.'

As will become clear in the course of the paper, Cantonese does not have any element that can be described as a marker of definiteness akin to English *the*, French *le* • *la*, or any comparable element studied in the vast literature on (in)definiteness. Therefore, giving a definition of (in)definiteness in Cantonese is not straightforward, since those values cannot be defined on the basis of specific forms (though we eventually argue that one variety of indefiniteness is formally marked in Cantonese). There is ample debate in the literature about how to approach these notions semantically and pragmatically. Here, we will define (in)definiteness in terms of the status of the referent of a nominal expression. Essentially, we will consider a referent to be indefinite if it is not shared by the hearer. In other terms, and much in line with notions in dynamic semantics (e.g. Heim (1983); Groenendijk and Stokhof (1989); Kamp and Reyle (1993)), we take nominal expressions to be indefinite if their referent is newly introduced in the discourse (and thus to the hearer), irrespective of whether the speaker has a specific referent in mind.

On a related terminological note, when discussing the meaning of the constructions under study, we will discuss their *interpretations*, by which we mean the way a putative hearer is able to understand the informational status of the referent of the targeted nominal. We also discuss *indefinite uses* of these phrases, by which we mean their ability to be interpreted indefinitely. Crucially, what we are interested is whether particular constructions are compatible with particular kinds of contexts, especially in terms of the properties of their discourse referents. Thus when we mention that a nominal phrase has an indefinite interpretation or an indefinite use, this is to be understood as shorthand for the fact that the referent of that phrase can be interpreted indefinitely in a particular context. We use *reading* as a technical term that applies to the distinct meanings of a semantically (and often syntactically) ambiguous sentence. One goal of this paper is to argue that distinct interpretations of the constructions under consideration are not in general due to semantic or syntactic ambiguity, but rather to underspecification.

A final note: the judgments regarding (un)available interpretations reported in this paper are based on the intuitions of the second author, who is a native speaker of Hong Kong Cantonese.

In the following subsections we discuss the possible interpretations of each of the three constructions exemplified above in more detail, and provide attested examples of indefinite uses of each construction.

2.1. Bare noun phrases

[BARE N] phrases are often used for indefinite reference of an underspecified number. For example, the sentence in (1a) could be used in a context in which the speaker has bought one or more than one fan, and in which these fans are not familiar to the hearer. A corpus example is shown in (2), for which, in the context of the utterance, the speaker might have kept one rabbit or more as (a) pet(s).[2]

(2) 我 養.過 **兔仔** 啊
ngo5 jeong5.gwo3 **tou3zai2** aa3
1SG raise.EXP rabbit SFP
'I once kept a rabbit.' HKCanCorp (Luke and Wong, 2015)

[BARE N] phrases can also be interpreted as indefinite and non-specific. In (3), *pang4jau5* 'friend' does not refer to any specific individual, but to a class of individuals.

(3) 唔.鍾意 話 好似 賣 高 些少 嘅 賣 俾 人, 嗰啲
m4.zung1ji3 waa6 hou2ci5 maai6 gou1 se1siu2 maai6 gam2 bei2 jan4, go2di1
NEG.like say like sell high a.bit sell like to people those
好似, 好似 喺 **朋友** 身上 搵錢 嘅 嘅啫
hou2ci5, hou2ci5 hai2 **pang4jau5** san1seong6 wan2cin2 gam2 ge3 ze1
like like on friend body make.money SFP SFP SFP
'(I) don't want to be, like, selling it at a higher price, like ripping off a friend.' HKCanCorp (Luke and Wong, 2015)

When the referent is unique (e.g. astral objects), bare nouns often receive a definite interpretation. *Jyut6kau4* 'moon' in (4) is a bare noun and it receives a definite interpretation.

(4) 阿姆斯壯 喺 1969 年 登陸 **月球**
aa3mou5si1zong1 hai2 1969 nin dang1luk6 **jyut6kau4**
Armstrong in 1969 year land moon
'Armstrong landed on the moon in 1969.'

Finally, as shown in (5), bare nouns can also receive a kind or generic interpretation.

(5) 貓 食 老鼠
maau1 sik6 lou4syu2
cat eat mouse
'Cats eat mice.'

[2]Most of the examples in this section are taken from the HKCanCorp corpus of Luke and Wong (2015). This is indicated with each example.

2.2. Bare classifier phrases

[CL N] phrases can receive both indefinite and definite interpretations. With most classifiers (except for the classifier *di1*, which will be discussed below), [CL N] phrases are interpreted as singular. In (6) and (7), the noun phrases *zek3syun4* 'CL ship' and *zoeng1pei5* 'CL quilt' are both interpreted as singular indefinites.

(6) 即係 佢 會 有-有 **隻 船** 出海
zik1hai6 keoi5 wui5 jau5-jau5 **zek3 syun4** ceot1hoi2
that.is 3SG will have-have CL ship cruise
'…that is, they will have a ship cruising.' HKCanCorp (Luke and Wong, 2015)

(7) 誒, 我 攞 **張 被** 俾 你 啊!
ai1 ngo5 lo2 **zoeng1 pei5** bei2 nei5 aa1
Oh.dear 1SG bring CL quilt to you SFP
'Oh dear. I'll bring you a quilt.' HKCanCorp (Luke and Wong, 2015)

On the other hand, the noun phrase *gaa3ce1* 'CL car' in (8) would typically be given a singular definite interpretation. The listener is likely to interpret the car as being the only (unique) car that the speaker owns. However, if the speaker is known to own many cars, the indefinite interpretation becomes stronger than the definite interpretation. In (9) it is also the definite interpretation that is the most obvious.

(8) 我 賣咗 **架 車**
ngo5 maai6zo2 **gaa3 ce1**
I sell.PFV CL **car**
'I sold (the/my) car.'

(9) 你 喺 **個 海** 嗰度 你 梗係 着 泳褲 喇 , 唔係
nei5 hai2 **go3 hoi2** go2dou6 nei5 gang2hai6 zoek6 wing6fu3 laa1 m4hai6
2SG COP CL sea there 2SG of.course wear swimming.trunks SFP NEG.COP
着 乜嘢 啊 .
zoek6 mat1je5 aa3
wear what SFP
'If you're at the sea, of course you'll be wearing swimming trunks, if not, what else (would you wear)?' HKCanCorp (Luke and Wong, 2015)

For the purposes of our paper, we do not distinguish between sortal and measure classifiers (Ahrens and Huang, 2016), given that they do not differ in terms of how they affect the informational status of the referents of the targeted constructions.[3] Nevertheless, one classifier deserves special mention: the so-called 'plural classifier' *di1* (啲). Indeed, if we use that classifier instead of the sortal *gaa3* in (10), the phrase is interpreted as plural:

[3]This does not mean that we believe that the two types of classifiers necessarily have the same kind of semantics, e.g. in the mechanics of their atomizing and selection functions.

(10) 我 賣咗 **啲 車**
ngo5 maai6zo2 **gaa3 ce1**
I sell.PFV DI1 car
'I sold (the/my) cars.'

Contrary to the other classifiers, *di1* does not have selectional properties: it can combine with any noun, including mass nouns. Like many other markers of plurality cross-linguistically, *di1* is also semantically an inclusive plural. This can be seen in (11), where the sentence is compatible with situations in which the speaker's mother occasionally brings only a single fan back from her Kyoto trips.

(11) 我 阿媽 每次 去 京都 都 會 買 **啲 扇** 返嚟
ngo5 aa3maa1 mui5.ci3 heoi3 ging1dou1 dou1 wui5 maai5 **di1 sin3** faan1lai4.
my mother every.time go Kyoto PRT will buy DI1 fan back.come
'Every time my mother goes to Kyoto she brings back fans.'

2.3. *jat1* phrases

[*jat1* CL N] phrases are built by combining a classifier and noun with the term *jat1*, which at first glance corresponds to the numeral 'one'. Unlike bare nouns and bare classifiers, *jat1* phrases can only receive an indefinite interpretation, which can be either specific or non-specific. In (12), the speaker draws the hearer's attention to a new mosquito bite on the hearer and introduces it into the conversation, so that *jat1 dat3 man1laan3* 'one CL mosquito bite' is indefinite and specific.

(12) 嘩 你 隻 手 已經 摷到 -死 喇, 有 **一 笪 蚊** 嘴
waa3 nei5 zek3 sau2 ji5ging1 we2dou3 sei2 laa1 jau5 **jat1 dat3 man1laan3** laa3
wow you CL hand already scratch.to die SFP have JAT1 CL mosquito.bite SFP
'Wow, your hand is already scratched to... Geez, you have a mosquito bite.' HKCanCorp (Luke and Wong, 2015)

In (13), *jat1 coet1 hei3* 'one CL movie' is indefinite and non-specific, as the speaker is not referring to a particular movie, but describing a hypothetical situation.

(13) 即係 你 唔係 成日 睇 呢, 睇 **一 齣 戲** 呢, 就
zik1hai6 nei5 m4hai6 sing4jat6 tai2 ne1 tai2 **jat1 coet1 hei3** ne1, zau6
that.is 2SG NEG.be always watch SFP watch JAT1 CL movie SFP then
覺得 佢 好 正
gok3dak1 keoi5 hou2 zeng3
think 3SG very amazing
'...that is, you do not always watch a movie and instantly think it is amazing.' HKCanCorp (Luke and Wong, 2015)

Note that with most classifiers, a *jat1* phrase gives rise to a singular interpretation. When the classifier and noun are combined with other numerals, the cardinality changes accordingly, cf. (14).

(14) 我 有 **三 把 扇** 呀
ngo5 jau5 **saam1 baa2 sin3** aa3
1SG have three CL fan SFP
'I have three fans.'

In these cases, *jat1* can be considered to have its 'standard' numeral semantics, meaning 'one' (and getting the same range of indefinite interpretations available to other numerals). However, unlike other numerals, *jat1* can also be combined with the plural classifier *di1*, in which case the phrase is no longer singular. An example is given in (15) which involves reference to a plurality of doctors.

(15) 阿明 睇.過 **一 啲 醫生**
aa3ming4 tai2.gwo3 **jat1 di1 ji1sang1**
A-Ming see.EXP JAT1 DI1 doctor
'A-Ming saw a few doctors.'

As noted above, [CL N] phrases formed with classifiers other than *di1* are themselves necessarily singular. We thus consider the singular interpretation to stem from the use of the classifier itself (as in [CL N] constructions) rather than directly from the semantics of *jat1*, in spite of its relationship with the numeral 'one'. In short, we think *jat1* is ambiguous between a 'normal' numeral meaning and a formal element that, as we discuss in more detail below, gives rise to a particular variety of indefinite interpretation.

2.4. Summary

The observations above are summarized in table 1.

	Number	**Indefinite**	**Definite**
[BARE N]	Undersp.	✓	∼ (for unique ref.)
[CL N]	SG with sortal classifier	✓	✓
	PL with *di1* classifier	✓	✓
[*jat1* CL N]	SG with sortal classifier	✓	✗
	PL with *di1* classifier	✓	✗

Table 1: Summary of the possible interpretations for the three target nominal constructions

The table makes it clear that even though the three constructions differ in terms of their compatibility with singular, plural, and definite interpretations, they all share the possibility of being interpreted indefinitely. These indefinite interpretations and the details of their semantics are the focus of the rest of the paper.

3. Bare nouns get low-scope indefinite interpretations via type-shifting

This section contrasts the interpretative possibilities of [BARE N] phrases with those of [CL N] and [*jat1* CL N] phrases, arguing that the former are necessarily low-scope, while the latter are semantically compatible with a full range of scopal possibilities. These facts are laid out in section 3.1. The fact that [BARE N] gets only a low-scope indefinite interpretation is in line with cross-linguistic observations in the literature,[4] in which indefinitely interpreted bare nouns receive only low-scope interpretations, contra other types of indefinites. This fact in turn is derived by treating the indefinite interpretation of bare nouns as arising from a type-shifting rule, which applies in such a way that non-surface scope interpretations are never generated. The details of such a proposal are given in section 3.2. The semantic details of [CL N] and [*jat1* CL N] are taken up in section 4.

3.1. Bare nouns as low-scope indefinites

Empirical support for the low-scope restriction on [BARE N] indefinites begins with the behavior of the three constructions in negated sentences like the one in (16). The felicity of each construction was checked relative to a context in which the speaker failed to bring any fans at all (the low-scope context), and one in which the speaker brought some fans but failed to bring some other(s) (the wide-scope context). As seen in table 2, the bare noun is compatible only with a low-scope interpretation relative to negation, while the other two constructions receive only a wide-scope interpretation relative to negation.

(16) Negation and scope

我 冇 帶 ((一) 把) 扇 嚟
ngo5 mou5 daai3 ((jat1) baa2) sin3 lai4
1SG NEG bring ((JAT1) CL) fan come

	[BARE N]	[CL N]	[JAT1 CL N]
'I did not bring any fans.' (low scope)	✓	#	#
'There is a fan I did not bring.' (high scope)	#	✓	✓

Table 2: Scope possibilities for the three nominal constructions with descriptive negation (free translations meant as a way to indicate the target interpretation)

As already noted, we analyze the indefinite interpretation of bare nouns as deriving from a type-shifting rule that is required to apply locally, giving only a low-scope reading. Turning to the other two constructions, the *unavailability* of the low-scope interpretation we might analyze as deriving from competition with the (unambiguously low-scope) bare noun alternative. Assuming for the moment that the [CL N] and [*jat1* CL N] constructions are *semantically* compatible with both a low-scope and a high-scope interpretation, we might derive the *pragmatic*

[4] See e.g. Dayal and Sağ (2020) for discussion and references

unavailability of the low-scope interpretation through competition. Since the bare noun is unambiguously low-scope, and also less formally marked, the preference for its being used in the low-scope context seems reasonable from a pragmatic perspective.

However, examples like the one in (17) make this explanation untenable. Here, the nominal appears with an intensional predicate, and once again the bare noun is compatible with only a low-scope (i.e. *de se*) interpretation. The other two constructions are compatible with *both* low and wide-scope (i.e. *de re*) interpretations. Concretely, the low-scope interpretation is tested against a context in which A-Ming does not have particular marriage prospect in mind, but loves astronauts and wants whomever he marries to be one. The wide-scope interpretation is checked relative to a context in which A-Ming wants to marry a particular person, who happens to be an astronaut, despite A-Ming being unhappy with that career choice (it being more dangerous than A-Ming would prefer). The judgments relative to these contexts are summarized in table 3.

(17) Scope with intensional predicates

阿明 想 娶 ((一) 個) 太空人
aa3ming4 soeng2 ceoi2 ((jat1) go3) taai3hung1jan4
A-Ming want marry ((JAT1) CL) astronaut

'A-Ming wants to marry an astronaut.'

	[BARE N]	[CL N]	[JAT1 CL N]
'A-Ming loves astronauts.' (low scope)	✓	✓	✓
'A particular person happens to be an astronaut.' (high scope)	#	✓	✓

Table 3: Scope possibilities with an intensional predicate

Thus, rather than a more general competition with the bare noun construction (which would lead, incorrectly, to a prediction that they would be infelicitous with low-scope interpretations in (18)), we think that, like English indefinites headed by 'some', [CL N] and [*jat1* CL N] are subject to a PPI-like restriction on their distribution, leading to incompatibility with low-scope interpretations in sentences with negation like (17). We leave to future research further explication of this restriction.

Turning to sentences with universal quantification and modality, the contrast seen in (16) and (17) seems to disappear:

(18) a. Universal quantifier

個個人 都 睇咗 ((一) 本) 書
go3go3jan4 dou1 tai2zo2 jat1 bun2 syu1
every.person all read.PRF ((*jat1*) CL) book

'Everyone read a book.'

b. Modal
我 要 喺 星期日 之前 睇 ((一) 本) 書
ngo5 yiu3 hai2 sing1kei4jat6 zi1cin4 tai2 jat1 bun2 syu1
I need by sunday before read ((*jat1*) CL) book
'I have to read a book by Sunday.'

In these two examples, we can imagine a context in which the particular book (to be) read is not specified; in (18a) each person can have read a (potentially) different book, and in (18b) the speaker is able to choose what book they will read. These are the low-scope contexts, and all three constructions are compatible with these contexts. Alternatively, we might be in a wide-scope context, where there is a particular book that everyone read, or in which there is a particular book the speaker must read. Again, all three constructions are compatible with these contexts. In other words, there seems to be no distinction in these examples between the three constructions.

To account for the contrast in judgment patterns between the examples in (18) and those in (16-17), we argue that the apparently 'wide-scope' interpretation of the bare noun in (18) is an illusion. Semantically, as suggested above, we propose that [BARE N] phrases are *always* low-scope, resulting from the inherently low-scope semantics of indefinite type-shifting. In (16), the semantics of [BARE N] results in a truth-conditional incompatibility with the wide-scope context. The semantics of [BARE N] here requires that there not exist any fan that the speaker brought. The wide-scope context is one in which the speaker has brought at least some fans, but not all. The low-scope semantics of [BARE N] thus gives rise to falsity in this context, and hence the sentence is incompatible with this interpretation. Similarly in (17), we take it that a low-scope indefinite *reading* is necessarily interpreted *de se* with respect to the intensional predicate. To get a *de re* interpretation like that implied by the wide-scope context, we require (by hypothesis) the indefinite to scope over the intensional predicate. Bare nouns are thus predicted, correctly, to be incompatible with wide-scope/*de re* interpretations.

But this truth-conditional incompatibility does not hold for the examples in (18). The low-scope semantics of the bare noun construction will not lead to falsity in wide-scope contexts here (i.e., ones where there is a particular book that everyone read, or in which there is a particular book the speaker must read). Another way to say this is that the wide-scope *reading* of such a sentence would *entail* the low-scope reading; as such, any situation verifying the wide-scope reading will also verify the low-scope reading, and thus the low-scope semantics posited for the bare noun construction will be true in any situation where a wide-scope semantics would be true.

If we alter the examples in (18) in such a way that the the wide-scope reading no longer entails the low-scope reading, then our original contrast reemerges. This is exemplified by example (19), about which the judgments given in table 4 mirror those in table 3.

(19) 阿明 要 娶 ((一) 個) 美國人
aa3ming4 jiu3 ceoi2 ((jat1) go3) mei5gwok3jan4
A-Ming need marry ((JAT1) CL) american
'A-Ming has to marry an American.'

	[BARE N]	[CL N]	[JAT1 CL N]
'Marrying an American is A-Ming's only solution to stay in the USA.' (low scope)	✓	✓	✓
'A-Ming has been engaged at birth with an American.' (high scope)	#	✓	✓

Table 4: Scope possibilities for the three nominal constructions with an intensional predicate as in (19)

3.2. Formal analysis: bare nouns and type-shifting

We begin our analysis by positing that nouns in Cantonese denote number-neutral properties. That is, a noun N will denote a type $\langle e,t\rangle$ property $P*$ that is true of any atomic individual for which $P(x)$ holds, as well as sums of such individuals. Cantonese nouns are thus in effect inclusive plurals (cf. the discussion and references in Little et al. (2022)). This kind of denotation applies straightforwardly to bare nominals in predicate position, where they take the type e subject referent as argument. Since the property is number-neutral, the subject referent can be either singular (20a) or plural (20b):

(20) a. 我 係 道士
ngo5 hai6 dou6si2
1SG COP daoist.priest
'I am a Daoist priest.'

b. 我哋 係 道士
ngo5dei6 hai6 dou6si2
1PL COP daoist.priest
'We are Daoist priests.'

Kind readings (which are beyond the scope of this paper) can be derived through type-shifting, using the down operator $\cap$ of Chierchia (1998):

(21) For any property P and world/situation s,
$$\cap P = \begin{cases} \lambda s\, \iota x[P_s(x)], \text{ if } \lambda s\, \iota x[P_s(x)] \text{ is in the set of worlds,} \\ \text{undefined otherwise.} \end{cases}$$
where P_s is the extension of P in s.

In our analysis, low-scope existential readings of bare nouns are also derived by type-shifting. One concrete option from the literature is to use the Derived Kind Predication (DKP) rule of Chierchia (1998) (see Deal and Nee 2018 for an accessible overview and summary). Since we treat Cantonese nouns as type $\langle e,t\rangle$ properties, this would be a two-step process, whereby the $\langle e,t\rangle$ property would first be type-shifted to a kind-denoting type e individual, using Chierchia's down operator $\cap$. When fed to a non-kind-selecting predicate, we would then apply the DKP rule in (22a), which involves mapping the kind back to a property using the complementary operator $\cup$, defined in (22b). This results in a lowest-scope indefinite interpretation, under the

assumption that type-shifting rules like DKP apply as locally as possible (see Chierchia 1998 and Krifka 2003 for discussion).

(22) a. Derived Kind Predication (DKP)
If P applies to objects and k denotes a kind, then $P(k) = \exists x[^{\cup}k(x) \wedge P(x)]$

b. Let d be a kind. Then for any world s,
$^{\cup}d = \begin{cases} \lambda x\,[x \leq d_s], \text{ if } d_s \text{ is defined} \\ \lambda x\,[\text{FALSE}] \text{ otherwise.} \end{cases}$
where d_s is the plural individual that comprises all of the atomic members of the kind.

The route mapped above is a rather circuitous one, and has been criticized by Krifka (2003), who argues instead that indefinite bare nouns (which for him denote properties, as here) are derived directly by an existential type-shifting rule (cf. Partee 1987), to resolve type clashes when a type $\langle e,t\rangle$ nominal appears in a type e argument position. To ensure a low-scope semantics, the existential type-shift operation is, like DKP above, required to apply maximally locally (or, procedurally speaking, as late possible in the derivation).

As far as we can tell, either of the two paths above will get us where we need for Cantonese, although we think Krifka's is approach is more straightforward. We could even (as noted by Krifka 2003) follow van Geenhoven (1998) and have type-shifting apply to the predicate instead, again resulting in a low-scope existential interpretation. For us, the important points are (i) nouns denote type $\langle e,t\rangle$ properties, and (ii) [BARE N] in argument position is interpreted via type-shifting, which in the case at hand leads to a necessarily low-scope indefinite interpretation. There are of course other type-shifting options available. As already noted, the $^{\cap}$ operator can be used to give a kind interpretation. [BARE N] can also receive a unique definite interpretation, as noted in the previous section. We take this interpretation to be derived by type-shifting as well, but leave details for future research.

4. Classifiers and choice functions

The interpretative possibilities seen so far empirically distinguish [BARE N] phrases on the one hand from [CL N] and [*jat1* CL N] phrases on the other. We have seen that [CL N] and [*jat1* CL N] phrases show two systematic differences with [BARE N] phrases. First, [CL N] and [*jat1* CL N] exhibit a number restriction. With a 'standard' classifier (that is, a classifier that would be used in a numeral construction), the interpretation is necessarily singular, in contrast to [BARE N], which is number neutral. A weak plural interpretation can be generated for [CL N] and [*jat1* CL N] phrases by instead using the 'plural' classifier *di1*, which is not possible in a numeral construction. Second, [CL N] and [*jat1* CL N] have been seen to exhibit a full range of scopal possibilities, with the exception that they cannot appear under the scope of negation, which we attributed to a positive polarity effect. We take these two differences (number and scope) in turn, and sketch an analysis of [CL N] and [*jat1* CL N] phrases that accounts for these differences. Space limitations prevent us from rendering the sketch fully, an enterprise we plan to undertake in future work.

4.1. Number properties

We take it that classifiers in Cantonese combine, syntactically and semantically, with nouns, with Cantonese thus being a 'classifiers-for-nouns' language (see Little et al. (2022) for a cross-linguistic discussion). Space limitations prevent us from justifying this stance in detail, but the very existence of [CL N] phrases is good preliminary evidence for this view (since we would otherwise need to posit a null numeral in these structures). The fact that [CL N] and [*jat1* CL N] phrases with standard classifiers are necessarily singular we take to be a function of the semantics of the classifiers themselves. Following Bale et al. (2019) and Little et al. (2022), we take it that classifiers in Cantonese have an 'atomizing' function, taking the number-neutral property denoted by its nominal complement and returning the set of atoms, in effect making the denotation singular. In a numeral classifier construction, this atomizing is a necessary ingredient to allow for counting (following Bale et al. (2019), who adopt the theory of numerals proposed by Ionin and Matushansky (2006). Here, however, where no numerals are used, the effect is simply to make the resulting set atomic, and thus singular. [CL N] and [*jat1* CL N] phrases in Cantonese thus provide evidence for this approach to the semantics of classifiers in their canonical use in numeral classifier constructions.

As discussed earlier, [CL N] and [*jat1* CL N] phrases with the 'plural' classifier *di1* are interpreted as (weak) plurals. The classifier *di1* is unusual in that (i) it cannot be used with numerals, and (ii) it does not select for noun type (i.e. it does not really 'classify' the nouns at all). These properties, we posit, are linked to the semantic plurality that *di1* marks in bare classifier constructions. Given that atomization is necessary for counting in Cantonese (again following the proposals in Bale et al. (2019) and Little et al. (2022)), a 'plural' classifier (which does not restrict its complement to a set of atoms) will not be useable for counting. Moreover, given that the 'classification' function of classifiers (i.e. their sensitivity to the semantic class of the noun with which they can be combined) is itself related to this atomizing function, a non-atomizing classifier such as *di1* will be useable with all types nouns.

Semantically, then, we think that in both [CL N] and [*jat1* CL N] phrases, the classifier combines with a type $\langle e,t \rangle$ noun (which denotes both atoms and sums), and returns either (i) the subset of atomic entities, in the case of a standard sortal classifier, or (ii) the original set, in the case of *di1* (we put aside the semantics of measure classifiers here). Note that this proposal makes *di1* semantically null, with its function presumably a syntactic one, given that these constructions syntactically require a classifier.

4.2. Scope properties

We have already seen that [CL N] and [*jat1* CL N] phrases have a range of scopal interpretations available. Turning to sentences involving scope islands, we find that both [CL N] and [*jat1* CL N] can receive island-violating wide-scope interpretations, as illustrated in (23).

(23) 如果 你 上完 ((一)個) 課程, 你 就 會 畢到業
jyu4gwo2 nei5 soeng5jyun4 jat1 go3 fo3cing4, nei2 zau6 wui5 bat1dou2jip6
if you take.finish JAT1 CL course you then will able.to.graduate

'If you finish a course, you will be able to graduate.'
'Any one will do.' ([BARE N],[CL N], [*jat1* CL N])
'But I don' t know which course it is.' ([CL N] or [*jat1* CL N])

The relevant contexts here are one where the addressee can graduate if they finish any course (the low-scope context), and one where there is a particular course they have to finish in order to graduate (the wide-scope context). All three constructions are compatible with the low scope interpretation, although this interpretation seems to be marked/dispreferred for [CL N]. For the wide-scope interpretation, the impossibility of [BARE N] is as expected. Both [CL N] and [*jat1* CL N] are compatible with the wide scope interpretation, showing that both of these constructions can be given island-violating scopal interpretations.

The example in (24) shows that the antecedent of the conditional in (23) is indeed an island for quantifiers in Cantonese. Here, a universally quantified noun phrase appears in the antecedent of the conditional, and only the low-scope interpretation is possible.

(24) 如果 你 上完 每 個 課程, 你 就 會 畢到業
jyu4gwo2 nei5 soeng5jyun4 mui5 go3 fo3cing4, nei2 zau6 wui5 bat1dou2jip6
if you take. every CL course you then will able.to.graduate
'If you finish every course, you will be able to graduate.'

To account for the exceptional scope-taking properties of [CL N] and [*jat1* CL N], we argue that their indefinite interpretations are derived via choice functions, inspired in particular by the foundational of Reinhart (1997), Winter (1997), Kratzer (1998), and Matthewson (1999), as well as that of Fodor and Sag (1982). Space considerations prevent us from going deeply into the technical details of the analysis. Intuitively, the idea is this: a choice-functional indefinite is derived by having a choice function variable, f, apply in-situ to a set-denoting NP. This variable is of type $\langle et, e\rangle$, and returns some entity from the set characterized by the NP.[5]

Up to this point, the literature cited above is in broad agreement. Analyses diverge in terms of what subsequently happens to this variable. For Reinhart and Winter, f is existentially bound, with binding occurring freely at different scope positions. This gives rise not only to wide-scope indefinite readings, including the apparently island-violating ones, but to low and intermediate scope readings as well. For choice-functional indefinites in St' át' imcets, Matthewson argues that only wide-scope interpretations are available, and thus that only wide-scope existential binding of the choice function variable is possible. Finally, Kratzer argues that the variable is not bound at all, but is left free, giving rise to a specific/referential indefinite interpretation (cf. Fodor and Sag (1982)). Another point of difference involves the question of ambiguity. Both Reinhart and Kratzer argue that English indefinites are ambiguous between a choice-functional and quantifier semantics, while Winter argues for a uniform choice-functional account of English indefinites.

Turning back to Cantonese, we propose that [CL N] and [*jat1* CL N] are both uniformly interpreted via choice function variables, and that these variables can be existentially bound at

[5]Slightly more technically: A function f is a choice function just in case for any non-empty set S, $f(S) = x$ for some x, where $x \in S$. There are technical issues that arise in case S is empty, which we set aside; see Winter (1997) for details and one solution.

any point, giving rise to various scopal possibilities, including the island-violating wide-scope interpretations seen above. To make things concrete, we posit a two-step process, whereby the classifier first combines with the noun phrase, deriving number distinctions, with the resulting phrase then being fed to a choice function variable. In the [*jat1* CL N] construction, we might treat *jat1* itself as the formal reflex of this variable, while in the [CL N] construction the variable is phonologically null.[6] Similar to Reinhart (1997) and Winter (1997), we posit that existential binding of the choice function variable can take place freely in Cantonese, giving rise to a range of scopal possibilities, including the island-violating ones.

4.3. Deriving the definite interpretation of bare classifier phrases

As noted in section 2, [CL N] phrases can be interpreted definitely as well as indefinitely. They thus contrast with [*jat1* CL N] phrases, which can only be interpreted indefinitely. Previous literature (a.o. Cheng and Sybesma (1999); Jenks (2018) which we review in the next section) has posited various analyses to derive the definite interpretation(s) of [CL N] phrases. Despite their differences, one thing these proposals share is the assumption that the definite interpretation(s) associated with [CL N] phrases is derived from a definite *semantics*; that is, [CL N] phrases are assumed to have one or more definite *readings*, which would make definitely interpreted [CL N] phrases at least two-ways ambiguous, with distinct indefinite and definite semantic readings derived from distinct semantic and/or syntactic structures. We close this section by suggesting an alternative, according to which the choice-functional semantics sketched above can uniformly derive both indefinite and definite interpetations of [CL N] phrases, with no need for positing any semantic or syntactic ambiguity.

With *jat1*, the choice function variable *must* be existentially bound, deriving the fact that [*jat1* CL N] phrases can receive *only* an indefinite interpretation.[7] We can thus think of *jat1* as a way of marking the existential closure of the choice function variable. For [CL N] phrases, we propose that existential binding is *optional*; it *can* be bound, and at all the same locations as can [*jat1* CL N]. But it need not be. When left unbound, we get (following Kratzer 1998) a specific/referential interpretation. In some contexts (namely, those in which the addressee is understood not to be familiar with the individual picked out by the choice function, or with the choice function itself), this specific interpretation will be indefinite. As Kratzer puts it, the value is "often intended by the speaker, but not revealed to the audience." But nothing in the semantics forces an indefinite interpretation.

We propose that the definite interpretation is just a pragmatic variant of the specific indefinite interpretation, reflected in contexts where the referent returned by a free choice function variable is familiar to both the speaker and the addressee. We leave the formal details to future work, but we are inspired here by von Heusinger (1997), who treats both definites and indefinites as term-denoting (type e) expressions, doing so through the use of choice functions. Roughly, in both cases a type $\langle e,t\rangle$ NP is converted to a type e expression by a choice function f. The definite/indefinite distinction, signaled in English by the choice of 'the' versus 'a', is

[6] We might instead take the classifier itself to contribute this variable (thus converting the NP from a property to an individual).

[7] More generally, true numerals (including *jat1* when functioning as a numeral) seem to come with this meaning component, driving the fact that numeral phrases in Cantonese are interpreted indefinitely.

handled (in a dynamic semantics) by resolving the choice function to an existing globally specified choice function (in the case of definites), or locally introducing a new choice function (in the case of indefinites) which then updates the global choice function.

In a language like English, we follow the proposal in Heim (1990, 2011) that the definite interpretation of an indefinite is blocked by the existence of the definite article. Since (contra literature we discuss in the next section) we propose that Cantonese lacks a definite article (overt or covert), there is nothing to prevent a choice-functional (type *e*) 'indefinite' from getting a definite interpretation (i.e. from being associated with a hearer-familiar specific referent). In short, the choice-function variable in [CL N] phrases can be left unbound, and in this case we get a specific referential interpretation that is underspecified for definiteness.

5. Previous analyses of Cantonese nominal expressions

Previous analyses of Cantonese nominal expressions have largely focused on the [CL N] construction, and on their definite, rather than indefinite, interpretations. We think this is because bare classifier constructions are one of the (many) areas where Cantonese differs strikingly from Mandarin. Though the construction is very frequent in Cantonese, it is rare and much more constrained in Mandarin.

Cheng and Sybesma (1999, 2008) are among the first authors to discuss the case of Cantonese nominal phrases from a formal perspective.[8] The core of their argument is that [CL N] phrases are syntactically ambiguous. Those that are interpreted as indefinites are Numeral Phrases with an empty numeral head which provides an existential quantifier (this also applies to indefinite bare nouns, which, in addition, have an empty classifier head). Definite [CL N] phrases are instead Classifier Phrases, in which the classifier essentially functions like an ι operator.

Wu and Bodomo (2009) treat the problem differently. In their account, the classifier always moves to the head of a DP in [CL N] phrases. Since a [CL N] phrase always has the same structure, definiteness does not come from any syntactic differences, as Cheng and Sybesma (1999) argue, but is "contextually constrained" (p. 495). Specifically, they claim the following: "(the definite interpretation) arises (a) when the referent has already been mentioned in the discourse context... (b) if not, the referent must be close by, so that the hearer can easily identify the referent." (p. 495-496). Though that characterization is probably too restrictive (e.g. definite [CL N] can be accommodated), it is close in spirit to our approach.

Li and Bisang (2012) offer a view that comprises a pragmatic, syntactic, and semantic perspective. They first argue that the information structure and word order of Chinese languages force the preverbal NP to receive a definite reading, a hypothesis that we fully subscribe to. Syntactically, they argue that an indefinite [CL N] is maximally a CLP, which deviates from the proposal of Cheng and Sybesma (1999). A definite [CL N], on the other hand, is a DP, in which the classifier has moved to the head of the DP, as in the analysis of Wu and Bodomo (2009). This is facilitated by the fact that there is no numeral in between to interfere with the movement. Thus, in their analysis, classifiers in Cantonese are not definite articles. They only

[8]These authors argue that Cantonese bare NPs cannot be interpreted as definites. The data, and most of the literature, suggest otherwise.

serve the function of individualization. Interestingly, however, in their proposal, the mechanism through which the interpretation of definiteness of a [CL N] phrase is obtained is not a product of their syntactic structure. Instead, Li and Bisang argue that the definite interpretation is "familiarity-based" (p. 350). The difference between a definite and an indefinite interpretation is whether there is a relevant context that is familiar to both the speaker and the hearer such that the hearer can pick out a referent. They discuss three contexts in which a definite interpretation may obtain: when the referent is visible in the context of utterance, when the referent is known by the interlocuters, or when the referent is identifiable via a bridging inference.

Jenks (2018) starts with an analysis of definiteness in Mandarin, which formally distinguishes unique definites (in the form of bare nouns) and anaphoric definites (marked by a demonstrative). Jenks takes this as evidence for the existence of two distinct forms of definiteness, for which he provides a formal description. Turning to Cantonese, he claims that the compatibility of [CL N] phrases with both unique and anaphoric definite referents is evidence that those phrases are ambiguous in their definite readings and that Cantonese has a semantically ambiguous null definite determiner. This element is comparable to English *the*, which is claimed to be ambiguous between a unique definite and an anaphoric definite determiner. It differs from English *the* in that it is silent and not directly observable. Under this analysis, [CL N] phrases are (at least) triply ambiguous between an indefinite reading and two definite ones.

In summary, previous studies mostly focus on how a definite interpretation is derived, and indefiniteness is analyzed in negative terms (i.e. what is not definite), but rarely considered on its own. Furthermore, these studies typically analyze the different interpretations of the structures at hand as the result of ambiguities. Our work focuses on the indefinite interpretations instead, especially by looking at how indefinites behave in different environments and how to account for the low and wide-scope interpretations of these elements in various contexts. Our analysis takes a semantic approach without making any claims about the syntax of the nominal expressions discussed. In particular, the choice functional semantics we propose for [CL N] phrases makes them compatible with both indefinite and definite interpretations (cf. infra), without having to postulate any form of syntactic or semantic ambiguity. This does not mean that we argue against such an ambiguity: it might be warranted by other syntactic facts, but we claim that the semantic evidence at hand does not itself require such an analysis.

6. Conclusion and openings

Our discussion has largely focussed on indefinite interpretations, but many issues remain open. We mention these here, as a roadmap for future work on these topics.

First, we left the non-indefinite readings of [BARE N] phrases to the side. As pointed out in section 2, [BARE N] phrases have definite and kind/generic readings along with indefinite ones. The details of these other readings should be explored in more detail in future work. The definite interpretation, and its restriction to unique definite reference, requires further exploration. Our suggestion that the definite interpretation of [CL N] phrases can be unified with their indefinite interpretation also requires further elaboration.

Another open issue has to do with the precise semantics of the classifier *di1*. Unlike other

classifiers, *di1* does not have selectional restrictions (it combines with most, if not all, nouns), nor does it seem to atomize the denotation of the noun it combines with (given its compatibility with plural denotations). As noted earlier, our current proposal makes it semantically vacuous, but further investigation might call this conclusion into question.

As is well known, the (in)definiteness of noun phrases in Chinese languages is affected by the position of the noun phrase relative to the verb. This effect (which we have set aside in this paper by focusing on post-verbal noun phrases) calls for an explanation, in particular for [CL N] and [*jat1* CL N] phrases. Pre-verbal phrases cannot be interpreted indefinitely, which bars [*jat1* CL N] phrases in those environments (unless they're introduced with an existential construction), and forces [CL N] ones to be given a definite interpretation. One option to account for this is to follow Cheng and Sybesma (1999) and consider that existential closure happens at the VP level. In our analysis this would mean that choice functions can only be existentially bound if they appear in the VP domain. Given that [*jat1* CL N] phrases require such binding, this would explain why they are not licensed pre-verbally, and why [CL N] have to be interpreted definitely, i.e. left unbound, when appearing pre-verbally.

Finally, we might consider the idea that *jat1* functions as an indefinite determiner in Cantonese. In many ways, it resembles indefinite determiners in languages like French or German, for which indefinite determiners are identical to the numeral one. There is thus a case to be made that Cantonese does have an indefinite determiner, though it lacks a definite counterpart. This would have repercussions for principles like *Maximize Presupposition!* (Heim, 1990), which deserve closer investigations.

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Rhetorical question marking: German *schliesslich*[1]

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Abstract. The German adverb *schliesslich* can be used in two senses: in a sentence-internal sense 'eventually' and in an intersentential sense similar to justificational 'after all' in English. I argue that these two uses are syntactically and semantically distinct, asking for an ambiguity analysis. Next, we address the observation that questions with justificational *schliesslich* must be interpreted as rhetorical questions (RhQ). The present analysis can predict this and offers the basis for studying general justificational RhQ in both German and English.

Keywords: *schliesslich*, *after all*, justification, rhetorical questions, discourse relations

1. Introduction

Why do we use rhetorical questions? Style guides characterize rhetorical questions as „a figure of speech in which a question is asked for a reason other than to get an answer—most commonly, it's asked to make a persuasive point."[2] Yet, the discourse relations for rhetorical questions (RhQ) have remained widely unresearched. The epistemic baseline for RhQ was set by Caponigro and Sprouse (2007), who propose the following condition (p. 10, (34)).

(1) A question Q in a discourse is interpreted as a RhQ iff the true answer to Q is in the current common ground: *ans(Q)* ∈ CG.

Caponigro and Sprouse argue that the question Q must not be reinterpreted as an assertive act. Instead, they argue, the discourse effects of uttering an interrogative Q with a known answer follow from pragmatics. This lines up with Farkas (2022) who describes RhQ in terms of their properties on the Conversational Score Board.

Biezma & Rawlins (2017) demonstrate that (1) is a necessary, but not a sufficient criterion for an acceptable RhQ. They argue that a question is not an acceptable RhQ in a discourse where *ans(Q)* echoes an immediately preceding assertion.

(2) A: Oh, look: Konstanz is in Germany, not Switzerland!
B: #What country is Konstanz in? (intended: RhQ)
(Biezma & Rawlins 2017: ex. 6).

Hence, all points in discourse are not suited to utter a question Q with a commonly known answer. Redundancy is not the only factor to prevent RhQs. The following examples (3b) – (d) illustrate further incoherent attempts to use RhQs.

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[2] https://www.litcharts.com/literary-devices-and-terms/rhetorical-question, visited Jan.15, 2024, see also Farkas 2022 on rhetorical questions.

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(3) The family wants to catch the 10.00 bus downtown. Everyone is staring at the clock. Leaving at 9.50 will be ok. It is now 9.45. Alex, known as a very punctual person, is absent.
   a. Alex (entering the room): I am here. / It's 9.45. We can leave.
   b. Alex (entering the room): #Am I in time? We can leave.
   c. Alex (entering the room): #What's the time? We can leave.
   d. Alex (entering the room): #Where am I? We can leave.

The assertions in (3a) are coherent conversation starters. As a very punctual person, let us assume that A knows the time and place, and his interlocutors know this. Hence, the answers to questions Q_b, Q_c, Q_d are in CG. Yet, (3b) – (3d) are infelicitous RhQ in the present discourse. Intuitively missing for a RhQ interpretation is some previous controversy around whether A will be in time.[3]

The discourse relations of RhQ are still underresearched in formal pragmatics. I argue that RhQ marked with *schliesslich* in German are *justificational* rhetorical questions. The adverb *schliesslich* codes specific discourse properties and offers a handle to study the links between RhQ and preceding text more closely.[4]

The paper is structured as follows. Section 2 surveys the grammar and use of *schließlich* in German declaratives and questions. I list syntactic, prosodic, and pragmatic reasons in favor of an ambiguity analysis with a sentence-internal reading *schließlich*$_{cul}$ and a discourse adverb *schließlich*$_{just}$. Section 3 proposes a semantic analysis for both uses, predicting that *schließlich*$_{just}$ in questions triggers a RhQ interpretation. Section 4 studies whether plain RhQ can also be used as justificational questions. We find constellations where RhQs systematically violate Caponigro and Sprouse's criterion in (1), which highlight the need for further research on the discourse effects of RhQs. Section 5 summarizes.

2. The grammar and use of *schließlich* in German

2.1. Two readings?

In one of its uses, the adverb *schließlich*$_1$ situates a temporally bounded event *e* as the culmination point ‚after other preliminary events took place'. It translates into English *eventually*. The declarative S(*schliesslich*) presupposes that *e* came about after some back-and-forth, as illustrated in (4). Sentence (4a) conveys that Jane decided only after being undecided between the two men for some time.

(4) Jane worried for a long time about who to marry: Bill or Tom.
   a. Schliesslich heiratete sie Tom.

[3] Some readers find (3b) acceptable. They might have accommodated a preceding conversation where Alex was accused of being always late.

[4] Most observations will translate to English RhQ with *after all* (Sadock 1971). Given that acceptability judgments for RhQ can involve quite subtle nuances, I will focus on German in the following.

schliesslich married she Tom
'Eventually, she married Tom.'

This use will be labelled as *schließlich*$_{cul}$ to indicate that an event *e* is presented as a culmination point.

In its second use, *schließlich*$_2$ relates the proposition denoted by sentence S to another, preceding utterance T in context. The sentence S can be stative or eventive and its event time is independent of any other events. S(*schliesslich*$_2$) refers anaphorically to a salient second proposition T and the host sentence S is presented as justification. This use is illustrated in (5).

(5) *Mary kann bezahlen. Schliesslich ist sie reich.*
Mary can pay schliesslich is she rich
'Mary can pay. After all, she is rich.'

The speaker aims to support the (possibly controversial) assertion ‚Mary can pay' by the less controversial assertion that she is rich. This use will be labeled *schliesslich*$_{just.}$ It translates into English justificational *after all*; the translation '*eventually, she is rich'* would be inappropriate in (5). There is a long-lasting debate in English around the uses of *after all* and whether they should be unified (Szczesniak 2015, Otsu 2018). For German, a comprehensive review of the properties of *schliesslich*$_{just}$ and *schliesslich*$_{cul}$ warrants two lexical entries that may be historically related but differ in their synchronic syntactic and pragmatic properties.

2.2. Schliesslich$_{cul}$

The use of *schliesslich*$_{cul}$ in declaratives was illustrated in (4) above. The adverb can also occur in questions like (6), where the presupposition projects as usual.

(6) A: Jane worried for a long time about who to marry, Bill or Tom.
B: *Wen hat sie schliesslich geheiratet?*
whom has she schliesslich married
'whom did she marry, eventually?'

B asks the question 'Whom did she marry' and presupposes that the marriage was the culmination point after a series of preceding events. B cannot ask the question in a context where she doesn't know how the marriage came about.

(7) B watches a happy bride, leaving the church after the wedding ceremony in a crowd of equally well-dressed happy looking young men. B wonders who the groom may be.
a. B: *Wen hat sie geheiratet?*
whom has she married
'whom did she marry?'
b. B: *#Wen hat sie schliesslich geheiratet?*
whom has she *schliesslich* married
'whom did she marry eventually?'

(7b) is an inappropriate question in this situation, given that B knows nothing about the bride or her choice of husband. Blocking tests for presuppositions confirm that *schliesslich*$_{cul}$ is indeed a presupposition trigger. This is illustrated in (8) (where the antecedent is given in English for the sake of simplicity).

(8) If Jane receives marriage proposals from several boys,
wird sie schliesslich den reichsten heiraten.
AUX.FUTshe schliesslich the richest marry
'If Jane receives marriage proposals from several boys, she will marry the richest after some back and forth.'

The antecedent clause introduces a context where Jane can reflect back and forth about whom to accept, which satisfies the presupposition of *schliesslich*$_{cul}$ in the main clause. The conditional as a whole does not presuppose any back-and-forth events. Presupposition blocking is a major test to distinguish presuppositions from non-at-issue meaning, which is of importance in Section 2.5 (Geurts 1999).

Finally, *schliesslich*$_{cul}$ cannot be used parenthetically in German declaratives or questions.

(9) Jane worried for a long time about whom to marry, Bill or Tom.
**Schliesslich, sie heiratete Tom.*
schliesslich she married Tom

The word order in (9) is ungrammatical. *Schliesslich* is situated left to the pre-verbal position in a German main clause. This position is pragmatically limited to topic setters or extra-clausal parentheticals and excludes sentence-internal adverbs. We will see in the next section that *schließlich*$_{just}$ is licensed in this position, which shows the differences in syntactic status. The same restriction also holds in questions.

(10) A: Jane worried for a long time about whom to marry, Bill or Tom.
B: **Schliesslich, wen hat sie denn geheiratet?*
schliesslich whom has she PRT married

In summary, the examples (10)/(10) cannot be interpreted in an *eventually* sense and the adverb *schliesslich*$_{cul}$ cannot be used parenthetically.[5]

2.3. Schließlich$_{just}$

Our initial example with justificational *schliesslich*$_{just}$ is repeated in (11).

(11) *Mary kann bezahlen. Schliesslich ist sie reich.*
Mary can pay schliesslich is she rich
'Mary can pay. After all, she is rich.'

[5] German speakers who rate such examples as grammatical will typically provide contexts and paraphrases that amount to justificational *schließlich*$_{just}$.

The sentence *S schliesslich*$_{just}$ refers to an antecedent T where *S* is offered to justify T. T can be a preceding assertion, like ‚Mary can pay' in (11). But T can also be a salient action obvious to the speaker and addressee, or a preceding question or command. In any case, T is perceived as more controversial than *S*.

(12) *Trink Deinen Tee aus! Schliesslich haben wir es eilig.*
drink your tea out schliesslich have we it hurried
'Finish your tea! After all, we are in a hurry.'

(13) [B observes A preparing herself a second cappuccino. A feels urged to justify.]
A: *Schliesslich ist heute Sonntag.*
schliesslich is today Sunday
'After all, today is Sunday'

The speaker in (12) justifies the directive ‚Finish your tea' by pointing out the (less controversial) fact that they are in a hurry. In (13), A justifies an action that could be judged as self-indulgent by pointing out that it is Sunday (allowing for such excesses). Such examples show that actions, in general, can be justified, whereas temporal presuppositions concern the word-to-world fit only (Searle 1976). In the following, I focus on justifications of assertion, leaving the exploration of general justifications for another occasion.

The following examples show that *schliesslich*$_{just}$ can be used parenthetically in declaratives and questions.

(14) A: Jane should quit smoking.
Schließlich: was ist ihr Beruf? (Ärztin, wie wir wissen)
'schliesslich: what is her profession?'
'What is her profession, after all? (she's a doctor, as we both know).

(15) A: Mary can pay.
Schließlich: Sie hat gestern im Lotto gewonnen.
Schliesslich she has yesterday in-the lottery won
'Mary can pay. After all: she won the lottery yesterday.'

The adverb *schliesslich*$_{just}$ in (14), (15) preceeds the preverbal position in a German V2 main clause. The adverb is prosodically non-integrated, as indicated by colons. The examples may lean towards oral registers but they are perfectly acceptable. German speakers judging (9) and (10) as grammatical will also construe justificational scenarios as illustrations.

Justificational *schliesslich* in questions triggers an interpretation as rhetorical question RhQ. This is illustrated in (16) and (14) above.

(16) A: I can't buy my kid an iPhone.
Bin ich schliesslich ein Millionär?
am I schliesslich a millionaire
'I can't buy my kid an iPhone. Am I a millionaire, after all? (obviously not!)'

Polar questions with *schließlich$_{just}$* like (16) can only be interpreted as RhQ, here with an implied negative answer. The RhQ justifes the preceding assertion ‚I cannot buy my kid an iPhone' by the implied proposition ‚I am not a millionaire'. Justificational RhQ with *schließlich$_{just}$* can also be constituent questions. The speaker in (14) and its non-parenthetical version (17) aims to justify a moral request on Jane by drawing attention to Jane's profession.

(17) A: Jane should quit smoking.
Was ist schließlich ihr Beruf? (Ärztin, wie wir beide wissen.)
what is schließlich her profession
'What is her profession, after all? (She's a doctor, as we both know.)'

All our *schliesslich$_{just}$*-questions rest on the assumption that the speaker and addressee know the answer, or otherwise, the intended justification would not come about: Uses of questions Q(*schliesslich$_{just}$*) must adhere to Caponigro and Sprouse's criterion for RhQ.

2.4. *Schließlich$_{just}$* contributes to the expressive dimension

There is clear evidence that *schliesslich$_{just}$* does not contribute to content at the propositional level. The relevant diagnostics were discussed extensively for English *after all* in earlier literature (Blakemore 1997, Lewis 2018, Szczesniak 2015), and the data directly carry over to *schliesslich$_{just}$*. Using the criteria of (Potts 2007), I argue that five of Potts' six characteristics apply to *schließlich$_{just}$*. In the following, *schliesslich* is to be read as *schliesslich$_{just}$*.

Independence. The propositional content of declaratives with *schliesslich* is independent of the information signaled by the adverb. The speaker in (11) asserts *p* = 'Mary is rich'. If (11) is negated or denied, the resulting propositional content is 'Mary is not rich'. The content of *schliesslich* is not captured by negation (Blakemore 1997). This shows that the adverb *schliesslich* always takes scope over negation. The scope and meaning of *schliesslich* in questions will be discussed in Section 3. Using *schliesslich,* the speaker communicates her intention to justify a preceding claim, directive, or action by *p*.

Immediacy. Using the adverb *schliesslich,* the speaker expresses rather than claims their intention. The addressee can not challenge the intention or accuse the speaker of being wrong. The discourse relation *justification* belongs to Austin's speech act type *expositives* (Austin 1962: lecture XII), where he diagnosed immediacy in his own terms by stating that, like all speech acts, the expositive act comes about by utterance. While the class was given up later, Austin's intuition about immediacy remains valid.

Perspective. If used in embedded speech, it is the reported speaker who wants to justify a second claim with *p* as we see in (18).

(18) *Peter meinte, Mary könne bezahlen. Sie sei schliesslich reich.*
Peter said Mary could$_{SUBJ}$ pay. She be$_{SUBJ}$ schliesslich rich
'Peter said that Mary could pay — after all, she was rich.'

The second sentence reports that Peter justifies his first claim that Mary can pay. It cannot mean that the speaker, in uttering (18), justifies anything.

Nondisplacability. The adverb refers to the current utterance context, as it is the current speaker who aims to justify an earlier claim. As the following examples illustrate, the content of *schliesslich* cannot be shifted to other contexts by modals such as *possibly*, or in conditionals.

(19) We should be polite to Mr. Müller.
Möglicherweise wird er schliesslich der neue Chef.
Possibly FUT-AUX he schliesslich the new boss
'He might be our new boss, after all.'

In (19), *schliesslich* takes scope over *möglicherweise* ('possibly'): The recommendation to be polite to Müller is justified by the *possibility* of him being our next boss. The speaker cannot mean to say: I recommend being polite to Müller. *Possibly, this is justified by his becoming our new boss.* The speaker in (19) is not uncertain about the argumentative power of the assertion. The only uncertain aspect is whether Müller will actually be the new boss.

(20) Maria must be an excellent cook.
#Wenn Du an Astrologie glaubst, ist sie schliesslich ein Stier.
If you in astrology believes is she schliesslich a Taurus

According to the rules of astrology (some say), Taurus women are destined to be excellent cooks. If the content of *schliesslich* was displaceable, (20) should be a felicitous way to convey "in case you believe in astrology, the following fact should convince you…". In fact, the sentence has no such reading.[6]

Descriptive ineffability. The contribution of *schliesslich* is easier to paraphrase than most other expressive items (e.g., epithets or modal particles). While a semantic characterization in terms of "justification" is possible—as Section 3 argues— naïve speakers may still find it difficult to identify and paraphrase the speaker attitude behind a sentence with *schliesslich*. As we will see, the adverb takes two propositional arguments, one provided by the host clause and the other accessed anaphorically in context. It indicates the speaker's intention to justify one by the other. The logical complexity of the word's argument structure aligns it with other modal adverbs and particles in the domain of words that are difficult to paraphrase in the language of things and properties.

Repeatability is the only property on Potts' list of expressives that doesn't hold for *schliesslich*. If the word *schliesslich* occurs in a sentence twice, it must be interpreted in different senses.

(21) Peter is not such a pet hater as he pretends to be.
Schliesslich hat er schliesslich doch noch zwei Katzen adoptiert.
Schliesslich has he schliesslich prt yet two cats adopted

[6] Some speakers pointed out that paratactic conditionals like the following can exhibit the missing reading: „Wenn Du an Astrologie glaubst: Schließlich ist sie ein Stier." (‚If you happen to believe in Astrology: She is a Taurus, after all') These conditionals belong to the class of Relevance-conditionals and I will leave their pragmatic and modal properties aside for now.

'*After all*, he *eventually* did adopt two cats.'

The propositional content of (21) is that Peter adopted two cats, presupposing 'after some back and forth'. The speaker asserts this to justify the claim that Peter is not a pet hater. The first instance in (21) is *schliesslich*$_{just}$, whereas the second must be interpreted as *schliesslich*$_{ev}$. Unlike what repeatability would lead us to expect, the two occurrences of *schliesslich* don't add up to a particularly forceful justification. Yet, violating repeatability is not a strong reason against expressive content, as Potts grants that this feature is often restricted by grammar.

In summarizing, five of six diagnostics confirm that *schliesslich*$_{just}$ conveys expressive content. We have thus identified a further important property distinguishing *schliesslich*$_{just}$ from *schliesslich*$_{cul}$, which is – as argued in section 2.2 – a presupposition trigger.

2.5. Summary of data

The data survey shows that *schliesslich*$_{cul}$ and *schliesslich*$_{just}$ differ in several regards. Culminative *schliesslich* contributes information about the referential event of the host clause. It conveys that the event was preceded by back-and-forth and is the culmination point in a series of earlier events. This information is presupposed, i.e., *schliesslich*$_{cul}$ is a presupposition trigger. The adverb can be used in questions, where its presuppositions project above the question operator. The illocutionary point of the question remains unchanged. Finally, the adverb in its event-modifying sense cannot be used parenthetically.

Justificational *schliesslich*$_{just}$ in a declarative S signals that the speaker claims S in order to justify a preceding claim T (or generally, a preceding action). This information is conveyed as non-at-issue content (Potts 2005, 2007) or use-conditional content (Gutzmann 2015), a pragmatic mode different from presuppositions. The adverb can be used parenthetically in this sense. It can also be used in questions, where it influences the illocutionary point of the utterance: the question must be interpreted as a RhQ.

These differences justify the stipulation of two different lexical entries *schliesslich*$_{just}$ and *schliesslich*$_{cul}$ with distinct meanings. It is tempting to claim (and probably true) that the justificational sense emerged from the culminative sense in language history. However, the project of finding a unified analysis for both senses includes the ancillary task of explaining why the best English translation of *schliesslich*$_{cul}$ 'eventually' doesn't have a justificational use. Likewise, German *am Ende* and *zuletzt* can be used as near-synonyms for *schliesslich*$_{cul}$ but don't have a justificational use. Given that my main focus lies on questions with *schliesslich*$_{just}$, the remainder of the paper assumes the ambiguity account.

3. Semantic Analysis

Section 3.1 proposes a semantic analysis of *schliesslich*$_{cul}$ in declaratives and questions. Section 3.2 offers an account for *schliesslich*$_{just}$ in declaratives and section 3.3 argues how the analysis can be adjusted for *schliesslich*$_{just}$ in questions. The analysis correctly predicts that *schliesslich*$_{just}$-questions must be rhetorical questions.

3.1. Schliesslich$_{cul}$

I propose to analyze *schliesslich$_{cul}$* as an adverbial modifier of event predicates, which takes its syntactic base position at the VP boundary in German (Frey 2003). Assuming that subjects are VP-internal, the adverbial modifier combines with an event predicate. I use ϵ as the type of events, thus modifiers of event predicates P are of type $\ll\epsilon,t>,<\epsilon,t\gg$. ⟦ *schliesslich$_{cul}$* ⟧ adds to P the presupposition that the eventuality in question is temporally preceded by a phase of preparatory events e' of diverging aims. The relation BACK+FORTH(e',e) is assumed to be true of (*e',e*) iff e' is a (single or complex) event that precedes *e,* and *e* is the culmination of that series. I acknowledge that a full account would have to be modal ('why don't the actions in *e'* straightforwardly lead to *e*?') and needs a perspectival point ('who presents the action series *e'* as closed by event *e*?'). While these refinements would be an attractive research project, I must leave them aside now. Brackets [ ] are used to notate presuppositions. This leads to the following denotation.

(22) ⟦ *schliesslich$_{ev}$* ⟧ = $\lambda P_{\ll\epsilon,t>,<\epsilon,t\gg}\ \lambda e.[\exists e'.\text{BACK+FORTH}(e',e)](P(e))$

The denotation of *schliesslich$_{ev}$* modifies an event predicate P and adds the presupposition that the P-events are preceded by a series *e'* of back-and-forth events to which *e* constitutes the culmination point. Semantic composition is illustrated for examples (4) and (6), omitting the question particle *denn* in (6) for the sake of simplicity.

(23) Schliesslich heiratete sie Tom.
- a. $\lambda e.\text{MARRY}_w(J,T,e)$ (set of events where Jane marries Tom in w)
- b. $\lambda P_{\ll\epsilon,t>,<\epsilon,t\gg}\ \lambda e.[\exists e'.\text{BACK+FORTH}(e',e)](P(e))$
  (denotation of *schliesslich*)
- c. $\lambda e.[\exists e'.\text{BACK+FORTH}(e',e)](\text{MARRY}_w(J,T,e))$
  (set of events where Jane marries Tom; assuming that there was some back-and-forth preceding the marriage)
- d. $\exists e.[\exists e'.\text{BACK+FORTH}(e',e)]\ (\text{MARRY}_w(J,T,e) \wedge \tau(e) < S)$
  (past tense and existential closure)

The sentence denotation (23d) asserts that Jane married Tom, and presupposes that the speaker and addressee know that there were complications before the marriage. (24) illustrates the question case. We adopt a question semantics where *wh*-constituents are interpreted as alternatives over entities (Beck 2004, Eckardt 2006).

(24) Wen hat sie schliesslich geheiratet?
- a. $\{\ \lambda e.\text{MARRY}_w(J,x,e)\ ;\ x \in \{\text{Tom, Bill}\}\ \}$
  (set of alternative event predicates for answers: Jane marries Tom / marries Bill)
- b. $\lambda P_{\ll\epsilon,t>,<\epsilon,t\gg}\ \lambda e.[\exists e'.\text{BACK+FORTH}(e',e)](P(e))$(denotation of *schliesslich*)
- c. $\{\ \lambda e.[\exists e'.\text{BACK+FORTH}(e',e)](\text{MARRY}_w(J,x,e))\ ;\ x \in \{\text{Tom, Bill}\}\ \}$
  (set of alternative event predicates for answers: Jane marries Tom / marries Bill, now with presupposition 'there was some back-and-forth before that marriage')
- d. $\{\ \exists e.[\exists e'.\text{BACK+FORTH}(e',e)]\ (\text{MARRY}_w(J,\text{Tom},e) \wedge \tau(e) < S)\ ,$
  $\exists e.[\exists e'.\text{BACK+FORTH}(e',e)]\ (\text{MARRY}_w(J,\text{Bill},e) \wedge \tau(e) < S)\}$
  (past tense and existential closure)

The denotation (24d) predicts that in a context like (6(6), the question has two possible answers:
a. '(After some back-and-forth), Jane married Tom'
b. '(After some back-and-forth), Jane married Bill'
We correctly predict that the presupposition of *schliesslich*$_{ev}$ is inherited by both answers. Likewise, the polar question with *schliesslich*$_{ev}$ (25) is predicted to take the back-and-forth for granted. This is warranted by the data.

(25) A: Within the same day, Jane got marriage proposals from Tom and Bill.
B: *Hat sie schliesslich Tom geheiratet?*
has she schliesslich Tom married
' Did she eventually marry Tom?'
A: #No, she accepted Tom's proposal right on the spot.

A cannot answer B to the negative on the grounds that Jane's decision wasn't preceded by back-and-forth pondering. This is exactly what we expect for presuppositions.

The account thus correctly predicts that *schliesslich*$_{ev}$ is interpreted sentence, and contributes presuppositions. It takes scope below the question operator in questions and the presupposition projects. As a VP modifier, the adverb cannot normally be used parenthetically (Haegeman 2012). While it would be interesting to study the notion of culmination and delineate the BACK+FORTH predicate more precisely, I leave this for later research.

3.2. *Schliesslich*$_{just}$ in declarative sentences

Schliesslich$_{just}$ in declarative sentences S indicates that the speaker claims S in order to justify some preceding claim or action *p*.[7] I assume that *schliesslich*$_{just}$ takes scope at the level of the speech act phrase (Speas & Tenny 2003), thus taking scope over question or imperative operators. This assumption will be important in 3.3.

The speaker's intention is conveyed at the non-at-issue level, whereas the propositional sentence meaning is at-issue-content. I use the relation JUSTIFY(sp, *q, p*) to code the speaker's intention. It has the following truth conditions:

(26) The relation JUSTIFY(sp, *q, p*) is true (in context c and world w) iff the speaker sp intends to offer proposition *q* to make *p* more likely, more plausible, or less objectionable to accept. The speaker considers claim *q* as less controversial, easier to accept than claim *p*.[8]

The claim that *p* preceded the declarative with *schliesslich*$_{just}$ in examples so far. The full analysis will have to ensure this anaphoric quality. Before moving on, take a brief look at *who* is supposed to find *q* more plausible than *p*. In the simplest examples the speaker aims to

[7] We focus on justification of claims.
[8] The relation JUSTIFY here is used in the same sense as SUPPORT in Eckardt (2023) on English *after all.*

convince the addressee. Natural examples show, however, that speaker and addressee can also solidarize against some third party who doubts *p*.[9]

(27) A: I think that Jane should marry Tom.
B: *Ja, schliesslich$_{just}$ hat er das schnellere Auto.*
yes schliesslich has he the faster car
'Yes – after all, he owns the faster car.'

This perfectly natural conversation shows that B can use *schliesslich$_{just}$* while A has already committed to *p* = 'Jane should marry Tom'. A and B implicitly address a third party — maybe Jane? — who has not yet accepted *p*. My analysis assumes that *someone* objects to *p*, which avoids stipulation of fictitious addressees.

After these clarifications, we can turn to an analysis of *schliesslich$_{just}$* in declarative sentences. I adopt the two-dimensional notation where tuples $< \Phi \bullet \Psi >$ code at-issue content Φ and expressive content Ψ.

(28) $[\![\textit{schliesslich}_{just}]\!]^c = \lambda q_{<s,t>}. < q \bullet {}^{\wedge}\text{JUSTIFY}(\text{sp}(c), q, T) >$
where sp(c) is the speaker in c, and T is a propositional anaphor. T must be resolved to a preceding proposition *p* that is more controversial than *q*.

We hence predict that the speaker, uttering *S schliesslich$_{just}$*, asserts *S* and thereby aims to increase the plausibility of an earlier claim T. The restrictions on T in (28) leave it open *who* believes that *p* is more controversial than [[S]], in line with the above discussion. (29) shows how the analysis plays out in dialogue (11).

(29) Mary can pay. Schliesslich ist sie reich.
a. $[\![$ Mary can pay $]\!]^c = \lambda w.\Diamond \text{PAY}_w(M)$
the proposition *p* that Mary can pay.
b. $[\![$ Sie ist reich $]\!]^c = \lambda w.\text{RICH}_w(M)$
the proposition 'Mary is rich'
c. $[\![\textit{schliesslich}_{just}]\!]^c ([\![$ Sie ist reich $]\!]^c)$
$= < \lambda w.\text{RICH}_w(M) \bullet {}^{\wedge}\text{JUSTIFY}(\text{sp}(c), \lambda w.\text{RICH}_w(M), T) >$
asserted content 'Mar is rich', and speaker's intention to use this fact to justify T
d. Anaphor resolution for **T**
$< \lambda w.\text{RICH}_w(M) \bullet {}^{\wedge}\text{JUSTIFY}(\text{sp}(c), \lambda w.\text{RICH}_w(M), \mathbf{\lambda w.\Diamond PAY_w(M)}) >$

According to (29d) the utterance asserts that Mary is rich, and conveys that the speaker thereby justifies the preceding, controversial claim 'Mary can pay'. This prediction is adequate.

While the denotation of *schliesslich$_{cul}$* can easily be applied in questions, the semantic composition of *schliesslich$_{just}$* with a question will raise an epistemic puzzle. We would derive a question (e.g., who is rich?) plus the speaker's intention to offer whatever the true answer may be as a justification for some controversial *p*. Such an epistemic stance would be irrational

[9] The condition, more precisely, should be phrased „speaker and addressee believe that there is someone C who objects to *p*". I leave this implicit as the refinement won't gain us anything in the course of this study.

if the speaker didn't know which answer was true. We must therefore make some adjustments to account for *schliesslich*$_{just}$ in questions.

3.3. schliesslich$_{just}$ in questions

We assumed that *schliesslich*$_{just}$ takes scope over CP and has thus access to the logical type of the sentence. Declarative sentences are of type <s,t>, whereas interrogatives are of type ≪s,t>,t>.[10] The semantics of *schliesslich*$_{just}$ in 3.2 is compatible with arguments of type <s,t>. We can now devise the denotation of *schliesslich*$_{just}$ for arguments of type ≪s,t>,t> based on the version for declaratives. It combines with a question Q, and I use *ans*$_c$*(Q)* to stand for the true answer to Q in context *c*.

(30) ⟦*schliesslich*$_{just}$ *Q* ⟧^{c} = < ⟦Q⟧^{c} • ^JUSTIFY(sp(c), *ans*$_c$*(Q)*, T) >
where sp(c) is the speaker in *c*, and T is a propositional anaphor. T must be resolved to a preceding proposition *p* that is more controversial than *ans*$_c$*(Q)*.
Rational-Use Restriction on c:
sp(c) knows *ans*$_c$*(Q)* and believes that ad(c) knows *ans*$_c$*(Q)*.

The Rational Use Restriction states that speakers use language rationally. It would be irrational to justify claims with propositions unknown to the speaker or addressee. The use of *schliesslich*$_{just}$ in questions requires that the speaker know *ans*$_c$*(Q)*, or else she could not aim to justify T with it. The speaker also assumes that the addressee knows *ans*$_c$*(Q)*. Otherwise, the justification would not catch on. Hence, the question's discourse aim can only be achieved if *ans*$_c$(*Q*) ∈ CG. That is, *Q* fulfills the necessary criterion for RhQ (Caponigro & Sprouse 2007). (31) illustrates the analysis for example (17).

(31) A to B: Jane should quit smoking. Was ist schließlich ihr Beruf?
a. ⟦ Q ⟧^{c} = { λw.Profession$_w$(J, x) ; x ∈ {lawyer, doctor, teacher, tailor, …} }
b. ⟦ *schliesslich*$_{just}$ ⟧^{c} (⟦ Q ⟧^{c}) = < ⟦ Q ⟧^{c} • ^JUSTIFY(A, *ans*$_c$*(Q)*, T) >
A poses the question and intends to justify some preceding proposition *p* with *ans*$_c$*(Q)*.
c. T is resolved to proposition *p* = 'Jane should quit smoking'.
d. The true answer to Q is *q* = λw.PROFESSION$_w$(J, DOCTOR)
e. < ⟦ Q ⟧^{c} • ^JUSTIFY(A, λw.PROFESSION$_w$(J, DOCTOR), 'Jane should quit smoking') >

As (31e) shows, the speaker A poses the question 'What is Jane's profession?'. At the same time, A knows that Jane is a doctor and also assumes that B knows this. A poses the question to justify *p* = 'Jane should quit smoking' with the fact that Jane is a doctor. This prediction matches the data.

Two final remarks before we move on. While the denotation in (31) is obviously parallel to (28), I don't suggest deriving it by general type-shifting principles. German has further justifying adverbs like *immerhin, endlich, am Ende,* and *schlussendlich* that cannot, or only

[10] I leave it to the reader to translate the sortal restrictions of *schliesslich* into Inquisitive Semantics (Ciardelli et al. 2019)

very restrictedly, be used in questions. Likewise, the German particle *ja* can be used in justificational declaratives but does not trigger an RhQ reading in questions.[11] Other languages may also have justifying particles or adverbs that are illicit in questions. Thus, while the step from declarative *schliesslich*$_{just}$ to interrogative is small, it should be coded in the lexicon. Secondly, the analysis leaves it open whether B should answer Q or not. This is in line with recent findings that RhQ in dialogue can trigger answers or consent (Biezma & Rawlins 2017, Farkas 2022). The most important prediction, however, is that *schliesslich*-RhQ differ from general RhQ in that they need an explicit antecedent. In the next section, this prediction will be tested, and I will compare general justificational RhQ with *schliesslich*-RhQ.

4. More on justificational RhQ[12]

4.1. Can plain RhQ be justificational?

The first fact to establish is whether a plain RhQ can also be justificational. We can simply test this by devising wellformed dialoges with Q(*schliesslich*$_{just}$) and then leaving out *schliesslich*$_{just}$. If the resulting dialog is felicitous and synonymous with the original one, we can conclude that plain RhQ can also be used as justifications. The following examples pass this test.

(32) A: We should have oysters for starters at our party. = *p*
B: *Wer kann schliesslich Austern widerstehen?*
who can schliesslich oysters resist?
'Who, after all, can resist oysters?' (rhetorical, JUSTIFY(B, 'nobody can resist', *p*))

(33) A: We should have oysters for starters at our party. = *p*
B: *Wer kann schon Austern widerstehen?*
who can prt oysters resist?
'Who can resist oysters?'$_{RhQ}$ (rhetorical, JUSTIFY(B, 'nobody can', *p*))

Example (33) uses a RhQ where *schliesslich* is replaced by the particle *schon.* The particle is a know cue for RhQ in German (Braun et al. 2018, Bayer & Struckmeier 2017, Meibauer 1986). *Schon* doesn't by itself convey justification. (33) therefore illustrates that a plain RhQ can be interpreted as justification. The following pair makes the same point, using a RhQ without questions in (34).

(34) A: We should eat 1 pound of spinach every day. = *p*
B: Right!
Welches Gemüse enthält schließlich am meisten Eisen?
which legume contains schliesslich the most iron
'Which legume, after all, is richest in iron?'

[11] For a more nuanced picture of *ja* and other particles in German RhQ see Viesel & Freitag (2019).

[12] I owe the following observations to Veronika Hering (Hering 2023), which I gratefully acknowledge.

(JUSTIFY(B, ‘spinach is richest in iron’, *p*))

A Polar RhQ with *schliesslich* can equally be replaced by a plain polar question which is used as a justification, see (35) and (36).

(35) A: We won’t buy champagne at 500$ the bottle. = *p*
B: *Sind wir schliesslich verrückt?*
are we schliesslich crazy?
‘Are we crazy, after all?’$_{\text{RhQ}}$ (JUSTIFY(B, ‘we are not crazy’, *p*))

(36) A: We won’t buy champagne at 500$ the bottle. = *p*
B: *Sind wir denn verrückt?*
are we prt crazy?
‘Are we crazy?’$_{\text{RhQ}}$ (JUSTIFY(B, ‘we are not crazy’, *p*))

(36) has the particle *denn* for smoothness. As before, *denn* makes the RhQ interpretation easier to access without by itself expressing rhetoricity or justification (Theiler 2020). All examples confirm that plain RhQ without *schliesslich*$_{just}$ can be used as justification.

4.2. Are all RhQ justificational?

Exploring the data in the opposite direction, we can ask whether all RhQ are justificational. Data like the following suggest that the answer is “no”.

(37) A: We should have oysters for starters at our party.
B: *Wer mag schon Austern?*
who likes prt oysters
‘Who the hell likes oysters?’

(38) A: Look, there is a fox passing.
B: *Welcher Fuchs würde schon am hellen Tag herum rennen?*
which fox would RhQ at-the light day around run
‘What kind of fox would dare running around in full daylight?’

The questions in (37)/(38) use the particle *schon*, which marks them as RhQs with a negative answer (Braun et al. 2018, Bayer & Struckmeier 2017). The RhQ in (37) implies the answer ‘nobody likes oysters’, which objects to A’s proposal. The answer to (37) cannot be interpreted as a justification of A’s utterance. In (38) the RhQ challenges A’s claim by its answer ‘no reasonable fox would run around in full daylight’. Again, the answer to the question does not justify A’s assertion.

These data illustrate that RhQs can also be used as objections and allow discourse links beyond justification. This finding takes up Asher and Reese (2005, 2007) hypothesis that RhQs serve to challenge the interlocutor’s discourse belief. While Asher and Reese refer to their questions as “biased questions”, their example questions are marked with *after all,* which forces a RhQ interpretation (Sadock 1971). In a similar vein, educational and descriptive literature often presents rhetorical questions as a rhetorical means to challenge an opponent.

On second thought, examples (37), (38) pose a general challenge to current pragmatic theories of RhQ in that they contradict Caponigro and Sprouse's necessary condition on RhQ in (1). Consider the CG in (38) before B's utterance. A has just asserted 'a fox is passing'. The implied answer of B's RhQ is 'no fox would pass in daylight'. In view of A's discourse commitment to p = 'a fox is passing', B can hardly pretend that *ans*(Q) ∈ CG. Similar considerations hold for (37). Given A's suggestion and assuming that A is a benevolent host, B knows that A's beliefs include 'our guests like oysters'. This belief contradicts *ans*(Q), which means that *ans*(Q) ∉ CG, and B cannot mistakenly believe it is. Were Caponigro and Sprouse wrong?

While the full range of data is beyond the scope of the present paper, a final test with *schliesslich* may indicate a way to rescure Caponigro and Sprouse's approach. For one, *schliesslich* in (38) is infelicitous, as we see in (39).

(39) A: Look, there is a fox passing.
B: **Welcher Fuchs würde schliesslich am hellen Tag herum rennen?*
which fox would RhQ at-the bright day around run
*'What kind of fox would dare running around in full daylight, after all?'

The RhQ with *schliesslich* cannot be used as a challenging retort in the same way as in (38). The next version shows that this is only due to the fact that *schliesslich* in (39) lacks an antecedent. If B overtly objects to A, the dialogue is felicitous even though the exchange remains, by and large, synonymous with (38).

(40) A: Look, there is a fox passing.
B: That's impossible.
Welcher Fuchs würde schliesslich am hellen Tag herum rennen?
which fox would schliesslich at-the bright day around run
'What kind of fox would dare running around in full daylight?'

In a table model analysis of (40), we can track that B hasn't accepted A's proposal to update CG. Instead, B tries to force A to commit to 'no fox would run around in full daylight' by agreeing to the presupposition that *ans*(Q) ∈ CG. This would force A to give up his public discourse commitment 'there is a fox'.

This invites the hypothesis that Caponigro and Sprouse's epistemic baseline should be refined. It might more aptly be phrased as "virtually everybody knows that *ans*(Q)". This version is stronger and more tolerant at the same time. It can accommodate single exceptions, such as A not believing *ans*(Q). But it could also explain the persuasive strength of RhQs: Is it wise for A to maintain a belief against everybody's better knowledge? Thus, comparing justificational with challenging RhQs forces us to rethink the epistemic baseline, an issue I leave for future research.

5. Summary and outlook

The present paper investigates the use of *schliesslich* in declaratives and questions, distinguishing between culminative *schliesslich* and justificational *schliesslich.* RhQs. I argue

that justificational *schliesslich* triggers the interpretation as RhQ in questions. On a historical note, similar data are reported for English: The justificational use of *after all* in declaratives is well-established in the literature (Blakemore 1997, Szczesniak 2015, Otsu 2018) and Sadock (1971) characterized *after all* as an RhQ marker. Data suggest that *after all* in questions expresses an act of justifiying and triggers a RhQ reading, just in the German case. Similar adverbials serve as RhQ triggers in Romance languages (Italian *finalmente,* Spanish *al fin, en fin*, Portugese *afinal*). While style and register preferences have to be delineated separately for each language, there is thus a typological trend suggesting that justification might be a common function of RhQs. This falls in line with Biezma and Rawlins' (2017) observation that the *sufficient* conditions to license RhQs have not yet been fully understood.

Justification is one prominent discourse function of RhQs. It contrasts with the discourse function that we see in *challenging* RhQs. These two functions suggest a possible integration of RhQ in the table model as very elaborate ways to *agree* or *disagree* with an assertion. The increasing interest in discourse functions of RhQs is mirrored in ongoing work, e.g., by Esipova and Romero (2023), who study *Re-asking* RhQs and *Explanation-seeking* RhQs in English and Russian. Kiss and Lo (2021), in turn, argue that Mandarin Chinese RhQs can gradually differ in inquisitiveness. The quest for the true function of RhQs will continue.

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What number marking on indefinites means: conceivability presuppositions and sensitivity to probabilities[1]

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Abstract. The inferences due to number marking on indefinites have been argued be pragmatic in nature, and to disappear in downward-monotonic environments. This paper shows that indefinites are associated to a conceivability presupposition even when embedded under negation. Furthermore, it presents the results of an experiment that shows, on the basis of a production task, that the preferred number for negated indefinites is sensitive to probabilistic information in a gradient way: the more common it is in general for the objects of interest to come in groups, the more plural is used, etc. The sketch of an account of these facts is provided, in a model of pragmatics where statements compete on the basis of their potential continuations.

Keywords: number marking, indefinites, experimental pragmatics.

1. Background: the pragmatic view of number marking on indefinites

English and many other languages distinguish two numbers, singular and plural. For expressions with well-identified (countable) referents, the choice of number depends on the atomicity of the referent: singular is used when the referent is an atomic individual, and plural when it is a collection of individuals. Indefinite DPs, whose referents can be unspecified, also bear number marking. In simple positive uses such as the examples in (1), use of a particular number contributes an inference that the unspecified witness of the indefinite has the atomicity corresponding to the number: if singular was used, the indefinite has exactly one potential atomic witness, while if plural was used, it has at least two.

(1) a. There is a blue circle on the card. $\rightsquigarrow |C| = 1$
b. There are blue circlers on the card. $\rightsquigarrow |C| \geq 2$
where C is the set of blue circles on the card.

In various non-veridical contexts however, number marking does not appear to affect truth conditions on indefinites. In particular, when indefinites are used under negation as in (2), or when negated indefinites are used as in (3), the observed truth conditions is that the potential witness set is empty, regardless of number. This pattern also extends to use of indefinites in questions.

(2) a. There isn't any blue circle on the card. $\rightsquigarrow |C| = 0$
b. There aren't any blue circle on the card. $\rightsquigarrow |C| = 0$

(3) a. There is no blue circle on the card. $\rightsquigarrow |C| = 0$
b. There are no blue circles on the card. $\rightsquigarrow |C| = 0$

The data in (2) and (3) has generally been taken to support an analysis where the denotation

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of plural NPs includes both atomic and non-atomic elements while the denotation of singular NPs only includes atomic individuals (cf. e.g. Schwarzschild 1996: p. 5, fn. 1 and references therein). This makes plurals in principle strictly weaker than singulars; however, when the predicate the indefinite combines with is distributive, the truth conditions end up being the same for both numbers. In particular, the truth conditions of the negative examples of (2) and (3) are straightforwardly predicted.

Under this view, the predicted meaning of positive examples with either number is that the witness set is non-empty; in other words, both sentences in (1) should mean that $|C| \geq 1$. The stronger meaning that is actually observed has then been analyzed a pragmatic inference, for instance by Spector (2007), Zweig (2009), and Ivlieva (2013). The shared idea of these accounts is as follows: the atomicity inference from singular marking is due to competition of the singular form with another form whose semantics would entail the existence of at least two witnesses, for instance the competition of (1a) with (4). The multiplicity inference from plural marking is due to competition of (1a) with (1b).[2] These enrichments are some form of scalar implicature, and they do not obtain under negation for the same reason that scalar implicatures in general do not, which is a general constraint that implicatures should not weaken the global meaning of the sentence.

(4) There are two blue circles on the card.

2. The conceivability presupposition

The pragmatic account we just sketched takes it as its aim to predict perfect equivalence between singular and plural indefinites in simple negative sentences. Both forms are however not fully interchangeable. Indeed, both forms appear to exhibit what we are going to call an "conceivability presupposition": they are subject to the condition that the number inference appropriate to each number *could in principle* obtain — that there could in principle exactly one or several witnesses. This is illustrated in (5) and (6). If we are talking about something that could exist at most in one instance, like the table of contents of a book in (5), use of plural as in (5b) is infelicitous. Meanwhile, talking about an object that can never be unique, such as the chapters of a book in (6), use of singular as in (6a) is infelicitous. This is summarized through the generalization in (7).[3]

(5) a. This book has no table of contents.
b. #This book has no tables of contents.

(6) a. #This book has no chapter.
b. This book has no chapters.

[2]The main thing that has to be explained in such an account is how (1b) can be enriched through competition with (1a), even though they are truth-conditionally equivalent. For Spector (2007), the implicature obtains by comparing (1b) to *the enriched interpretation* of (1a). For Zweig (2009) and Ivlieva (2013), the enrichment happens at a subsentential level where the two forms are not equivalent.

[3]This effect is noted by Spector (2007), but only for the case of plural. Farkas and de Swart (2010) discuss the full paradigm.

(7) **Conceivability presupposition:** a singular- (resp. plural-)marked indefinite presupposes that it is conceivable that it could have exactly one (resp. more than one) witness.

Note that we diagnose the inference described by (7) as a presupposition because it generally projects regardless of the semantic environment: we can observe it not just when indefinites are negated, but also when they occur in questions or in conditional antecedents, or when negated indefinites occur in those environments. In positive cases such as in (1), the presupposition is entailed by the enriched truth conditions of the sentence, and therefore indetectible. Furthermore, this inference only makes sense as a pre-condition for asserting the sentence, rather than something that proceeds from the sentence's assertion: once (5a) for instance is accepted, the common ground does not contain any worlds where the book has any number of tables of contents, so that we cannot formulate a constraint about their uniqueness or lack thereof.

3. The gradient pattern of number marking in production: an experiment

3.1. Motivation

Our generalization so far only describes what governs the choice of number in cases where potential witnesses are known to be unique or non-unique. When both conceivability presuppositions are satisfied, we allow for both numbers to be used. This is in general correct: as we have seen, it is in general possible to use both numbers under negation in such cases, and they yield truth-conditionally equivalent sentences. Nevertheless, it is natural to ask what determines speakers' actual choice of number in these cases. This section describes a production experiment that tries to address this question.

One (perhaps unlikely) hypothesis, which we will call H_0, is that variation between singular and plural under negation is governed purely by non-semantic factors, such as stylistic effects and speakers' personal preferences, or even pure randomness. Alternatively, there is an intuition that what matters in cases where the appropriate number for potential witnesses is not clear is the atomicity of *prototypical* witnesses, or some related notion. In particular, Farkas and de Swart (2010) essentially propose the generalization in (8), on the basis of examples like (9).

(8) **Farkas and de Swart's generalization:** a singular indefinite presupposes that in a prototypical situation, there would be a unique atomic witness.

(9) a. (i) Do you have children?
(ii) ?Do you have a child?
b. (i) Do you have a child on our baseball team?
(ii) ?Do you have children on our baseball team?

(adapted from Farkas and de Swart, 2010)

As we will discuss in Section 4.1, this generalization can be derived from existing proposals on number semantics with conservative amendments, and we can derive some form of the conceivability presupposition of plural from it as a *Maximize Presupposition* effect; the conceivability presupposition of singular follows from the generalization. Under this view, the apparent free variation in cases where both numbers are conceivable is an illusion due to the possibility of restricting our attention to prototypical cases. Thus, in situations where both unique and

non-unique witnesses are salient, we expect plural productions to dominate. We will call this hypothesis H_1.

The third hypothesis we will consider, H_2, also involves some notion of typicality or prototypicality: it could be that speakers choose the number they use on the basis of whether they perceive witnesses as being *more typically* unique or non-unique. Unlike in H_1, there is no asymmetry between singular and plural under this view: we expect singular to be used more when potential situations with a unique witness are more salient, and plural to be used more; when both possibilities are salient, we expect both productions to be equally natural. We will call this hypothesis H_2.

Our goal is to tell apart these three hypotheses; since the question is how speakers decide what number to use, we can do it through a production study. The study presented here is premised on the assumption that at least when discussing abstract situations that do not relate to real-life experiences or cultural knowledge, prototypicality comes down to frequency: what is most prototypical is what occurs most often.[4] Then, if we expose participants to situations where sometimes a certain set has a unique member and sometimes it has several members, and we vary the frequency of each situation, we can control what participants perceive as prototypical; if we then prompt them to produce a sentence containing a negated indefinite over S, our various hypotheses make predictions as to what number they should use, which we can verify. To recapitulate, the predictions are as follows:

(10)
a. H_0: Productions will not depend on the distribution of situations.
b. H_1: We will observe singular productions when situations of uniqueness dominate, and plural productions otherwise. When both kinds of situations are equally common, we will observe plural productions.
c. H_2: The more situations of non-uniqueness, the more plural productions. When both kinds of situations are equally common, we will observe both kinds of productions.

3.2. Description of the experiment

The experiment was conducted online, with 100 participants recruited through the platform Prolific, who reported English to be their first language. Participants were told that their task was to learn a rule from examples. They were shown a series of 20 cards with abstract symbols on them, and asked for every card to guess whether the card was "valid" according to some unspecified rule. After every guess, they were given immediate feedback on whether the card was in fact valid or not. They could see at all times all the feedback they had so far, that is, the list of valid and invalid cards they had seen; an example of a trial is shown in Figure 1. After the 20 trials, they were asked to describe what they thought the rule was in one sentence, by completing the prompt *"the card is valid when..."*. The median duration of the experiment was 3:32 minutes, and participants were paid £0.90 each.

The general idea is that participants were exposed to a probability distribution over symbols, which varied with each condition, and that the experiment was set-up so as to make them likely

[4] See section 4.2 for more discussion on this topic.

to produce negated or negative indefinites in the final question, so that we can see how their productions vary with the probability distribution. Concretely, cards shown to participants contained symbols of one of four categories: blue circles, red squares, green diamonds or black crosses (cf. Figure 1). Each card contained several different kinds of symbols, chosen randomly; symbols of a given kind were clustered together and could number between 1 and 5. The rule that participants had to guess was always the same: cards were valid if they did not have any blue circles.

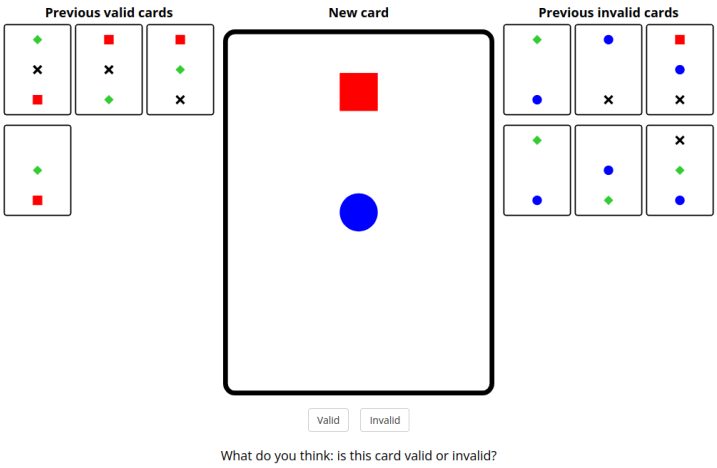

Figure 1: Example of a trial in the Sg condition.

Participants were randomly assigned to one of five conditions, which determined the conditional probability that there were multiple symbols of a given kind on the card, when there were any. In other words, if a card included say black crosses, the condition determined the chance that the card had several black crosses, rather than just one. In every condition, all categories of symbols followed the same distribution. The conditions are described below:[5]

(11) a. **Sg:** 0% chance that there are multiple symbols on the card, if there are any.
b. **SgPl:** 10% chance that there are multiple symbols on the card, if there are any.
c. **Mix:** 50% chance that there are multiple symbols on the card, if there are any.
d. **PlSg:** 90% chance that there are multiple symbols on the card, if there are any.
e. **Pl:** 100% chance that there are multiple symbols on the card, if there are any.

3.3. Results

Participants' final productions were categorized by the author as containing a negated or negative singular indefinite (*SG*), containing a negated or negative plural indefinite (*PL*), or describing the rule without using a negated or negative count indefinite (*Other*), without looking at

[5]Since stimuli were generated randomly for each participant, the actual distribution of what a given participant saw was not exactly what is given here. More information on the exact shape and distribution of the stimuli as well as access to the code and data is available on request.

the participant's condition. Unclear cases were categorized as *Other* as a conservative default.[6] Furthermore, 14 participants who did not appear to be describing the rule were excluded from the analysis. In spite of these difficulties, most productions clearly fell into the *SG* and *PL* categories.[7]

The proportion of participants in each category as a function of the condition is shown in Figure 2. We can see that the share of *SG* productions varies with the share of unique-symbol stimuli in a gradient way: the more unique-symbol stimuli, the more *SG* productions. Conversely, the more multiple-symbol stimuli, the more *PL* productions.[8] This is consistent with H_2, but not with H_0 and H_1. In conclusion, this experiment has uncovered that number marking on negated indefinites, in production, depends on the distribution of prototypical situations (or perhaps situations in general) in a gradient way.

4. Discussion

4.1. Consequences for the analysis of number marking

As we already mentioned, the conceivability presupposition specifies what number should be used in extreme cases where only one number could be countenanced in positive use, but allows for both numbers in any intermediate situation. In our experiment, both singular and plural forms were used, in varying proportions, in all situations where both unique and non-unique instances had been shown. This situation of free variation presents a challenge for pragmatic, competition-based approaches to number inferences, such as the theories we have mentioned in Section 1, or any theory based on the *Maximize Presupposition* principle (along the lines of Sauerland 2003). Indeed, these theories derive the truth conditions or presuppositions of utterances by enriching some basic meaning with the negation of the truth conditions or presuppositions of competitors. This leads to the prediction that the use conditions of different competitors should not overlap, unlike what we observe here, where both singular and plural can be used in most situations, and they only come apart in extreme cases.

[6] In particular, a number of productions include some variant of "there is no blue". I assumed these participants were mostly using "blue" as a mass noun, to refer to the colour, and categorized the production as *Other* accordingly. It is likely that a few of them actually intended "blue" to be a count noun, which would make their productions *SG*; while this is somewhat non-standard English, there are some clear cases of "blue" as a count noun in *PL* productions, e.g. "there are no blues".

[7] Two participants who reversed the rule (that is, described its negation) were included in the analysis reported in the abstract and slides, and excluded on second thought for the analysis reported here; this does not affect results meaningfully. In general, participants were not excluded for adding extra conditions or unnecessary precisions to the rule. Many participants did not produce a full clause (e.g. they wrote "no blue circles"); they were not excluded for this either. The complete list of participants' productions together with their categorization is available on request.

[8] For the reader wondering about statistical significance, here are the p-values obtained from the likelihood-ratio test for a logistic regression between the condition (seen as an ordinal variable) and the category *PL* (seen as a binary variable), for various subsets of the data:

Restriction	All productions	*PL* or *SG* productions
All conditions	$< 10^{-6}$	$< 10^{-8}$
3 intermediate conditions	$< 10^{-2}$	$< 10^{-3}$

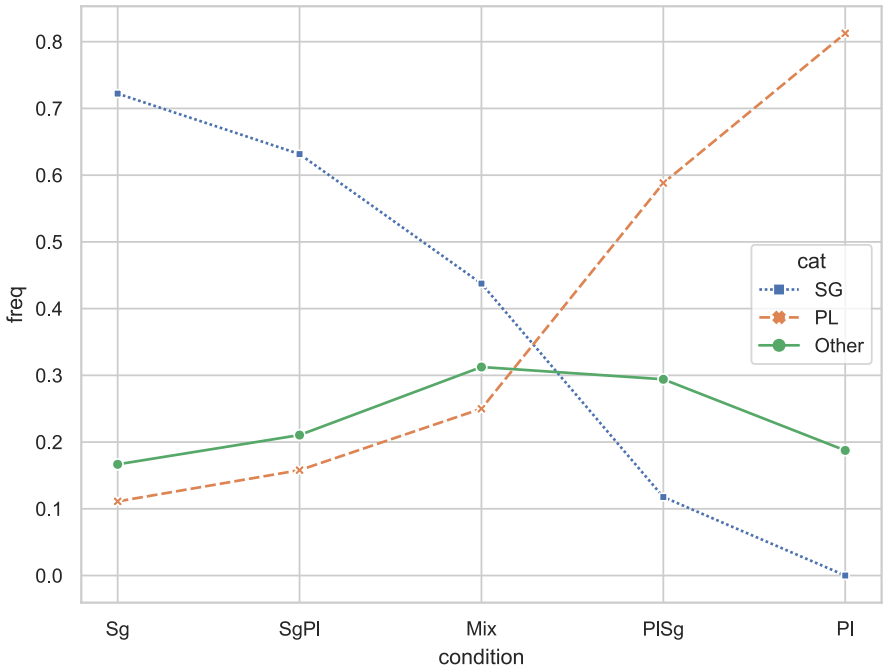

Figure 2: Share of participants using a negated singular indefinite (SG), a negated plural indefinite (PL), or another strategy (Other), as a function of condition. Conditions are ordered by increasing frequency of stimuli containing multiple symbols of the same kind.

To make this point more concrete, suppose we wanted to derive the conceivability presupposition of plural. It would be tempting to think that the *Maximize Presupposition* (MP) principle, according to which one should not use a sentence if an equivalent competitor has a stronger presupposition, will help us. What we then derive is that one should only use plural when the presupposition of singular is not satisfied; for this to correspond to the conceivability presupposition of plural, the presupposition of singular has to be that it is *certain* that any witness would be unique. If we allow for the possibility of (perhaps defeasible) contextual restriction to prototypical situations, we end up with what we have called hypothesis H_1 above: singular presupposes that prototypical witnesses are always unique. This is still much stronger than the conceivability presupposition of singular, and too strong in light of our experimental results: we observe singular productions even in the Mix and PlSg conditions, where participants see as many instances of grouped symbols as lone symbols. The problem here is that we want to derive use conditions that overlap, but theories based on MP or scalar implicature mechanisms more naturally predict that competitors will be in complementary distribution. Of course, one could also maintain that the distributions of singular and plural are in fact complementary, but with a dividing line that is a "soft" judgement, e.g. "a parent most typically has one child on a given baseball team". The theoretical challenge is then to generate such an inference, as we discuss in the next section. In conclusion, the existing approaches to deriving number inferences in positive uses do not extend to negative cases, whether one is trying to capture the sensitivity to probabilities or merely to derive the limiting presuppositions.

The fact that we observe a few plural productions in the Sg condition, but no singular production in the Pl condition, can be taken as further support for the well-established idea that plural is

semantically weaker than singular. However, I am not aware of a precise theory that would explain it. Furthermore, this observation is based on only a handful participants and would merit further investigation.

4.2. On probabilistic biases in semantics and pragmatics

The possibility of sensitivity to probabilistic biases in semantics and pragmatics has been the subject of some discussion.[9] The kind of formal-logical models most often used in the literature do not allow for sensitivity to "soft" information; nor do they allow for gradient predictions. There exists a different family of modelling approaches involving probabilistic calculations, such as the *Rational Speech Act* model (RSA, a.o. Bergen et al., 2016) or the *Iterated Best Response* model (IBR, Franke and Jäger, 2014) among others, where productions follow from a numerical optimization procedure and can depend in a gradient way on inputs, and in particular on speakers' prior biases about the world.

Fox and Katzir (2020) argue that the way in which these models allow for sensitivity to biases is problematic: they show that the models predict that various pragmatic effects should disappear or be modified in some way in conditions of extreme prior biases on speakers' part, even though in truth the effects in question persist in those situations. Nevertheless, Enguehard and Spector (2021: sec. 2.2) present a specific case where the alternation between two forms whose enriched truth conditions are equivalent appears to be sensitive to prior biases. The experiment presented here is to the author's knowledge the first case of sensitivity to biases for which the gradience of the effect is demonstrated, which makes the conclusion that biases are the determining factor much more certain. Thus, our results speak for the integration of probablistic devices at some level of pragmatic modelling, whether taking inspiration from the aforementioned family of models or in some other way.

It should be noted that the precise nature of the "soft" information responsible for the effect we uncovered is unclear, and I do not think it should be identified to epistemic biases in general. Our various hypotheses for production patterns were formulated in terms of prototypicality rather than probability or frequency, and we made the working hypothesis that these come down to the same thing in our experimental setting. While the notion of protypicality is too vague to make precise predictions, in some realistic examples, it is clear that probability is not the right predictor. For instance, both (12a) and (12b) are acceptable and (12a) is if anything more natural, even though in a realistic situation, the speaker is more likely to find many chairs than to find exactly one; what seems to matter here is that the speaker only needs one chair.[10]

[9]Here I use "(prior) bias" to refer to probabilistic information agents may have about the world, e.g. "it is 50% likely to rain tomorrow". This is often referred to as a "prior belief" in the context of Bayesian modelling, but in the context of linguistics and philosophy, the word "belief" is mostly used for non-probabilistic information about which worlds are possible at all or not.

[10]In a related vein, Denić (2023) describes a case where a pragmatic effect is sensitive to numerical properties of the situation that formal-logical models are generally not sensitive to, while probabilistic models are. In spite of this adequation with probabilistic models, the effect is not sensitive to epistemic biases, and behaves as if the speakers' biases were replaced by some generic defaults for the purpose of pragmatic processes.

(12) I arrived late at the seminar and all the seats were taken, so I went to have a look in the surrounding rooms, ...
  a. ...but there was no chair anywhere.
  b. ...but there were no chairs anywhere.

5. Towards an account

In this section, we will provide the ingredients of an account of number marking on indefinites; the proposal is programmatic in nature and we will not provide a detailed formal set-up. At the heart of the proposal is a pragmatic principle whereby speakers try to set-up useful referents for future discourse. The main advantage of this way of looking at pragmatic competition is that it immediately generalizes to all environments. The possibility for free variation and sensitivity to biases will come from the fact that the principle is impossible not to violate in some cases, which forces speakers to go with their best guess.

One question any account of number inferences needs to address is how to make different predictions for singular and plural indefinites, given that they are assumed to be truth-conditionally equivalent. As we have discussed, Zweig (2009) and Ivlieva (2013) do it by considering subclausal constituents, while Spector (2007) allows for enriched meaning to enter competition. What we are going to rely on here is the dynamic potential of indefinites.[11]

5.1. The dynamic potential of negated indefinites

It is well-known that indefinites can bind pronouns outside their scope, even in the absence of a well-identified referent, a fact which has prompted the development of dynamic semantics. In early dynamic theories such as DPL (Groenendijk and Stokhof, 1991) negation was made to block dynamic binding on the basis of examples like (13).

(13) #There is no bathroom here. It's upstairs.

However, there are in fact many cases where an anaphor refers back to a negated or negative indefinite. This include so-called *bathroom*-pronouns, named after the example in (14), which occur in the second member of a disjunction and refer back to a negative indefinite in the first member. A negated indefinite can also be referred back to if it is itself under negation, as in (15).

(14) There is no bathroom here, or it is upstairs.

(15) It is false that there is no bathroom here. It is upstairs.

Other cases where one may refer back to a negated indefinites include modal contexts, as in (16), and after a retraction or denial, as in (17).

(16) There is no bathroom here. It would be downstairs.

(17) — There is no bathroom here.
  — Yes there is! It is upstairs.

[11] A recent proposal by Sudo (2023) also relies on dynamic potential in order to account for number inferences in positive sentences; I lack space and time to discuss it here in detail.

These examples can be analyzed in a dynamic theory as long as the notion of truth is divorced from dynamic effects, so that referents can be set up even when the proposition is false. This can be done within a bilateral system (e.g. Krahmer and Muskens, 1995; Elliott, 2020) where propositions have a positive and a negative denotation, or in a system where referents and context updates are represented separately (e.g. Hofmann, 2019); we will not provide a detailed theory here.

5.2. Number marking on negated indefinites and their bindees

Pronouns bound by an indefinite have to match the indefinite in number. This is shown in (18) and (19).

(18) It's not true that the card doesn't have a circle.
  a. It's just hard to see.
  b. *They're just hard to see.

(19) It's not true that the card doesn't have any circles.
  a. *It's just hard to see.
  b. They're just hard to see.

It is clear that (18a) can be used felicitously to describe a situation where there is a unique circle on the card. However, if there are several circles all the card, it is not natural for a speaker who has the card in front of them to assert (18a). Similarly, (19b) is degraded in a situation where the speaker can see that the card has exactly one circle. Thus, the use of the pronoun triggers an inference to the effect that the pronoun's number is appropriate to its maximal referent.[12] Note that this inference is not present in the first sentence, since one may explicitly introduce a referent of the appropriate number with a new indefinite, as in (20a) and (20b).

(20) a. It's not true that the card doesn't have a circle. It has several but they're hard to see.
  b. It's not true that the card doesn't have any circles. It has one but it's hard to see.

While again we will not develop a full system here, this pattern can be modelled in a dynamic theory under the following assumptions: (a) the referents introduced by indefinites bear formal number features, which anaphors have to match (as is assumed by Sudo (2012)), (b) the number features on pronouns are nevertheless interpreted and have to be appropriate to actual referents, and (c) pronouns receive maximal interpretations.

[12]Note that this is a judgement on naturalness of production. In an informal survey, I have not found consistent judgements on whether these examples are interpretable and what their truth conditions are when the pronoun's number is not appropriate. In particular, if there are several circles on the card, of which some but not all are hard to see, it is unclear whether (18a) is true. The truth conditions and precise use conditions of generic variants of these episodic examples are unclear in a similar way; this connects to debates in the litterature on the interpretation of *donkey*-pronouns. It would of course be very interesting to investigate these issues experimentally and bring together production and comprehension data; this is beyond the scope of this paper.

5.3. Explaining number inferences: a pragmatic principle of forward-looking cooperation

The previous sections have established that the choice of number marking on negated or negative indefinites affect the possible ways in which the conversation may continue. Indeed, after a first speaker has uttered (21) (repeated from (3a)), a second speaker who knows that there is in fact one barely visible circle on the card may contradict the first speaker by using (22a). If, however, the second speaker knows there are several such circles, they cannot use (22a), where the pronoun's number does not match the referent (or where the referent is not maximal, depending on one's point of view); nor can they use (22b), where the pronoun's number does not match that of the indefinite that licenses it. One can see this as a situation of ineffability, where a speaker would like to express a statement about something for which there is a referent in the discourse context, but has no licit way of doing so. In such a situation, the second speaker is forced to introduce their own referents, for instance through saying (22c). A similar problem can arise in the case where the first speaker used plural in their negative assertion, while the second speaker is aware of a unique witness.

(21) There is no blue circle on the card.

(22) Context: *there are several, hard to see blue circles on the card.*
   a. #Yes there is! It's just hard to see.
   b. *Yes there is! They're just are to see.
   c. Yes there is! There are several, they're just hard to see.

In light of the pattern outlined above, the first speaker's choice of number is not entirely innocuous: it will determine in which situations a potential contradictor can re-use the first-speaker's referent, or needs to introduce a new one. What I would like to propose here is that this is at the source of the conceivability presupposition and the gradient sensitivity of production to biases. The key assumption is that speakers are trying to *set up useful referents*, in application of a conversational principle of facilitating potential continuations of the conversation — a forward-looking maxim of Manner. The principle can be for instance stated as in (23).

(23) ***Provide useful referents*:** between utterances of equivalent acceptability as per other principles, prefer the one that sets up referents that can be used in well-formed continuations.

The conceivability presupposition of number marking on indefinites follows immediately from this principle, together with the theory of binding and number marking sketched in the previous section: the referents set up by the indefinite — which exist even for negated indefinites — are useless if their number is known not to be appropriate. When the conceivability presuppositions of both numbers are met, it is in fact impossible for speakers to obey (23): whatever number they use, there is a chance that it could lead to the situation of ineffability we described above. In those cases, a natural strategy for speakers is to resort to a best guess as to what continuations might be needed later, so as to minimize the chance of ineffability. This explains that speakers will be sensitive to distributional information about the witnesses in their choice of number.

Corrections or denials are often assumed to fall outside the ideal conversational setting formal pragmatics models, and it might seem strange to propose that the pragmatic system is optimized to facilitate them. It should be noted, however, that the above reasoning is not limited to

negated indefinites and retractions thereof. What the reasoning relies on is that indefinites create referents, and that these referents are accessible later. As evoked in Section 5.1, dynamic theories where negative indefinites can set up referents more generally allow for indefinites' referents to be preserved at some level of the semantic representation, regardless of the syntactic environment of the indefinite. Furthermore, while we have focussed on denials as a simple example, there are also ways of using referents created in arbitrary environments while keeping to monotonic conversational updates, in particular through appropriate use of modals as in (16). The proposal therefore extends to use of indefinites in any environment. In particular, the same patterns of valid and invalid continuations extend to use of indefinites in questions, another case where singular and plural have been described as equivalent; this is seen in (24). The principle in (23) is very natural in this case, as the first speaker is interested in the information the second speaker will provide. Through its application, we predict the choice of number for indefinites in questions to follow the same rules to as for negative statements; at least for the conceivability presupposition, we have seen that this is correct.[13] Here we see that our proposal is not dependent on the notion of truth conditions, and applies even to non-truth-conditional sentences.

(24) Situation: *there are several blue circles on the card.*
Q: Is there a blue circle on the card?
a. A: Yes, *(there are several,) but they're hard to see.
b. #A: Yes, but it's hard to see.

The account presented here is not fully formalized; some of the difficulties that formalizing it entails include specifying how the set of competitors is determined, as well as how the pragmatic principle we stated interacts with other conversational principles; this latter question becomes non-trivial once we accept that pragmatic principles are violable, as we did. When it comes to the specific issue of number marking, it would be desirable to extend it into an account of all number inferences, including in positive uses.[14] Given that number inferences in positive cases have been argued to show similarities to scalar implicature computation and *Maximize Presupposition* effects, it would also be desirable to try to relate our approach of forward-looking competition to existing competition-based interface mechanisms.

6. Conclusion

The goal of this paper was to ascertain the difference in meaning between singular and plural indefinites in syntactic contexts where the number inferences usually associated to them,

[13] In order to properly extend the account to questions, we need a dynamic theory of questions where dynamic ouput and truth are separated. As it happens, the dynamic theories with this property that we discussed in Section 5.1 do not cover the case of questions, while existing dynamic theories of questions (e.g. Haida, 2008; Roelofsen and Dotlačil, 2022) do not have this property. Enguehard (2021) proposes a bilateral theory of questions with the appropriate formal properties.

[14] When it comes to positive uses, our account does not derive the strong inferences associated to number: what we derive is the same thing as for negative uses, specifically the conceivability presupposition and perhaps a soft inference of the form: "blue circles are more likely to come in groups". The strong inference — e.g. "there are several blue circles" — can perhaps be derived if we assume that direct monotonic continuations are privileged: speakers care more about avoiding ineffability for future updates building up on their assertion than for denials, counterfactual claims etc. It remains to be seen if this idea can be formalized.

and analyzed by various authors as scalar implicatures, do not obtain, and in particular under negation. We have seen that negated or negative indefinties trigger a conceivability presupposition to the effect that the witness set of the indefinite *could in principle* have the cardinality associated to the indefinite's number features. Through an experiment, we have shown that this presupposition is a limiting case of a more general pattern whereby the number of the indefinites is determined by whicher cardinality is more common or more prototypical for its witness set. These facts are difficult to explain in many existing theoretical approaches, both because it is difficult to generate inferences that are not mutually exclusive through competition mechanisms, and because soft distributional information, as opposed to propositional information, is not taken into account. We have offered a tentative solution in the form of a model of pragmatics where the potential continuations of the utterance are a driver of competition.

Beyond the specific issue of number marking, I hope that some of the ideas presented here can be of wide interest to semantics and pragmatics researchers. In particular, I believe the experimental approach consisting in teaching people a distribution — or any other kind of information — through an non-trivial task before actually making them perform the task of interest can reduce the risk that effects might be driven by the uncontrolled ways participants provide missing bits of context or import world knowledge. I also hope that the idea of reasoning about potential continuations of an utterance can be applied to other phenomena; compared to competition mechanisms based on logical comparisons, this approach presents the advantage that it applies equally well to non-truth-conditional statements such as questions.[15] Finally, our data provides a novel example of gradient sensitivity to distributional information in pragmatics, which speaks to the necessity for pragmatic theories of integrating this sort of information.

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Yet another player in the *re* domain: the redirectional (*send-it-somewhere-else*) reading [1]

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Abstract. The paper analyzes a neglected reading which appears in the domain of iterative morphemes focusing on the English prefix *re-*. The analysis is discussed against the backdrop of the structural vs. lexical types of analyses suggested by previous research for other readings of iteratives, notably the repetitive and restitutive ones (von Stechow 1996, among others). The relationships of the different readings are discussed. The current proposal is formulated by updating Zwart's (2019) semantics, hence fully compatible with a lexical account. The relevant relation defined is called 'redirectional' and the reading observed 'send-it-somewhere-else', starting out from the most literal instances, i.e., locational and specifically path-based ones, which link up directly to, and extend, other more widely discussed notions of (counter-)directionality and reversal. Questions from the current research arise for semantics, but also its mapping with the morphosyntax.

Keywords: iteratives, *re-*, *again*, functional/decompositional adverbs, structural vs. lexical

1. Introduction

In this paper, I will focus on a reading of the English prefix *re-* that can be illustrated with the sentences in (1) and which I dub the *send-it-somewhere-else* or SISE reading for the sake of concreteness:

(1) a. I need to receive a TCP packet destined to my application, then **re**send it to another destination on the network, while keeping the Original IP. (web-based)
b. The plane was headed to JFK, but the local authorities **re**directed it to LaGuardia.
c. I bought a car from Kim and I'm **re**selling it to Abby.
d. The president **re**tweeted Jonelle's message.

The semantics of such sentences has thus far not been systematically analyzed as far as I can see. This entails that some basic work will have to be covered, some terms clarified, and then sometimes larger questions will be asked. It also entails that, with some high certainty, not all the aspects will be covered when comparing the current object of investigation with other readings or items in the so-called *re* domain. That is, notably the classical repetitive and restitutive or counterdirectional readings of e.g. *again,* German *wieder,* or of *re-* itself for that matter, among others, also in other languages, which have been studied thoroughly and often controversially in their facets for instance in Morgan (1969), McCawley (1971), Dowty (1979), Fabricius-Hansen (1983), von Stechow (1996), Jäger & Blutner (2000), Klein (2001), Beck (2005). I will also not go into many of the interesting syntactic details that surround iteratives such as *again* and *re-,* but I will summarize a few and point to further relevant literature.

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The structure of the paper is as follows. The remainder of this first section introduces basic terminology and the questions to be raised, before Section two addresses the central readings of iteratives and the way they have been handled in earlier research. Section three describes and analyzes the SISE reading, while the final section offers further-going discussion and an outlook.

1.1. The area of investigation, terminology

The class to which the prefix *re-* belongs semantically is that of an iterative morpheme. This standardly translates to having a morpheme that presupposes an iteration, or a previous occurrence of an event or of a result state that precedes the one asserted. Oftentimes, such items are free morphemes. They include adverbs like *again,* particles like *back*, and sometimes (at least in their genesis) even prepositions like *against* (cf. Beck & Gergel for the relationship of such items in the historical evolution of English, where they are all related; cf. Fabricius-Hansen also for the relationship of the meanings 'again' and 'against' in the case of German *wi(e)der;* cf. Zwarts 2019 for synchronic illustration with Dutch *terug*). The morphemes clearly don't have to be free, as the prefix *re-* shows, which includes the most prominent readings of *again* (Marchand 1960). The term '*re* domain' has been used in a detailed study on Dutch by Zwarts (2019), even if *re-* itself is not the object of investigation there and the reading I am concerned with isn't either. But it is a handy term and I adopt it as equivalent for iteratives. The specific reading I will introduce is certainly not precluded from being available in some other representatives of the class either, even if it appears to be more restricted (for instance, with *again* and German *wieder*) or not available at all, to my knowledge, e.g. at least with German's cognate of Dutch *terug, zurück*, 'back'. (There are of course multiple and independent ways to express the relevant meaning in most languages, I assume.)

A further point of taxonomy which may require clarification includes the fact that some researchers (e.g. Rapp & von Stechow 1999, Maienborn & Schäfer 2011) have also called the class of relevant adverbs (including *again* or German *wieder*) 'functional adverbs'. The term can be somewhat misleading if one thinks of functional projections in the Tense-Aspect-Mood/modality domain and the adverbs that can accompany them there, say, in the sense of Cinque (1999); cf. e.g. Axel-Tober & Gergel (2014) for discussion among many others. There is of course a way to bring the two lines of research together, namely in terms of scope (cf. von Stechow's 1996 original tying of interpretation to rather specific functional projections, also outside the TAM domain), but in general the two lines of research follow quite distinct objectives, notably the clausal spine vs. the narrower structure of events. The items typically studied in the two lines of research are also quite distinct, hence I will not use the term 'functional' in the relevant sense here.

'Decomposition' is another informative term that has been occasionally used to properly include the class of the *re* domain. It also includes adverbs like *almost* and prepositional phrases like *for ten minutes*. This is a potentially clearer term and it has the advantage that it can be properly defined, for instance in the sense that such items can modify subparts of predicates (Dowty 1979, von Stechow 1996, Beck 2005), but there are some limitations in importing the term for our class. The main downside is that it can mistakenly be taken to imply that the morphemes under scrutiny automatically should be able to decompose the internal structure of

the predicates or the events they modify, which they don't always do. That this is not the case has been argued strongly e.g. by Fabricius-Hansen (1983, 2001) and Jäger & Blutner (2000), or that it may not always be the case has been suggested e.g. in Rapp & von Stechow (1999), von Stechow (2000), Beck (2005), or Gergel & Beck (2005). Hence the term as such is not neutral and I will consider 'iterative' or the '*re* domain' as the appropriate neutral labels for the time being when we want to refer to the class, so that it doesn't only include items that are necessarily decompositional.

1.2. Questions to be raised

When a reading that hasn't been previously systematically explored is claimed in an area which has seen multiple decades of research, we will naturally have to focus on what the reading is exactly and how it connects to other readings that have been discussed more systematically in earlier research. In a nutshell, the main questions to which I will seek answers are the following:

i. What is the reading descriptively?
ii. How can it be analyzed?
iii. How does it relate to the previously recognized readings?
iv. How can it throw light on the controversies related to the field and especially the structural/lexical divide?

My focus lies in showing – quite descriptively – that the reading is indeed distinct from the readings that have captured most of the attention in the field and to offer an analysis that is consistent with current research in the field, which I formulate in terms of Zwarts (2019). If one likes putting things into standard boxes, then this is done at face value in a lexicalist account in the current approach. Or in other words, in the terms introduced in the previous subsection I will not pursue a strictly decompositional approach. But I will sketch a path at the end of the paper how one could explore how far such an approach can go. Eventually I will argue that rather than trying to exclude 'the other' approach, more benefit can be gained from recognizing that connections between the readings (including the one at stake here) must exist in any approach and the key in understanding the phenomena more generally may well lie in finding the right translations or mappings between the different approaches.

2. Previously recognized major readings and their analyses

2.1. Transferring from *again*?

The literature concerning the representation of iteratives has been built starting out from adverbs like *again* and their ambiguities (Morgan 1969: 61, McCawley 1972: 24, and much literature after the Generative Semantics wave). The most prominent reading that comes to mind in connection with iteratives is the repetitive one, as available in (2a-d):

(2) a. The Mars rover was cruising again.
b. Alvin was happy again.
c. Maria caught the bug again.

d. Don cemented the backyard again.

The sentences in (2) all allow a contextualization suited for readings in which a previous eventuality of the same kind (where the term is used broadly, to include a Vendlerian state as in (2b)) is presupposed to have held. A standard, here simplified entry for the repetitive reading is given (3) (e. g. Gergel & Beck 2015:29, among many others).

(3) $[[\textit{again}_{\text{REPETITIVE}}]] = \lambda P.\lambda e{:}\exists e'[e'<e \ \& \ P(e')].P(e)$

The repetitive interpretation then clearly requires the presupposition that the predicate also held at an earlier time, while its assertion is trivial.

Not for all the sentences in (2) is a contextualization uncontroversially available in which a reading that is semantically genuinely *distinct* from the repetitive obtains. Specifically, a second prominent reading is, in most research, denied for states and activities, but only uncontroversially assumed to arise for achievements and accomplishments. For the two types of events, there is indeed agreement that such a reading obtains. In (2c), Maria need not have caught the dog previously (this being the repetitive reading), but the dog could have been on leash and then escaped before the event at issue. That is, Maria put him back in the state of captivity in which he had been before. In the same vein, in (2d), the concrete in Don's backyard might have had too many cracks and Don cemented it (even though he never cemented it before himself, so the agent expressed by the subject never performed the entire event previously).

On one view of treating the ambiguity just introduced for telic eventualities, a state which had held before had been restored or repeated in such sentences when they convey non-repetitive readings. Under such a view, the adverb must then have access to the internal event structure of the predicate so that it can target just the result state. The adverb comes with the requirement of imposing a presupposition that a similar state must have held earlier on. The reading is standardly referred to as restitutive or as an inner reading in Dowty's originally introduced terminology. But no additional lexical entry is required for *again* under this view, as the entry in (3) is general enough to also apply to stative eventualities such as the result states. But the syntax of the result state must be visible to the adverb for it to be modified accordingly.

On a second view, however, the non-controversial non-repetitive type of reading requires some kind of a reversal or a counterdirectional predicate to have held. This can be the escape of the dog, or the cracking up of the concrete in the sentences (2c-d) above. Under such a view, a simplified entry as in (4) can do the basic job (cf. Fabricius-Hansen 2001, Beck & Gergel 2015, Gergel & Beck 2015):

(4) $[[\textit{again}_{\text{COUNTERDIRECTIONAL}}]] = \lambda P.\lambda e{:}\exists e'[e'<e \ \& \ Pc(e')].P(e)$

The notation Pc stands here for the earlier presupposed counterdirectional predicated to the asserted predicate P, the assumption being of course that one can find such an event. There are a number of refinements of this approach in the literature; see especially Zwarts (2019) for discussion of this line of research, out of which we will introduce the essentials that are directly required for a transfer to an analysis of *re-* in Section three. In general, the term 'restitutive' has indeed typically been used by approaches arguing for a structural account of the ambiguity

(championed by von Stechow 1996 who has shown interesting further syntactic correlates for the Dowtian view from the syntax of the German middle field), while 'counterdirectional' is the term that has been used in lexical accounts such as Fabricius-Hansen's (2001). Pedersen (2014) proposes an account close in spirit to Fabricius-Hansen's in which scalar structure is additionally closely considered and calls the counterdirectional reading a 'reversal reading'. Following mostly Beck & Gergel (2015), Gergel & Beck (2015), I will clumsily call the prominent non-repetitive type of major reading treated by earlier research 'rest/cd', simply to be able to refer to the reading itself in a manner that is independent from a particular type of analysis. Notice also that the repetitive reading entails the rest/cd one, but nonetheless a different state of the world holds for the latter to be true; hence this is generally recognized as a distinct reading both by the structural and the lexicalist camp.

Historically, the standard iteratives of English and German have developed – in simplified form, cf. Fabricius-Hansen (2001), Beck et al. (2009), Gergel & Beck (2015), Gergel (2017), Kopf & Gergel (2023) for some of the details – from being almost exclusively rest/cd to being increasingly repetitive. This applies necessarily also to the relevant frequencies of usage. If one wishes to connect the entailment relationship with the direction of development, then one might be tempted to claim that a specialization has been unfolding in the case of these main representatives of the iterative class. Presumably similar things could be claimed about Dutch *terug,* which is about to make it to repetitive readings only in some varieties, as Zwarts (2019) argues. But the inductive step, namely towards generalizing this to an invariant rule showing in the developmental direction " rest/cd→repetitive", does not seem to be warranted, as Gergel & Puhl (2023) claim on the basis of dialect data from the Saarland region (Gergel, Blümel & Kopf discuss the intricacies of a now extinct adverb of earlier English, where the picture is also considerably more complex than in the case of the best known representatives of the class in the West Germanic languages).

We need not take a definite stand at this point with regards to the structural/lexical divide, the direction of historical development or the respect to the two major readings, as our focus lies elsewhere, but some remarks will be made from the perspective of the reading we focus on at the end of the paper.

2.2. Standard readings and the prefix *re-*

When we turn to the prefix *re-*, the picture appears to be blurred in several ways, even when we only want to describe the standard iterative readings we just observed for *again.* On a very first approximation, one may be tempted to claim that *re-* and *again* are synonymous, as some descriptive dictionaries and works have claimed. But it will become clear very quickly that the number of predicates to which *re-* can attach is considerably smaller. For instance, from the predicates in (2) above, only those of (2c) and (2d) would allow *re-*prefixation of their head verb. I use the term predicate rather than verb, even if the eventual host is of course the verb, since the restrictions have to do with the predicate and we are not purely dealing with a classical, say morphophonetic restriction of the verb. For instance, *cruise*, the verb of (2a) is not incompatible with *re-* per se (though surely not frequent), but it appears more likely to allow the prefixation when used with a syntactic object, which is not the case in (2a) above. But as the examples in (5) show, it is possible to get (even) *re-cruise* when an object appears:

(5) a. Alpacino was re-cruising Sunset Boulevard in his new car.
b. We re-cruised the airplane to its best speed and altitude.
c. In July, they re-cruised the two blocks.

Re-cruise is as mentioned anything but a frequent verb and it is notably one that does not have very obvious or predictable objects (e.g. the sense of information density). I hence believe that such examples should make the point about the restriction and the creative power of the basic rules beyond it (cf. e.g. Marantz for a review of the literature which contains many rather common example). Notice that (5b-c) are adapted after attested examples in specialized registers of aviation and forestry (cf. https://www.quora.com/Does-the-pilot-tell-the-passengers-when-a-commercial-plane-is-experiencing-serious-issues-during-flight and https://www.bcfac.ca/app/uploads/sites/837/2020/06/2016frp002a.pdf). Let's also briefly consider the opposite situation, i.e. one in which a handful of rather predictable objects exists, say *snow, earth* etc. for a verb like *shovel.* Then alongside *Jane was re-shoveling the snow*, something like *Jane was re-shoveling at that time* is acceptable for some speakers (with context), but naturally then an implicit object must be retrievable from the respective context.

Even beyond implicit objects, the transitivity restriction is not perfect, as some intransitives also allow *re*-prefixation (Marchand 1960). The observation is usually further refined towards one referring to underlying objects (e.g. phrased in terms of unaccusativity, as Horn 1980 did in an analysis couched in the framework of relational grammar), as sentences as those in (6) are possible, while those in (7) are not.

(6) a. The downtown store re-opened.
b. The metal re-melted.

(7) a. *The captain re-jumped (up).
b. *Amy re-sneezed.

The most recent version of the Oxford English Dictionary (2023) essentially summarizes the central distribution and the meanings of *re-* as follows:

(8) Prefixed to ordinary verbs of action (chiefly transitive) and to derivatives from these, sometimes denoting that the action itself is performed a second time, and sometimes that its result is to reverse a previous action or process, or to restore a previous state of things. (OED, 2023, "re-prefix" 1.a.)

But we are of course only scratching on the distributional surface. When one restricts attention to transitive predicates that do allow *re*-prefixation, further issues exist as well. For instance, a controversy exists with regards to whether *re-* truly allows both classical readings of iteratives (cf. e.g. the claim that it is essentially just the restitutive or 'internal' reading, originally going back to Dowty 1979, although some authors including those of the OED do not see this as narrowly and Dowty himself admits at least two types of exceptions – further subdivisions and possible correlations are possible, but I will not go into them here). Another interesting claim in the literature has been what Marantz (2007) reports on as the sole-complement restriction, such that for instance predicates built with ditransitive verbs would not allow *re-* prefixation. I will return to aspects of this issue briefly in section 4. I cannot summarize the breadth and depth

of the syntactic literature here given the distinct focus, i.e., both on the area of semantics and a reading that I claim is distinct from those to which systematic attention has been devoted. But on top of the general insight from the earlier approaches, it is worth keeping in mind that the productivity of morphological processes comes in degrees and there is a multitude of factors which impact it (s. e.g. Carstairs-McCarthy 2002 for only a few) including not only token-based but also rule-based frequency (Yang 2016) and historical developments (Marchand 1960). By the latter we cannot possibly mean that processes that took place a long time ago directly influence current usage patterns, but that some of the grammatical trajectories of such processes (or sometimes perhaps even apparent 'accidents', when we don't know their deeper causes) might have triggered processes that fall in place with other grammatical factors to yield new sub-rules at the intersection of structure and meaning.

3. The SISE reading, some differences from the major readings of iteratives

In this section, I consider a reading of *re-* which I term the send-it-somewhere-else (SISE) reading, propose an analysis for it, and discuss its relationship to the other (key) readings in the domain of iteratives.

3.1. SISE readings: a lexical analysis

Consider the sentences in (9) below (repeated from (1) for convenience):

(9) a. I need to receive a TCP packet destined to my application, then **re**send it to another destination on the network, while keeping the Original IP. (web-based)
b. The plane was headed to JFK, but the local authorities **re**directed it to LaGuardia.
c. I bought a car from Kim and I'm **re**selling it to Abby.
d. The president **re**tweeted Jonelle's message.

What they convey is not repetitive, since there is descriptively no full event or predicate that is sensibly to be presupposed (i.e. of sending the packet to another destination, directing the plane to LaGuardia, etc.). The rest/cd type of reading is to be ruled out as well for the following reason. The predicates are telic, but the result state can't be taken for granted (to have held at an earlier time) for a restitutive reading to be true, i.e. there is no previous arrival at another destination, no previous having been sold to Abby etc. On a stricter attempt to see whether a counterdirectional reading proper holds, we would need reversal events to hold and they are far from perfect, if available at all, too. There is, for instance receiving in (9a), but this can barely count as the counterdirectional to a *distinct* destination (one would have wished for resending to the original destination and the verb *resend* per se would allow such readings easily, but clearly not in the context at hand). Similarly, there is no straightforward and precise reversal of the direction to be pursued by the plane, the selling of the car or the direction of the message in (9b-d), respectively.

What holds in sentences such as those of (9a-d) is that there is a previous similar event of sending, directing, selling, or tweeting in the background (i.e. to be presupposed), but the event at issue needs to follow a path that is crucially neither the same nor the opposite, but rather one that finds an endpoint (culmination) which must be distinct from the one of origin; or else, we

have a distinct reading. It is for this reason that a term such as 'send it somewhere else' may serve as a convenient description.

I propose to implement the observation just introduced by extending the framework of Zwarts (2019). Naturally, I only present the framework in simplified fashion and refer the reader interested in more details (including in the specifics of Dutch *terug,* 'back') to Zwarts's work and the references there.

First, we standardly assume with Zwarts that items from the *re* domain will map sets of events to sets of events (understanding any eventuality). Second, we assume the more relevant tools pertain to paths, which are generally thought of as trajectories through some physical or conceptual space. A path in the account is a function from the real-numbers interval [0,1] or some subinterval thereof to a space. The idea is that themes move along paths through time and can be traced accordingly, so that PATH(p)(i) reflects the location of a path at a time between 0 and 1. LPATH is the partial function mapping events to physical paths while APATH is the one mapping events to action paths, i.e. paths that are less straightforwardly localized; others also exist. As a side note, recall that predicates that are headed by a *re*-verb in general have an underlying theme indeed, so that in our case, this condition holds as strongly as it possibly can in the domain of iteratives.

A REVERSE direction models what Zwarts terms a counterdirectional/returnative reading (a subtype as it were of the rest/cd) and this looks as follows in terms of a relation between paths:

(10) For any two paths p and p', REVERSE (p, p') if and only if (i) $p(0) = p'(1)$ and (ii) there is a $j \in (0,1]$ and an $i \in [0,1)$ such that $p(j) = p'(i)$. (Zwarts 2019: 224)

Building on the same background, let's approach the direction needed for the SISE readings of concern. To this end, I define a relationship between paths which I call REDIRECT as in (11) (and compare the two definitions subsequently):

(11) For any two paths p and p', REDIRECT (p, p') if and only if (i) $p(0) = p'(1)$ and (ii) for all $j \in (0,1]$ and an $i \in [0,1)$, $p(j) \neq p'(i)$.

The first condition of (10) and (11) is identical, ensuring that the second path starts where the first one stops. The second condition in (10) states that a non-initial position of p is identical to a non-final position of p'. That is, the path 'returning' is required to have at least some overlap with the original one. But for the REDIRECT relation that we need this is an unnecessary condition. It is also one that does not correspond with intuitions. On the contrary, typically we will want the redirected path not to overlap with the original one (for SISE to obtain). The condition I utilize therefore instead ((ii) in (11)) is built accordingly so that the original (presupposed) and the 'redirected' path be distinct. This is simple and a relatively strong condition in the version I have given here. It is conceivable, for instance, that there may be cases where it might suffice e.g., for most points to be distinct in the two paths. But it essentially captures the intuition that a theme is 'sent somewhere else'. That is,it undergoes movement to a distinct location (or transformation to a different state). While Zwarts naturally uses the REVERSE relation to build a returnative meaning (as rendered in (12)), the SISE meaning I propose is built based on the REDIRECT relation, as I show in (13), in which the existence of a

previous event e′ is presupposed such that it will satisfy the REDIRECT relation when the latter is applied to it and the asserted event:

(12) RETURNATIVE = λE. λ*e*: ∃*e′* [*e′* < e ∧ *E′*(*e′*) ∧ REVERSE (LPATH(*p*), LPATH(*p′*)]. [*E*(*e*)] (Zwarts 2019: 223)

(13) [[***re***$_{\text{SISE-PHYSICAL}}$]] = λE. λ*e*: ∃*e′* [*e′* < e ∧ *E′*(*e′*) ∧ REDIRECT (LPATH(*p*), LPATH(*p′*))]. [*E*(*e*)]

This naturally applies to verbs which include a motion component most straightforwardly and of course more (though clearly not all) verbs that include optional goals into their argument grids can show the reading. For instance, the verb *re-shovel* that I mentioned in 2.2 above can have a SISE reading as well, e.g., in a contextualization such as (14):

(14) Larisa re-shoveled the snow to a different location (after it had been shoveled to the wrong place, where it potentially blocked an entry for the neighbor's cat).

Further transfer to action, more specifically transmission paths (say possession or messaging, as in the sentences in (9c-d)) above is almost trivial as well: substitute LPATH in (13) by Zwarts' action path, APATH. If further types of paths are necessary for SISE readings, they will naturally receive an analogous treatment. The key reason I see for now to keep the specifics of different types of paths in place (L, A, …) and not to use a generalized notion of PATH instead: a prominent type of path from the counterdirectional literature (scalar ones, Pedersen 2014) is harder to get on the data available. E.g., putative degrees of reselling or retweeting are not immediately and intuitively plausible.

3.2. More on relationships between readings

A further extension can arguably be culled by extending the analysis to cases where the sense of direction is even less prominent, but in which – crucially again – a *distinct* result state can be obtained, even though the activity part did once more hold true at a previous time. This yields verbs such as *rephrase, remodel, reshape, reform,* etc. where the end result is a different phrasing, modelling, shaping, forming, and so on. Incidentally, the boundary between hyphenated and non-hyphenated versions of different verbs is not always an entirely clear one with respect to the repetitive/SISE distinction. While there are typically nuanced semantic distinctions between the two types of forms, the hyphenated forms can also sometimes be interpreted as SISE, and not only repetitively. For instance, in the following case, one might oscillate between a repetitive and a SISE reading:

(15) At the same time, the Byzantines re-formed their own power structures. (Chr. Wickham, *The Inheritance of Rome*, Penguin, 2009, p. 483)

In the context in which (15) occurs, the Byzantines will have formed their original power structures at an earlier time interval. But at the relevant event time they formed them specifically with a distinct result. Simply forming them once more is not informative in the

context. Such cases may be viewed as borderline, but finding potential ambiguities should not be too surprising for the area of iteratives.

Oscillations between SISE and rest/cd readings can be identified as well. They may be of a different type. Consider the verb *remove* (which is also one of the most frequent ones in Middle English when *re-* was borrowed from Anglo-Norman (and ultimately Old French, according e.g. to the OED), even if we discuss Modern English examples here only).

(16) The janitor removed the stone from the doorstep.

In principle this can yield a SISE reading, accommodating the fact that the stone in question has been placed by the janitor to a different location than where it had come from. But the difference is not as strong from a rest/cd reading as in other examples. For instance, if the object is changed from *the stone* to *the chair,* then it is quite likely the chair will be put back by the janitor more or less just to the location where it came from and where its typical place is. One factor that can drive such variability in meaning then, seems to be an underspecification (rather than say, a true scopal ambiguity) between different trajectories in relationship to the original path. If it was a path that can function as a reversal (sometimes maybe even because the exact location will not matter), then a rest/cd reading will be more likely. Conversely, if it becomes relevant that the asserted path must go somewhere else compared to the one that is presupposed (or accommodated), then a SISE reading will become prominent.

Despite such cases in which potential ambiguities and cases of underspecification may appear (though I believe less systematically than in the classical case of the repetitive vs rest/cd readings), I think that the readings can be kept apart in the appropriate contextualizations quite straightforwardly most of the time. Before concluding this subsection, let's mention nonetheless one more diagnostic through which SISE will appear as indeed distinct. Klein (2001: 268) offers an excellent paraphrase for iteratives of the repetitive and the rest/cd kind, namely along the lines of "and this not for the first time". This yields a good approximation and window for *again* words on the two classical readings, where one just has to think about what to insert for the anaphor "this" in the paraphrase of the presupposition. Is it a full event? Then it will be a paraphrase of the repetitive reading. Is it a result state? Then the rest/cd. But this is not so straightforwardly the case for SISE. Inserting such a continuation is at the very least not always felicitous; cf. the examples in (9) above, in which the anaphor fails for the respective SISE readings. While there is a sense in which at least some part of the event related to the core activity (some directing, selling etc.) has happened before, this can't be picked up felicitously by the anaphor that works well for the two other readings. The anaphor heuristic that I introduced by using Klein's paraphrase then supports a distinction, too.

Overall, I have argued in this section that the SISE reading is – as a baseline – at least as distinct from the repetitive and the rest/cd reading as the others are from one another. In fact, I believe possibly more so, due to the distinctly specified target point or result state. This is not only a matter of definition, but one that makes all the difference in the clear SISE readings (pace possibly undetermined ones – we may note from corpus experience that such cases of underdetermination always exist in real life including for the classical readings, even if the majority of naturally occurring readings can be determined; cf. e.g. Kopf & Gergel 2023 for discussion of corpus work on iteratives). I have conducted my argument in intuitive and

analytical terms through the description and the entry offered in the previous subsection in which crucially target points of the relevant path were required that are different from the original path; or else the reading is not to be classified as SISE.

4. Further discussion

In this section, I briefly discuss the relationship of the two possible accounts – structural vs. lexical – and mention only a few additional peculiarities of *re-* as an outlook for further research.

4.1. Structure vs. lexicon?

What I hope to have shown in this paper is full compatibility of the reading which I defined as redirectional (in terms of its underlying path configuration) or more specifically as SISE with the help of a lexical account, specifically building on the tools utilized in Zwarts (2019). Is a structural account of the reading therefore automatically excluded? I think it is fair to answer 'no' in the current understanding of the accounts of iteratives.

I have very recently come to possess Carlson & Roeper's (1980, CR) article with a rich treatment of morphological processes in which, *inter alia*, readings of *re-* are observed that only target the activity part of the relevant accomplishments. The simplified research context is as follows. CR notice that a verb like *put* does not take *re*-affixation (**John reput the dog in the kennel*) and attribute this to its having two arguments. A contradiction arises, however, then for verbs like *redirect* or *relocate*, since these are acknowledged to also subcategorize for the goal PP (some dative PPs are claimed to behave similarly), but they are legitimate with *re-* prefixes, e.g. as in (17) (Carlson & Roper 1980: 142):

(17) John relocated the dog in the kennel.

The gist of CR's account is based on maintaining a distinction between arguments and complements and they do not offer specific entries for *re-* on the relevant SISE reading. But they sense that the relevant presuppositions *can* be distinct in such cases from those of the standard readings of *again* quite clearly. (My claim was similar, though not entirely identical, in that the relevant readings *must* be distinct when the context is controlled.) While their claim that *again* never shows this kind of behavior (i.e. SISE) simply because it is always claimed to include all of the arguments in its scope needs to be taken issue with (for instance, speakers of earlier and sometimes Modern English have produced/ still accept the verb *sell* on SISE readings), the account CR offer can, in essence, serve as the sketch of a structural account of SISE readings, which still remains to be fully evaluated in a version that is more spelled-out in its semantic assumptions, entries, and especially interface connections, as standard phrase structure will not easily work to the exclusion of arguments, no matter how they are labeled. This is incidentally a serious, but presumably not unsurmountable challenge for close structural accounts.

Even if unsolved data exist for all iteratives which are often ignored (see CR for many cases in point, or e.g. Jäger & Blutner 2000), it may seem fair to say that the distributional picture of

re- appears to be considerably more complex than that of *again* (see below for some more data, too), Nonetheless, I'd like to suggest a picture that is perhaps more unifying than one might think with respect to the types of accounts that are typically pursued. The thrust of my suggestion is that the long-standing question structural vs. lexical is, in fact, not placed quite the ideal way. The more insightful way may be *how* the individual readings one obtains are related. (Notice that I presuppose that they must be related.) This kind of interrelatedness may be more obvious on structural accounts, where essentially one and the same entry is mechanically (or 'elegantly', depending on the point of view) attached to different constituents. But lexical accounts have in fact also sought to deepen our understanding of the phenomena in a variety of ways and especially in terms of the cognitive connections that exist between readings – whether historically (as e.g. under Fabricius-Hansen's impetus), in terms of locational/conceptual paths and possibly also semantic maps (as in Zwarts), or a variety of other ways. It is also worth noting that lexical accounts do not always lack predictive power, while they take care of descriptive accuracy. For example, von Stechow (2000) points out quite forcefully, while acknowledging some of the criticism in Jäger & Blutner (2000), that the latter account overgenerates in a number of ways, especially in view of the fact that standard modern structural accounts also have a lexical, and in this case arguably less powerful component (i.e. in determining whether a verb will be 'decomposed' or not). Finally, when one has better tools to see how the individual readings are related in different accounts, the follow-up relevant question could (and I think, should) be: How are the accounts to be translated to one another, assuming that they – in fact – describe different aspects of essentially the same connections between readings?

4.2. Outlook minutiae

While the basic semantics of iteratives may appear straightforward, there is in fact a wealth of unsolved data already existent in the available literature (in addition to the need for further empirical strengthening and nuancing which may be inherent to much of the insightful theoretical framework that I touched on – cf. e.g., the recent *Experiments in Linguistic Meaning* initiative along the lines of Knowlton, Schwarz & Papafragou 2023 on the methodological side, independently of iteratives). While this cannot be the place to review the entire set of challenging datapoints in the literature on iteratives, I will simply mention two areas (temporal texture and quantifiers) and only quite punctually. The first point below is chosen specifically because it has what seems to me to be a rather narrow domain of application, while the others are points of broader if not unlimited application. This distribution is purely for illustration purposes; it does not entail that there aren't more general points with respect to textual structure already in the literature (on the contrary) or vice-versa, that even more fine-grained/'idiosyncratic' points regarding quantification should not exist.

One of the restrictions that are quite narrow in the domain of application pertaining to *re-* as a prefix, can be illustrated with sentences such as those in (18) in contexts in which, at some point in, say, 2025 the individual subject of each of the two sentences has in fact won the presidential election in the US, respectively. (We are considering two obvious but different scenarios then for a. vs. b., where they would be 'true'):

(18) a. Biden got re-elected.
b. Trump got re-elected.

(18b) would feel odd in view of the actual world as we know it as a continuation of the state of affairs available in 2023 or at any rate preceding the actual election of 2024, where Biden is president (and this regardless of political opinions, and once again, assuming that in this case Trump will have won the relevant electoral contest). The likely reason for the infelicitous status of (18b) seems to be that the predicate *re-elect* requires an inference of its object or passivized subject as being the incumbent in the term directly preceding the election. This effect of adjacency in the temporal interval does not hold if we substitute *re-* with *again*. The fact that the inference appears to be cancelable (for instance, via continuations such as *for a non-consecutive term,* allowed for some speakers) indicates that it is likely to be an implicature. (Recall narrow application, it is easy to find examples of other predicates where no immediate adjacency of the backgrounded and the asserted relevant interval needs to hold.)

Finally, quantifiers are a case in point which have produced some puzzles in the research history of iteratives. Within current scope, I restrict myself here to pointing out a highly eclectic selection of data too, but this time on SISE readings of *re-*.

Echoing Jäger & Blutner's (2000) famous indefinite examples with *again* (used there to argue against a decompositional or structural view) one may of course compare the behavior with *re-* also on a SISE reading, as for instance in the following sentence:

(19) A Delaware resettled in Oregon (while most were forced to go to what is now Oklahoma).

While there has been some discussion about judgments and consequences of such sentences (cf. also von Stechow's 2000 remarks), for SISE on a lexicalist account, the placement of an indefinite in such a construction falls rather naturally as far as intuitions go.

There are, however, plenty of issues to be fixed for SISE readings naturally, too. For instance, assume that a Delaware individual already resettled to Oregon before all others did and there was no other '(re-)settling' at all that took place initially. Then one would have to invoke some such activity say, from the legal act that triggered the entire resettlement process, else accommodate it accordingly, or do some other kinds of amendments.

Finally, let me point out a reading that can also be contextualized for SISE readings including in quantificational contexts. Consider (20):

(20) *Context*: on our street a device became very quickly popular, but always only for a short time. *Target sentence*: Everybody resold their device to their neighbor.

The sentence in (20), on the contextualization given, namely one which may call a 'chain' (or more precisely and likely 'domino') reading, is acceptable, among others. First note a detail (which does not seem to bother native speakers, who find the sentence natural), namely that the chain is not necessarily perfect above, as the last person on the street will not have had another neighbor on their street (the assumed domain of quantification) to sell the device to (it is unlikely in the context set up that they will have sold it to the first person). To get at least a purer domino type of reading, let's assume e.g., that the last person on the street sold the device to a neighbor just around a corner which didn't belong to the same street. But setting this aside:

given a semantics of SISE in which the backgrounded trajectory of origin and the target of the relevant asserted path is distinct, as for instance the one proposed above, one will also have to see that two components of meaning can be serialized this way.

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Dual Number in Kazym Khanty: Not-at-issue content that does not project[1]

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Abstract. The Projection Principle (Beaver et al. 2017) states that semantic content projects iff it is not-at-issue. This paper presents a counterexample to this claim: the dual number in Kazym Khanty featuring the duality implication that is not-at-issue content that does not project.

Keywords: formal semantics, dual number, (not-)at-issue, projective content, Khanty, Uralic languages.

1. Introduction

According to the Projection Principle (Beaver et al. 2017), semantic content projects if and only if it is not-at-issue with respect to the Question Under Discussion (QUD). The goal of this paper is to provide a counterexample to this claim. In particular, I will show that the duality implication of the dual number in Kazym Khanty (a Uralic language spoken in Siberia, Russia) is an example of not-at-issue content that does not project.

The structure of the paper is as follows. After the introductory Section 1, I will provide background information on the semantics of the dual number in Kazym Khanty (Section 2). In Section 3, I will discuss the notion of (not-)at-issueness proposed in (Simons et al. 2010) and show that the duality implication of the dual number is not-at-issue. Section 4 is dedicated to the projectivity and the "Family-of-Sentences" (Chierchia & McConnell-Ginet 1990) diagnostics which show that the duality implication of the dual number does not project. To resolve the tension between the not-at-issueness and the non-projectivity of the dual number's meaning, I will argue that the duality implication is unfocusable assertion (Section 5). In Section 6, I will discuss whether it should be surprising that not-at-issueness and projectivity do not always correlate. The paper will conclude in Section 7.

2. Dual Number in Kazym Khanty: background, assumptions, and methods

Kazym Khanty is a dialect of Northern Khanty, a Uralic language spoken in Western Siberia. It features a tripartite number system: singular, dual, and plural, and does not have articles (Kaksin 2010). The dual number is used when the NP refers to a set of exactly two individuals. For instance, the sentence in (1) entails that there are exactly two children walking on the street; (1) is infelicitous if the number of children is one or more than two.

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(1) kam-ən ńawrɛm-ŋən junt-λ-əŋən
street-LOC child-DU play-NPST3DU
'Children (exactly two/*at least two/*at most two) are playing on the street.'

This implication of the dual in (1) is the empirical focus of this paper. As I will show in the subsequent sections, it violates the Projection Principle (Beaver et al. 2017), being an instance of not-at-issue content that does not project.

Before moving to that part, however, it is important to establish precisely what is meant by the duality implication in question, so that the tests of (not)-at-issueness and projection can be applied more accurately. Typically the number is analyzed as a modifier: it applies to a predicate over individuals and restricts its extension (Spector 2007; Zweig 2009; Martí 2020; Scontras 2022, a.o.). In accord with this approach, I will informally define the duality implication as in (2). For the moment I will remain agnostic as to whether this inference follows from what the dual contributes to what is asserted, or instead to conditions on felicitous use. But we will see that the tests on projection lead us to favor the former.

(2) **Duality implication of the dual number**
Let f be the predicate over individuals provided by the dual-marked NP, w be the world of evaluation and c be the context, i.e. the relevant domain of interpretation.
The number of x such that f(x) is true in w and c equals two in w and c.

In what follows, I will assume that the duality implication is present in a target sentence if and only if it entails (2).

Another important methodological caveat that deserves mention has to do with the importance of the referential status of the bare dual NPs used in the projection/not-at-issueness stimuli. The NP in a definite phrase, like "dog" in "the dog", contributes to what its use presupposes (Frege 1892, Strawson 1950), while in a quantification phrase, like "every dog," it may not. Khanty does not have articles, but the common view suggests that in languages without audible articles, the meaning of the sentence nonetheless includes the *iota* operator contributed audibly in English by "the" (Partee 1987; Chierchia 1998; Dayal 2004; a.o.). Thus, if the dual NP in a sentence is used with definite meaning, we can expect the duality implication to project for the independent reason. That means that to test whether the duality inference projects on its own, one should put a dual NP in an indefinite context, since indefinite articles, and their covert analogues in articleless languages, are not presupposition triggers. For that reason, I constructed each stimulus in this study in such a way that the indefinite interpretation of the dual NP is forced.

The examples in this paper were collected during online elicitation sessions with 3 native speakers of Kazym Khanty living in the village Kazym (Khanty-Mansi Autonomous Okrug, Russian Federation), in August and September 2023. During the sessions, I asked consultants to translate Russian stimuli into Kazym Khanty and then, if needed, provided an alternative potential translation into Khanty, and asked for their judgements. For each sentence, a context was introduced to make the translation more natural and, in some cases, to control for the target semantic variables.

In the next two sections, I will introduce the notions of (not-)at-issueness and projectivity and show that the dual number is diagnosed as both not-at-issue and non-projective content, which contradicts the assumption that not-at-issueness and projectivity correlate (Simons et al. 2010; Beaver et al. 2017).

3. (Not)-at-issueness

The rubric of *(not-)at-issueness* was first introduced in Potts 2005 to cover the special semantic behavior of conventional implicatures, appositives and non-restrictive relative clauses. The basic intuition is that meanings differ in whether they contribute to the main point of the utterance. This difference is illustrated in (3):

(3) a. Who is your new roommate?
b. John, my friend from college, is my new roommate.
c. #John, my new roommate, is a friend from college.

Although both (3b) and (3c) convey the same information (John is the speaker's roommate and their friend from college), only (3b) is a natural response to (3a), while (3c) is an incoherent answer to the same question. This contrast arises due to the asymmetry in terms of relevance between the appositive NP and the main clause: main clauses convey the relevant information, while appositives provide a side comment.

Simons, Tonhauser, Beaver and Roberts (2010) define at-issueness the following way:

(4) **Definition of at-issueness** (Simons et al. 2010: 323)
a. A proposition *p* is **at-issue** iff the speaker intends to address the QUD via *?p*.[2]
b. An intention to address the QUD via *?p* is felicitous only if:
i. *?p* is relevant to the QUD, and
ii. the speaker can reasonably expect the addressee to recognize this intention.

Applying (4) to sentence (3b), we can see that the proposition 'John is my new roommate' is at-issue since it addresses the question under discussion, that is, directly answers (3a). In contrast, the proposition 'John is my friend from college', (3c), implied by the appositive is not-at-issue since it does not constitute a relevant answer to (3a). In addition, the contrast in (3) shows that appositives are dedicated to not-at-issue content: the reversed syntactic marking of the very same propositions results in the infelicity of (3c).

Thus, according to the definition in (4), at-issue content should address the question under discussion. As we saw in (3), appositive NPs convey *not*-at-issue content, and accordingly, they cannot be used to address the QUD. This is also true for the dual number in Kazym Khanty (5c); in contrast to the numeral *kăt* 'two' (5b), it cannot be used to answer the question in (5a), which interrogates the number of children.

[2] The notation *?p* introduced in Simons et al. 2010 denotes "the question whether *p*, i.e. the partition on the set of worlds with members *p* and ¬*p*" (ibid.: 317).

(5) a. **muj-arat** ńawrɛm kam-ən junt-λ?
what-QUANT child street-LOC play-NPST[3SG]
'**How many** children are playing on the street?'

b. kam-ən **kăt ńawrɛm** junt-λ
street-LOC two child-DU play-NPST[3SG]
'**Two** children are playing on the street.'

c. #kam-ən ńawrɛm-**ŋən** junt-λ-əŋən
street-LOC child-DU play-NPST-3DU
'Children, **of which there are two,** are playing on the street.'

The dual number can be a part of the answer if the cardinality of referents is not relevant for the question. For instance, sentence (6b) can be an answer to the question in (6a): what matters for the QUD is who the players are, while their cardinality is not-at-issue.

(6) a. **χuj** kam-ən junt-λ?
who street-LOC play-NPST[3SG]
'**Who** is playing on the street?'

b. kam-ən **ńawrɛm-ŋən** junt-λ-əŋən
street-LOC child-DU play-NPST-3DU
'**Children (two)** are playing outside.'

In sum, the duality implication of the dual number is a clear instance of not-at-issue content since it cannot address the QUD. The Projection Principle therefore predicts that the duality implication should also be projective. However, as I will show in the next section, it does not project.

4. Projectivity

4.1. Setting the stage

Projectivity is a property of certain implications that they avoid falling within the scope of certain semantic operators (Stalnaker 1970 et seq; Karttunen 1974 et seq.; Heim 1983 et seq; Chierchia&McConnell-Ginet 1990, among others). Simons, Tonhauser, Roberts and Beaver, the authors of the Projection Principle, define projection the following way:

(7) **Definition of projection** (Simons et al. 2010: 309)
An implication *projects* if and only if it survives as an utterance implication when the expression that triggers the implication occurs under the syntactic scope of an entailment-canceling operator.

To illustrate how projection works, let us consider the two sentences in (8). (8a) implies two propositions: 'Mary does not smoke' and 'Mary used to smoke'. Crucially, under negation

(8b), the first entailment gets canceled, and only the second one remains intact. Thus, according to the definition in (7), this last inference projects through negation, since it survives as an implication even though the expression that contains it is embedded under an entailment-canceling operator.

(8) a. Mary stopped smoking.
⇒ *1. Mary does not smoke.*
⇒ *2. Mary used to smoke.*
b. Mary did not stop smoking.
⇏ *1. Mary does not smoke.*
⇒ ***2. Mary used to smoke.***

Projectivity is well-known as one of the properties of presuppositions (Stalnaker 1970, Karttunen 1974, Heim 1983). The duality implication of the Kazym Khanty dual number, however, is not a presupposition: the duality of the referents of a dual NP does not have to be in the common ground, as demonstrated in (9).

(9) Context: The speaker and their friend go for a walk. The speaker sees two unknown children playing on the street, and tells their friend:

kam-ən	ńawrɛm-ŋən	junt-λ-əŋən
street-LOC	child-DU	play-NPST-3DU

'A couple of children are playing on the street.'

The context suggests that the mentioned children are not familiar to the speaker or the addressee. Neither is it the case that the speaker expects to meet exactly two children, or believes that children usually come in twos. Still one can naturally use the dual NP in (9) to inform the addressee that the number of these new children was two.

However, the fact that the duality implication is not a presupposition does not mean it is not projective; there are other types of meaning that survive embedding under an entailment-canceling operator (consider their detailed taxonomy in Tonhauser et al. 2013). In the following subsections, I will apply the so-called "Family-of-Sentences" diagnostics (Chierchia & McConnell-Ginet 1990) to the duality implication of the dual number, and show that it does not project through negation, questions, conditional antecedents or possibility modals.

4.2. Dual number under negation

The duality implication does not project through negation. Sentence (10) can be uttered if someone mistakenly thought that what is lying on the table was a couple of apples, when in fact it was a single pear. Use of the sentence does not imply that there are two apples or any other duality of referents somewhere else. Instead, the speaker claims that the object in question was incorrectly identified, and it is neither dual nor an apple: it is a single pear.

(10)

păsan-ən	japlokaj-ŋən	χɵn,	kruša	uλ
table-LOC	apple-DU	NEG	pear	lie.NPST[3SG]

'Not two apples, but one pear is lying on the table.'

4.3. Dual number in questions

The duality implication does not project in questions either: it can be a part of what is questioned, as shown in (11). Given the context provided, there is no specific duo of children that Grandma has in mind: she might just think that the noise resembles the typical voices of children. The context in (11) also suggests that Grandma is not even sure that it is a couple of children (or any other couple) that causes the noise, it is just her best hypothesis, and needs her grandson's confirmation. In other words, the duality implication is a part of what is asked about, not what is taken to be true. Thus, the duality does not project in (11). If it did, we would expect the question to mean something like 'I am sure there is something in the quantity of two that produces the sound from outside, is this a couple of children playing?'.

(11) Context. Grandma is sitting inside her room and hears some noise from outside. She thinks that maybe there are children playing outside, but she is not sure – it could also be dogs barking or even the wind blowing. Her grandson comes from the school, and she asks him:

kam-ən ɲawrɛm-ŋən junt-λ-əŋən?
street-LOC child-DU play-NPST-3DU
'Are there two children playing on the street?'

4.4. Dual number in conditionals

The duality implication likewise does not project in conditional antecedents. It can be part of the hypothetical condition, and need not hold at the world of evaluation, as is shown in (12). The context implies that the existence of a pair of gloves that should be on the table is not guaranteed; it could be an unlucky day when the hospital managers forgot to provide any gloves. The doctor knows it, and yet that does not prevent him from using the bare dual *perčatkajŋən* 'gloves' in (12). This means that the inference that there is a duality of gloves – or any other entities – is not entailed.

(12) Context. Every day, the hospital buys a pair of gloves that surgeons can take if they are preparing for surgery. Sometimes, however, the hospital forgets to provide such an extra pair. A surgeon realized he needs gloves and asks his assistant:

păsan ɵχtij-n perčatkaj-ŋən uλ-λ-əŋən ki,
table on-LOC glove-DU lie-NPST-3DU if
măn-ɛm tʉw-a-λi
I-DAT bring-IMP-SG>NSG
'If a pair of gloves is lying on the table, bring them.'

4.5. Dual number in possibility modals

Finally, the duality implication of the dual number does not project through possibility modals. It shares the same level of uncertainty as the other implications in the scope of a modal operator. This is demonstrated in (13). As the context suggests, the speaker is not sure that there is a

duality of children (or anyone/anything else) outside that may produce this noise; it could be a single child, or more than two children, or just the wind blowing.

(13) Context. Someone asks the speaker about the noise in the street. The speaker thinks they hear two children's voices, but they are not sure, it could be just the wind blowing.

iśipa	ńawrɛm-ŋən	kam-ən	junt-λ-əŋən
probably	child-DU	street-LOC	play-NPST-3DU

'Probably, children are playing on the street.'

4.6. Projectivity: results

In summary, the duality implication of the dual number does not project through any of the semantic operators from the Family-of-Sentences diagnostics (negation, questions, conditional antecedents, and possibility modals). This contradicts the Projection Principle: given that the duality implication is clearly not-at-issue content, it should also be projective. In the next two sections, I propose an analysis that will resolve this tension and will discuss possible disconnects between not-at-issueness and projectivity.

5. Duality implication as Unfocusable Assertion

To account for the behavior of the Kazym Khanty dual, I argue that the duality implication of the dual number contributes to what is asserted, as in (14), and yet cannot be focused, with the result that its content is always not-at-issue.[3]

(14) $[[DU]] = \lambda f_{<e,\,t>}.\ \lambda x_e.\ f(x)\ \&\ \#_f(x) = 2$

The hypothesis that not-at-issueness of the duality implication of the dual number in Khanty follows from its unfocusability is motivated by previous research. According to Sidorova 2016 and Golosov & Pisarenko 2021, the dual number cannot get narrow focus, unlike the numeral *kăt* 'two'.[4] My own data from contrastive focus and the scope of the particle *təp* 'only' confirm this generalization: dual NPs can bear focus only if the dual number does not contribute to the focus alternatives.

Under contrastive focus, dual NPs are felicitous if the semantic focus is on the property denoted by the nominal predicate (15a), but not on the number of individuals (15b). In the latter case, a numeral phrase with *kăt* 'two' should be used instead (15c).

(15) a. păsan-ən japlokaj-**ŋən** χən, krušaj-ŋən uλ
table-LOC apple-DU NEG pear-DU lie.NPST[3SG]
'Not a couple of apples, (but) a couple of pears is lying on the table.'

[3] $\#_f(x) = 2$ is true if and only if the number of *x* atomic with respect to *f* equals two.

[4] The link between at-issueness and focus is also pointed out in (Tonhauser 2012), where she proposes that one property of at-issue content is that it "determines the relevant set of focus alternatives" (ibid.: 245). However, what Tonhauser means is that the at-issue content of a question determines how it should be addressed, and she does not discuss other focus-sensitive environments.

b. #păsan-ən japlokaj-**ŋən** χən, **(i)** japloka uλ
table-LOC apple-DU NEG one apple lie.NPST[3SG]
Expected: 'Not a couple of apples, but one apple is lying on the table.'

c. păsan-ən **kăt** japloka χən, **i** japloka uλ
table-LOC two apple NEG one apple lie.NPST[3SG]
'Not **two** apples, (but) **one** apple is lying on the table.'

In the scope of *təp* 'only', the dual NPs are felicitous only if the salient alternatives do not differ in terms of number. For instance, in (16), the intention of the speaker is to emphasize that only girls came, but not boys. Hence, there is only one salient alternative, 'The boys are sitting in my class', which is negated. The cardinality of individuals does not matter for these two focus alternatives, and the dual NP is felicitous.

(16) Context. Students, two girls and eight boys, have their first day at school, so teachers keep track of them. All of them were in the first class, but in the second class, only the girls came. The person teaching the second class calls the other teacher and says:
ma χuś-am-a ɛwɛ-ŋən təp oməs-λ
I place-POSS.1SG-DAT girl-DU only sit-PST[3SG]
'Only **girls** are sitting in my class.'

In contrast, the dual NP is infelicitous in (17b). In this case, what speaker emphasizes is that among the whole set of students, only two people came, and both were girls. Hence, the alternatives negated by *təp* differ not only in whether girls and/or boys came, but also in how many students of each group were present. Accordingly, cardinality is a parameter that is involved in deriving the alternatives and that blocks the use of the dual NP in (17b). Instead, again, a sentence with the numeral *kăt* 'two' must be used, as shown in (17a).

(17) Context. Students, eight girls and eight boys, have their first day at school, so teachers keep track of them. All of them were in the first class, but in the second class, only two girls came. The person teaching the second class calls the other teacher and says:
a. ma χuś-am-a **kăt** **ɛwi** təp oməs-λ
I at-POSS.1SG-DAT two girl only sit-PST[3SG]
b. #ma χuś-am-a **ɛwɛ-ŋən** təp oməs-λ
I at-POSS.1SG-DAT girl-DU only sit-PST[3SG]
'Only **two girls** are sitting in my class.'

Thus, the dual number cannot be under narrow focus, which explains why the duality implication is not-at-issue. Focus establishes the set of alternatives relevant for the QUD, and the dual number, which is not focused, fails to contribute to the formation of this set. However, that does not prevent it from being in the scope of entailment-canceling operators (given that it does not help to resolve the QUD). In other words, the duality implication can be canceled by semantic operators if it is not the main implication targeted by those operators.

6. Discussion

In this section, I will argue that the existence of not-at-issue content that does not project should not be surprising: the definitions of the projectivity and (not-)at-issueness do not logically lead us to the same type of phenomenon.

The definition of at-issueness relies on relevance to the Question Under Discussion: if content addresses it, it is at-issue, and if not, it is not-at-issue. However, this definition does not entail that not-at-issue content must project, i.e., avoid falling within the scope of entailment-canceling operators. One imaginable counterexample would be an informative implication that is not relevant for the current QUD and yet stops being entailed in the scope of semantic operators, together with the main, at-issue content.

That is exactly what the duality implication of the Kazym Khanty dual number does. When an indefinite dual NP is used in a sentence where it does not fall within the scope of an entailment-canceling operator, the dual number provides the implication that there are two individuals. This implication is secondary to the main point of the discussion but is nevertheless an entailment; if the number of individuals does not equal two, the sentence is not true. Crucially, when a dual NP is embedded under an entailment-canceling operator, the duality implication remains not-at-issue, but is no longer entailed: it can be a part of what is questioned, negated, etc., as long as the cardinality of the individuals does not matter to the QUD. In other words, the duality implication cannot be the main target of negation, question, conditional, or possibility modal, but at the same time, it does not have to be something the speaker commits to either.

Thus, the Kazym Khanty data simply show that two aspects of meaning (or use) that are distinct conceptually are furthermore distinct in fact, contrary to the hypothesis of Beaver et al. 2017.

7. Conclusions

The duality implication of the dual number in Kazym Khanty poses a challenge to the Projection Principle (Beaver et al. 2017), according to which a semantic inference is not-at-issue if and only if it projects. Contrary to expectations, the inference of two individuals provided by the dual number is not-at-issue and at the same time does not project. I argue that this duality implication can be analyzed as a type of unfocusable assertion. It is part of the dual number's content, but it cannot receive narrow focus (the reasons for that are still to be explored). This result, in turn, indicates that projectivity and not-at-issueness (as defined by Simons et al. 2010) are independent parameters; a not-at-issue implication can get canceled when it is in the scope of an entailing-canceling operator.

Abbreviations

1,2,3 – persons, DAT – dative case, DU – dual number, IMP – imperative mood, LOC – locative case, NPST – non-past tense, POSS – possessive marker, PST – past tense, QUANT – quantity question word, SG – singular number, X>Y – multiple agreement (X – features of the subject, Y – features of the object).

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Degrees of confidence are not subjective probabilities[1]

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Abstract. We assume that *confident* reports have their standard degree-based truth conditions: to be *confident* that p is to have a degree of confidence that p which is at least as high as some contextually determined threshold; to be *more confident* that p than that q is to have a degree of confidence that p that is higher than one's degree of confidence that q; and so on. But what are degrees of confidence? The standard answer is that agents' degrees of confidence are simply their Bayesian subjective probabilities: for example, how confident one is that it's raining = how likely one thinks it is that it's raining. We raise a number of challenges for this Bayesian account, and propose an alternative. This new account supports a pragmatic explanation of the apparent equivalence of degrees of confidence and subjective probabilities, and offers a more integrated picture of how different doxastic attitudes fit together.

Keywords: confidence, gradable doxastic attitudes, subjective probability, plausibility orders.

1. Introduction

Philosophers, economists, and psychologists often find it productive to model agents' opinions as *subjective probabilities* (also called *degrees of belief* or *credences*). Intuitively, an agent's subjective probabilities measure how likely they think it is that various propositions are true. Ideally, these subjective probabilities should satisfy the axioms of probability theory and guide the agent's behavior (for example, by determining which bets are fair by the agent's lights).

Despite the intuitive gloss just given, any reductive analysis of subjective probabilities as beliefs about how likely things are faces significant challenges.[2] As a result, many authors have instead sought to operationalize subjective probability in other ways (Ramsey, 1931; de Finetti, 1937; Jeffrey, 1965), or been content to treat the notion as theoretical posit that earns its keep through its explanatory power (Eriksson and Hájek, 2007).[3]

But perhaps the dominant approach to subjective probabilities is to identify them with degrees of *confidence*. Here are some representative quotations:

> [Subjective] probability measures the confidence that a particular individual has in the truth of a particular proposition" (Savage, 1954: 3)
>
> [T]he levels of confidence you might have in various propositions [are] your degrees of belief in them. (Foley, 1993: 140)

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[2]Challenges include: (i) worries that such analyses over-intellectualize subjective probability, (ii) worries about circularity for those who wish to analyze belief (Genin, 2019) and/or probability operators like *likely* (Rothschild, 2012; Yalcin, 2012; Moss, 2018) in terms of subjective probabilities, and (iii) impossibility results showing that no such analysis is possible in an orthodox (static) semantic framework (Russell and Hawthorne, 2016).

[3]Others still have questioned whether the notion is even in good standing (Holton, 2014; Williamson, ming).

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> A person's credence in a proposition X is her level of confidence in its truth. (Joyce, 2009: 263)
>
> Credences are numerical degrees of confidence. (Titelbaum, 2019: 1)

Call this the *Bayesian account*. Is it right? Is the attitude expressed by *confident* reports in ordinary English really the same as these theorists' notion of subjective probability?

This paper argues that it is not. Or, more cautiously, it argues that the primary use of *confident* in ordinary English is one for which degrees of confidence are not subjective probabilities. Obviously many academics writing about subjective uncertainty have a practice of using graded *confident* reports as synonymous with subjective-probability jargon, and this practice comes naturally and is easily inculcated. The extent to which this 'Bayesian use' occurs spontaneously in naïve speakers, and whether it constitutes an ambiguity in *confident*, is an important question, but one which we must leave for future work.

In this connection, though, a word of caution before proceeding. There are some people for whom the Bayesian use of *confident* has become second-nature. For them, *confident* reports immediately prompt explicitly probabilistic thinking. If you are such a reader, and you balk at some of the (in)felicity indications in what follows, you are not alone. But (except where otherwise noted) most speakers consulted shared the indicated judgments.

Here is the plan. After reviewing degree semantics for *confident* reports (§2), we explain and motivate the orthodox Bayesian account of degrees of confidence (§3). We then identify three ways in which degrees of confidence fail to behave like subjective probabilities (§§4-6), propose a new account that explains these data (§§7-9), and conclude with some further theoretical considerations in its favor (§10). Some generalizations of the account are explored in appendices.

To preview, here are two distinctive features of the account developed below. First, the attitude of having (at least) a given degree of confidence in a proposition is modeled by universally quantifying over a non-empty set of accessible worlds. This is the standard way of modeling other doxastic and epistemic attitudes, but it is incompatible with degrees of confidence being subjective probabilities. Second, though, subjective probabilities still play an important role: they are necessary but not sufficient for having the corresponding degrees of confidence, and they coincide with agents' degrees of confidence in the cases we are typically concerned with.

2. Degree semantics for *confident* reports

We begin by rehearsing the standard degree-based truth conditions for *confident*-reports; see Cariani et al. (ming) for discussion of how these can be derived compositionally.

For any agent A, world w, and proposition p, let $conf(A,w,p)$ be the degree of confidence which, in w, is A's degree of confidence that p. This is undefined if, in w, A has no degree of confidence that p (i.e., if the question *how confident is A that p* has a false presupposition at w). We assume that degrees of confidence are totally ordered by a relation $>$.

The truth conditions for comparative confident reports are then the obvious ones:

$[\![A \text{ is more confident that } \varphi \text{ than that } \psi]\!](w) = 1$ iff $conf([\![A]\!], w, [\![\varphi]\!]) > conf([\![A]\!], w, [\![\psi]\!])$

$[\![A \text{ is just as confident that } \varphi \text{ as that } \psi]\!](w) = 1$ iff $conf([\![A]\!], w, [\![\varphi]\!]) = conf([\![A]\!], w, [\![\psi]\!])$

Likewise for explicit talk about degrees of confidence:

$[\![\text{is how confident } A \text{ is that } \varphi]\!](d)(w) = 1$ iff $conf([\![A]\!], w, [\![\varphi]\!]) = d$

A positive (i.e., non-comparative) *confident* report is true just in case the agent's degree of confidence in the relevant proposition meets a contextually determined threshold θ_c^{conf}:

$[\![A \text{ is confident that } \varphi]\!]^c(w) = 1$ iff $conf([\![A]\!]^c, w, [\![\varphi]\!]^c) \geq \theta_c^{\text{conf}}$

3. Motivating the Bayesian account

Let us assume that the notion of subjective probability is in good standing and that, at the present level of idealization, we can model agents' subjective probabilities by a function Pr from agents and worlds to probability distributions. That is, for any agent A and world w, $Pr_{A,w}(\cdot)$ is a probability distribution, and $Pr_{A,w}(p)$ is the agent's subjective probability in w that p is true. As usual, a proposition p is identified with the sets of worlds in which it is true.

We can now formalize the orthodox Bayesian account of degrees of confidence, which identifies them with subjective probabilities:[4]

BAYESIANISM
$conf = Pr$

In what follows we make the standard assumption that *think ... likely* reports express agents' subjective probabilities (notwithstanding the complications mentioned in note 2). That is:

$[\![A \text{ thinks that } \varphi \text{ is more likely than } \psi]\!](w) = 1$ iff $Pr_{[\![A]\!],w}([\![\varphi]\!]) > Pr_{[\![A]\!],w}([\![\psi]\!])$

$[\![\text{is how likely } A \text{ thinks it is that } \varphi]\!](d)(w) = 1$ iff $Pr_{[\![A]\!],w}([\![\varphi]\!]) = d$

This allows us to motivate BAYESIANISM by observing that, in many cases, graded *confident* reports seem to pattern with *think ... likely* reports.

(1) *Context*: Alice asks Bob what the capital of Spain is. He says he doesn't know, but he thinks that it's either Madrid or Barcelona. Alice then asks:

a. How confident are you that it's either Madrid or Barcelona?
b. How likely do you think it is that it's either Madrid or Barcelona?

It is very difficult to hear a difference between (1a) and (1b) in this context. More generally:

ANSWER EQUIVALENCE
When a speaker offers their opinion in answer to a question (even if it is just their best guess), their conversation partners do not distinguish *how confident* the speaker is in their answer from *how likely* the speaker *thinks* it is that their answer is true.

[4]More precisely: $conf(A, w, \cdot)$ and $Pr_{A,w}(\cdot)$ are the same (partial) function from $\mathscr{P}(W)$ to $[0,1]$ (for all worlds w and agents A), and degrees of confidence are real numbers in the unit interval under the usual ordering.

Any account of degrees of confidence must explain this pattern. BAYESIANISM does so in the simplest and most straightforward way.

4. First challenge: doxastic constraints

BAYESIANISM predicts that agents have degrees of confidence in every proposition for which they have subjective probabilities. But this seems incorrect. Consider:

(2) *Context*: Petra, Quinn, and Rita are about to race. Bob bets on Quinn. Alice then tells him that Carl, a seasoned track coach, thinks that Petra will win. Bob dejectedly asks:

a. How confident is he that Petra will win?
b. How likely does he think it is that Quinn will win?
c. #How confident is he that Quinn will win?

Unlike (2b), (2c) seems to have a false presupposition (that Carl has some degree of confidence that Quinn will win). BAYESIANISM wrongly predicts that (2b) and (2c) should be equivalent.

The fact that (2a) is licensed in this context, but (2c) is not, motivates two general principles:

THINKING TRUE
Thinking that a proposition is true entails having some degree of confidence in it.

THINKING FALSE
Thinking that a proposition is false entails not having any degree of confidence in it.

These two principles are silent about cases where agents neither think that p nor think that not-p. What should we say about such cases? The two most natural proposals are:

DISBELIEF EXCEPTION
Agents have degrees of confidence in all propositions in which they have some subjective probability, except for propositions that they think are false.

THINKING REQUIREMENT
Agents have degrees of confidence only in propositions that they think are true.

The remainder of this section argues that the second proposal is preferable to first.

The simplest motivation for the DISBELIEF EXCEPTION is that it is a minimal departure from BAYESIANISM. To that extent, we think it is well motivated only insofar as it can be combined with the following principle (which is also suggested by ANSWER EQUIVALENCE):

BAYESIAN WHEN DEFINED
$conf(A,w,p) = Pr_{A,w}(p)$ whenever $conf(A,w,p)$ is defined.

But there are strong reasons to reject the combination of DISBELIEF EXCEPTION and BAYESIAN WHEN DEFINED. This is because together they conflict with the following three principles:[5]

[5] *Proof*: By NON-EXTREMITY, it is possible to be confident that p and have a non-maximal degree of confidence d in p. By BAYESIAN WHEN DEFINED, d is a non-maximal subjective probability. By NON-ENTAILMENT, it is possible to have subjective probability at least d in a proposition q without thinking that q. Consider such an agent

CONFIDENCE ENTAILMENT
Being confident that p entails thinking that p.

NON-EXTREMITY
The threshold θ_c^{conf} for being *confident* is non-maximal in many ordinary contexts c.

NON-ENTAILMENT
There is no non-maximal degree of subjective probability that entails thinking that p.

These principles can be motivated as follows:

- CONFIDENCE ENTAILMENT is intuitively plausible, and also explains the infelicity of claims like *A is confident that p, but I wouldn't go so far as to say that A thinks that p*.[6]
- NON-EXTREMITY is the natural explanation of the felicity of sentences like:

  (3) She's confident that Djokovic will win Wimbledon, and she's even more confident that the winner will be either Djokovic or Alcaraz. (See also Cariani et al. (ming).)

- NON-ENTAILMENT is defended at length in Holguín (2022) and Williamson (ming). Among other considerations, they observe that, from the fact that a lottery entrant knows how likely they are to lose, we cannot conclude that they think that they will lose.

Let us now turn to THINKING REQUIREMENT. It derives some support from the fact that it is the simplest alternative to DISBELIEF EXCEPTION (which we have just argued against). It is further motivated by the fact that, given CONFIDENCE ENTAILMENT, it holds for all degrees of confidence d that are the threshold θ_c^{conf} for the positive form of *confident* in some context c.[7] And there are many such degrees of confidence, given NON-EXTREMITY, since the positive forms of non-maximal gradable adjectives are generally context-sensitive in this way. For these reasons (among others) we will assume THINKING REQUIREMENT in what follows.

Now observe that, when combined with ANSWER EQUIVALENCE, THINKING REQUIREMENT has the following striking implication:

EXTREME WEAKNESS
There is no non-minimal degree of subjective probability that entails not thinking that p.

This is because an agent may assign low subjective probability to their best guess in answer to a question. So they have the corresponding (low) degree of confidence this answer, by ANSWER EQUIVALENCE, despite thinking that it is true, by THINKING REQUIREMENT. By considering sufficiently fine-grained questions we can make this degree of confidence arbitrarily low.

This picture of how thinking, guessing, and subjective probabilities are related is defended by Holguín (2022) on independent grounds. To illustrate, in response to the question *who will win Wimbledon*, someone who thinks that Djokovic has no more than a 25% chance of winning

who also doesn't think that not-q. By DISBELIEF EXCEPTION and BAYESIAN WHEN DEFINED, they are confident to degree d in q, and hence they are confident that p, contradicting CONFIDENCE ENTAILMENT.

[6]Following Hawthorne et al. (2016) and Rothschild (2020), we use *I wouldn't go so far as to say that they think* rather than explicit negation to control for the fact that *think* neg-raises (i.e., *A doesn't think that p* tends to be interpreted as equivalent to *A thinks that not-p*).

[7]We assume that *think* is not context sensitive in a way that depends on how confident it takes to count as *confident*.

might truly answer *I'm not sure, but I think that Djokovic will win* – provided, that is, that there isn't anyone else who they think is more likely to win.[8]

Let's take stock. We first argued against BAYESIANISM, on the grounds that it conflicts with THINKING FALSE. We then argued against a natural fallback position, the combination of BAYESIAN WHEN DEFINED and DISBELIEF EXCEPTION, on the grounds that it conflicts with CONFIDENCE ENTAILMENT, NON-EXTREMITY, and NON-ENTAILMENT. We then motivated THINKING REQUIREMENT on two grounds: (i) it is the most natural alternative to DISBELIEF EXCEPTION, and (ii) it has many true instances (given CONFIDENCE ENTAILMENT and the relevant context sensitivity of the positive form of *confident*).

Before moving on, it will be convenient to have a name for the following biconditional, which is equivalent to the conjunction of THINKING TRUE and THINKING REQUIREMENT:

> COMMITMENT
> An agent has some degree of confidence in a proposition if and only if they think that the proposition is true.

5. Second challenge: closure without extremity

This section raises a further challenge for BAYESIANISM, which also puts pressure on BAYESIAN WHEN DEFINED. It concerns the closure of *confident* under conjunction.

To illustrate the issue, consider examples like the following:

(4) *Context*: Juan thinks that it is 90% likely that he weights at least 75kg, and thinks that it's 90% likely that he weighs at most 77kg.
   a. #Juan is confident that he weighs at least 75kg and confident that we weighs at most 77kg, but he isn't confident that he weighs between 75 and 77kg.

BAYESIANISM predicts that (4a) is true in contexts c where $.8 < \theta_c^{\text{conf}} \leq .9$. And there are presumably such contexts, given NON-EXTREMITY.[9] Yet (4a) sounds like a contradiction, or at the very least seems to attribute a quite strange state of mind which Juan presumably isn't in.

The example is also a challenge for BAYESIAN WHEN DEFINED. Suppose, as seems natural, that Juan thinks that he weighs between 75 and 77kg, and hence both thinks that he weights at least 75kg and thinks that he weighs at most 77kg. So Juan has some degree of confidence in each of these propositions, by THINKING TRUE. BAYESIAN WHEN DEFINED then wrongly predicts that (4a) should have a true reading in some contexts (where $.8 < \theta_c^{\text{conf}} \leq .9$).

This argument does not assume that *confident* is always closed under conjunction. Still, it will be helpful in what follows to isolate a family of general closure principles:

[8]The fact that such uses of *I think* function as hedged assertions is sometimes offered as a reason to doubt that they are literal first-personal attitude ascriptions; see Clarke (2024). Against this suggestion, note (i) that such uses licenses subsequent third-person reports (e.g., *she thinks that Djokovic will win*), and (ii) their hedging function is naturally explained, as a scalar implicature, by them being genuine first-person attitude ascriptions.

[9]If .9 feels implausibly low, or .8 implausible high, for θ_c^{conf} in an ordinary contexts, we can choose different numbers: the example depends only on $0 < \theta_c^{\text{conf}} < 1$, which is secured by NON-EXTREMITY.

CLOSURE$_{\text{think}}$
If *A* thinks that *p* and thinks that *q*, then *A* thinks that *p and q*.

CLOSURE$_{\text{conf}}$
If *A* is confident that *p* and confident that *q*, then *A* is confident that *p and q*.

CLOSURE$_{\text{deg}}$
If *A* is confident to degree at least *d* that *p* and confident to degree at least *d* that *q*, then *A* is confident to degree at least *d* that *p and q*.

CLOSURE$_{\text{think}}$ is intuitively compelling, and is defended by Holguín (2022). It is also validated by orthodox Hintikka semantics for *think* (see §7). CLOSURE$_{\text{conf}}$ is similarly compelling, and it will be validated by the account of degrees of confidence developed below (since, as advertised, this account yields a version of Hintikka semantics for *confident*).

There are of course well known challenges to CLOSURE$_{\text{think/conf}}$, such as those deriving from Makinson's (1965) influential preface paradox. In appendix B we show how the account of degrees of confidence developed below can be non-disruptively modified to accommodate such (purported) closure failures. But for now, to reiterate: the challenge that (4a) poses for BAYESIANISM does not assume the truth of any general closure principle.

Let us now turn to CLOSURE$_{\text{deg}}$. It can be motivated by CLOSURE$_{\text{conf}}$ in the same way that THINKING REQUIREMENT was motivated by CONFIDENCE ENTAILMENT: CLOSURE$_{\text{conf}}$ is valid only if CLOSURE$_{\text{deg}}$ holds for all degrees of confidence *d* that could be θ_c^{CONF} in some context *c*, in which case CLOSURE$_{\text{deg}}$ plausibly holds for all degrees of confidence whatsoever.

CLOSURE$_{\text{deg}}$ entails the validity of further principles involving graded *confident* reports which do not explicitly mention degrees of confidence, such as the following:[10]

CLOSURE$_{=}$
If *A* is just as confident that *p* as they are that *q*, then *A* is just as confident that *p and q* as they are that *p*.

It hence predicts the infelicity of sentences like:

(5) ??Deb is just as confident that she will show up tomorrow as she is that she will show up the next day, but she is less confident that she will show up on both days.

Speakers' judgments about such sentences vary, and while the view developed in the main text does validate CLOSURE$_{\text{deg}}$, the more general account explored in appendices B-C does not.

6. Third challenge: second guesses

This section raises a different challenge for BAYESIAN WHEN DEFINED, which does not turn the closure of *confident* under conjunction. However, the relevant judgments are subtle and not shared by all speakers consulted, and so serve more to illustrate some distinctive empirical predictions of the account developed below than to provide a persuasive argument for it.

Consider the following variant of (3):

[10]This entailment assumes that agents are never more confident in a conjunction than they are in its conjuncts.

(6) *Context*: Joey is prognosticating about who will win an upcoming squash tournament.
   a. Parke: Who do you think will win?
   b. Joey: Nouran Gohar.
   c. Parke: How confident are you that she will win?
   d. Joey: Fairly confident, and I'm even more confident that the winner will be either Gohar or El Sherbini.

Many speakers take (6d) to imply that El Sherbini is the player who Joey thinks is second most likely to win (after Gohar). While this could have a pragmatic explanation, it is worth isolating a general principle which would license a purely semantic explanation of such inferences:

> SECOND GUESSING
> If an agent thinks that p is the true complete answer to a question they are considering, and they are even more confident of the disjunction *p or q* (where q is another complete answer to this question), then q is the answer that they think is next most likely after p.

Note finally that BAYESIAN WHEN DEFINED does not merely fail to support the inference from (6d) to El Sherbini being Joey's second guess. It also seems to predict, incorrectly, that the second conjunct of (6d) should sound redundant (provided it is common ground that El Sherbini has a non-trivial chance of winning), since it should be obvious that Joey has higher subjective probability that either Gohar or El Sherbini will win than he has that Gohar will win.

7. Part I: Hintikka semantics for *confident* and *think*

This section outlines a simple account of degrees of confidence, and shows how it can be used to validate both COMMITMENT from §4 and the family of CLOSURE principles discussed in §5. Assessing the other principles discussed above will require bringing in subjective probabilities (see §8) and question sensitivity (see §9), which will also help in motivating and fixing the intended interpretation of the formalism introduced here.

The basic idea is to use Hintikka semantics for degrees of confidence. Informally, agent A is confident to degree at least d in the proposition p if and only if p is true in all of A's confident-to-degree-at-least-d worlds.

More precisely, for any agent A and degree of confidence $d \in [0,1]$, $C_A^d(w)$ is the set of worlds compatible with everything that A is, in w, confident of to degree at least d. As such, we require that $C_A^d(w) \subseteq C_A^{d'}(w)$ whenever $d > d'$ (since being confident to degree at least d entails by being confident to degree at least d' for any $d' > d$). It follows that $C_A^0(w) = \bigcap\{C_A^d(w) : d \in [0,1]\}$.

We can now define the function $conf$ used to specify the truth conditions for *confident* reports:[11]

> DEGREES OF CONFIDENCE
> $conf(A,w,p) = max\{d : C_A^d(w) \subseteq p\}$; this is undefined if $C_A^0(w) \not\subseteq p$

We adopt standard Hintikkan truth conditions for *think*. Where $D_A(w)$ is the set of 'doxastically accessible' worlds (those compatible with everything that, in w, A thinks is true) we have:

[11] This definition assumes that $\{d : C_A^d(w) \subseteq p\}$ contains its own supremum whenever it is non-empty, which is a consequence of the probabilistic constraints introduced in §8.

$[\![A \text{ thinks that } \varphi]\!](w) = 1$ iff $D_{[\![A]\!]}(w) \subseteq [\![\varphi]\!]$

Finally, we relate *think* to *confident* by identifying the set of doxastically accessible worlds with the set of worlds compatible with everything that the agent has any degree of confidence in:

DOXASTIC ACCESSIBILITY
$D_A(w) = C^0_A(w)$

The orthodox degree semantics for *confident* reports in §2, together with Hintikka semantics for *think*, then validates COMMITMENT as well as all of $\text{CLOSURE}_{\text{think/conf/deg/=}}$.

8. Part II: Probability + Plausibility ⇒ Confidence

This section explains how degrees of confidence relate to subjective probabilities.

Having rejected BAYESIANISM, we cannot characterize degrees of confidence from subjective probabilities alone. Any such characterization will require introducing additional structure.

To this end, we appeal to a relation of 'comparative plausibility' between worlds. Let $v \succeq_{A,w} u$ mean that, in w, A finds v at least as plausible as u. This is a technical notion, which will be analyzed further in §9 (where $\succeq$ is defined from subjective probabilities and a contextually determined question). For now, we require only that $\succeq_{A,w}$ be a well-founded total preorder on the set of possible worlds W. Following Lewis (1973), we can repackage the information encoded in $\succeq_{A,w}$ using a set $\$_{A,w}$ of 'spheres', defined as follows:

$\$_{A,w} = \{\{u : u \succeq_{A,w} v\} : v \in W\}$

We are now in a position to given an explicit definition of C, the basic notion in terms of which degrees of confidence are defined:

DEGREES FROM PROBABILITY
$C^d_A(w) = \bigcap\{p \in \$_{A,w} : Pr_{A,w}(p) \geq d\}$

Given DEGREES OF CONFIDENCE, this entails that an agent's degree of confidence in p is the highest subjective probability that the agent assigns to any p-entailing sphere:

CONFIDENCE FROM PROBABILITY SPHERES
$conf(A,w,p) = max\{Pr_{A,w}(q) : q \subseteq p \text{ and } q \in \$_{A,w}\}$

Moreover, given DOXASTIC ACCESSIBILITY, it entails that the doxastically accessible worlds are all and only the worlds that the agent takes to be maximally plausible:

PLAUSIBLE OPINIONS
$D_A(w) = \{v : \forall u(u \not\succ_{A,w} v)\}$ (where $v \succ_{A,w} u$ iff $v \succeq_{A,w} u$ and $u \not\succeq_{A,w} v$)

These direct characterizations of $conf$ from Pr and $\succeq$ (via \$) and of D from $\succeq$ will prove useful when considering generalizations of the present proposal, as discussed in the appendices.

One nice consequence of DEGREES FROM PROBABILITY is that how confident an agent is that a given proposition is true is never less than how likely the agent thinks it is that the proposition is true. That is, we validate the following weakening of BAYESIAN WHEN DEFINED:

LOWER BOUND
$conf(A,w,p) \leq Pr_{A,w}(p)$ whenever $conf(A,w,p)$ is defined.

9. Part III: Probability + Partitions ⇒ Plausibility

This section gives a probabilistic analysis of comparative plausibility. This analysis essentially appeals to a contextually determined *question*. The resulting question-sensitivity of *confident* reports is not unprecedented (Yalcin, 2018; Hoek, ming), and it will allow us to account for ANSWER EQUIVAELNCE despite having rejected BAYESIANISM.

We model the relevant question Q as a partition of W, and write $[w]_Q$ for the cell of Q containing w. Comparative plausibility is defined in terms of the comparative probability of these cells.[12]

PLAUSIBILITY FROM PROBABILITY
$v \succeq^Q_{A,w} u$ iff $Pr_{A,w}([v]_Q) \geq Pr_{A,w}([u]_Q)$

The question Q is a parameter supplied by context. How it is determined is an urgent issue, since we do not assume that Q is always the same as the question intuitively under discussion.[13] That said, following Holguín (2022), we think the following is typically the case:

PRAGMATIC HYPOTHESIS
Q is the contextually relevant question for interpreting *think* and *confident* reports about an agent who is offering their opinion in answer to Q.

Armed with this hypothesis, we can offer a pragmatic account of ANSWER EQUIVALENCE. This is because our subjective probabilities systematically constrain the opinions we give when answering questions. For example, when discussing the question *who will win the tournament*, Joey will only guess that Gohar will win if there is no other player who he thinks is more likely to win. Building on observations like this, Holguín (2022) and Dorst and Mandelkern (2022) defend something very close to the following generalization[14]:

QUESTIONS AND OPINIONS
When, in w, a speaker A offers their opinion p in answer to a question Q (even if it's just their best guess), $p \in \$^Q_{A,w}$ (where $\succeq^Q$ is defined as above, and $\$^Q$ is defined from $\succeq^Q$).

Finally, note that DEGREES OF CONFIDENCE and DEGREES FROM PROBABILITY entail:

COINCIDENCE
$conf(A,w,p) = Pr_{A,w}(p)$ for all $p \in \$_{A,w}$

Taken together, PRAGMATIC HYPOTHESIS, QUESTIONS AND OPINIONS and COINCIDENCE entail ANSWER EQUIVALENCE (as well as SECOND GUESSING).

By way of illustration, consider the following example:

[12]This definition is borrowed from recent work on knowledge and belief in formal epistemology (Levi, 1967; Lin and Kelly, 2012; Leitgeb, 2017; Goodman and Salow, 2021, 2023; Holguín, 2022; Hong, 2023).
[13]Goodman and Salow (2021, 2023) give cases where the question intuitively under investigation (e.g., whether a coin is fair) is more coarse-grained than the question (e.g., how many time will the coin land heads) relevant to determining comparative plausibility for the purposes of giving adequate truth conditions for attitude reports.
[14]They also allow guesses to break ties in plausibility; see appendix A for how this can be accommodated.

(7) *Context*: Ann is about to flip a fair coin as many times as it takes until it lands heads. We ask her opinion about how many flips this will be. Consider some potential answers:
   a. Just one.
   b. At most five.
   c. ??Not two.

Let us assume that Ann's subjective probabilities match the known chances: $Pr_{A,w}(\mathbf{n}) = .5^n$, where $\mathbf{n}$ is the proposition that the coin will take n flips to land heads. Where $Q = \{\mathbf{n} : n > 0\}$ (i.e., the question she is asked), it follows that $\$^Q_{A,w} = \{\bigcup\{\mathbf{m} : m \leq n\} : n > 0\}$. So *Ann thinks that the coin will be flipped just one time* is predicted to be true in this context (although in appendix A we show how this prediction can be relaxed). So (7a)-(7c) are then all propositions that Ann thinks are true. QUESTIONS AND OPINIONS is consistent both with her answering (7a) and with her answering (7b), since both $\mathbf{1} \in \$^Q_{A,w}$ and $\bigcup\{\mathbf{m} : m \leq 5\} \in \$^Q_{A,w}$. For these answers, Ann's subjective probabilities equal her degrees of confidence (in context), in keeping with ANSWER EQUIVALENCE. By contrast, her answering (7c) is ruled out by QUESTIONS AND OPINIONS (even though it is a proposition that she thinks is true), since $W \backslash \mathbf{2} \notin \$^Q_{A,w}$. So although Ann's subjective probability (.75) and her degree of confidence (.5) in this proposition come apart, this is no counterexample to ANSWER EQUIVALENCE.

10. Conclusion

Our account of degrees of confidence has three core features: (i) linking *confident* and *think* via COMMITMENT, (ii) rejecting BAYESIAN WHEN DEFINED in favor of the weaker LOWER BOUND, and (iii) appealing to worlds' comparative plausibility to explain how agents' degrees of confidence can sometimes be lower than their subjective probabilities (albeit elusively so). These features are all retained in the more sophisticated proposals explored in the appendices.

We conclude by highlighting a broader theoretical motivation for the present approach – namely, that it coheres with recent work on the interconnections between various doxastic and epistemic attitudes and with work on how these attitudes are shaped by comparative plausibility.

Goodman and Holguín (2023) argue that something like our account of degrees of confidence is needed to accommodate the normative connections between knowing, being sure, and assertion. In brief, they argue that *be sure* expresses the least degree of confidence d which is both subject to a knowledge norm (one should be confident to degree d only of things that one knows) and normative for assertion (one should assert only things that one confident of to degree at least d), and then argue that no degree of subjective probability satisfies this theoretical role.

Comparative plausibility, as defined in §9, also figures centrally in recent theories of knowledge (Goodman and Salow, 2021, 2023; Hong, 2023), assertion (Mandelkern and Dorst, 2022), and 'full' or 'outright' belief (Levi, 1967; Lin and Kelly, 2012), often combined with probability thresholds along the lines proposed here (Leitgeb, 2017; Cantwell and Rott, 2019; Goodman and Salow, ming).[15] Moreover, the general idea that an ordering of worlds is key to theorizing about the structure of knowledge and rational belief is a recurring theme in both traditional and

[15] As for the attitude expressed by *believe* in ordinary English, Hawthorne et al. (2016) and Rothschild (2020) argue that it is synonymous with *think* in the constructions considered here.

formal epistemology; see Goodman and Salow (2023, ming) and references therein.

These precedents are significant. One might have thought that, whatever its merits, our account of degrees of confidence is less parsimonious and more complicated than BAYESIANISM, since it uses more primitive notions and features more complicated definitions. We think this charge is mistaken, since the notions and ideas appealed to here have independent motivation in the surrounding literature. If anything, it is a demerit of BAYESIANISM that it treats *confident* so differently from typical treatments of other doxastic and epistemic attitudes.

Appendix

Three appendices show how our account of degrees of confidence can be generalized to apply to agents whose doxastic attitudes have a more complicated structure than we have so far allowed.

A. *Thinking* outside the box

So far we have assumed that the worlds doxastically accessible for an agent are all and only the worlds that are maximally plausible for the agent. Here we show how to generalize our account of degrees of confidence to agents who violate this PLAUSIBLE OPINIONS idealization.

We start by taking the set $D_A(w)$ of worlds doxastically accessible for A (in w) as primitive. While much of the exciting work in the study of doxastic attitudes lies in exploring further constraints on D (cf. Holguín's (2022) 'cogency' constraint that $D_A(w)$ be non-empty and closed under $\succ_{A,w}$) we impose no such constrains here in the interest of generality.

Next we use D to define a new system of spheres $\$^*$ from the old one $\$$:

$$\$^*_{A,w} = \{D_A(w)\} \cup \{D_A(w) \cup p : p \in \$_{A,w}\}$$

(Observe that $\$^* = \$$ whenever D is defined from $\succeq$ and Pr via DOXASTIC ACCESSIBILITY, DEGREES OF CONFIDENCE, and DEGREES FROM PROBABILITY.)

For any φ, let φ^* be the result of replacing all occurrences of $\$$ in φ with $\$^*$. The new account of degrees of confidence is DEGREES FROM PROBABILITY*. It preserves all of the earlier account's important features. In particular:

1. COMMITMENT, CLOSURE$_{\text{think/conf/deg/=}}$, and LOWER BOUND continue to hold.
2. COINCIDENCE* holds. As a result, ANSWER EQUIVALENCE and SECOND GUESSES are still predicted given QUESTIONS AND OPINIONS* (which is the link between thinking and guessing that is actually defended in Holguín (2022); cf. note 14).

B. Relaxing CLOSURE

As mentioned in §5, the preface paradox raises an important challenge for the various CLOSURE principles discussed above. To take Makinson's (1965) original example, it seem possible that

every claim in a book be one that its author is confident is true without the conjunction of all of the claims in the book being something that the author is confident is true. This appendix shows how to modify our account of degrees of confidence to accommodate such (purported) failures of CLOSURE$_{\text{conf}}$. Crucially, and unlike BAYESIANISM, doing so is compatible with endorsing the pattern of judgments about (4a) used to motivate it and similar instances of CLOSURE$_{\text{conf}}$.

The basic idea is that preface-style cases involve incomparabilities in comparative plausibility: cases where neither $v \succeq_{A,w} u$ nor $u \succeq_{A,w} v$. For example, where p and q are two claims in A's book that concern different questions, v could be a world where p is true but q is false, and u a world where q is true but p is false. One way of developing this idea would be to derive comparative plausibility from a set of questions $\mathscr{Q}$, so that $v \succeq^{\mathscr{Q}}_{A,w} u$ iff $v \succeq^{Q}_{A,w} u$ for all $Q \in \mathscr{Q}$, with each $\succeq^{Q}$ derived from Pr according to PLAUSIBILITY FROM PROBABILITY as before; see Goodman and Salow (2023). In the interest of simplicity, here we will simply show how failures of CLOSURE$_{\text{conf}}$ can arise organically and non-disruptively by allowing incomparabilities in comparative plausibility – i.e., by relaxing the requirement that $\succeq_{A,w}$ be a *total* pre-order.

Here is an implementation of this idea that departs as little as possible from the account in the main text. The treatment of *think* is unchanged, and PLAUSIBLE OPINIONS continues to hold. We make two changes. First, we adopt a more ecumenical definition of $\$_{A,w}$:

$$\$_{A,w} = \{p : \{v : \forall u(u \not\succ_{A,w} v)\} \subseteq p \text{ and } \forall v \in W, \forall u \in p(v \succeq_{A,w} u \Rightarrow v \in p)\}$$

This definition agrees with the previous one whenever $\succeq_{A,w}$ is a total pre-order. Intuitively, a sphere is now any set of worlds that (i) is entailed by the strongest proposition that the agent thinks is true (i.e., it contains all of the worlds that the agent takes to be maximally plausible), and (ii) contains every world that is at least as plausible as any other it contains.

Second, we adopt CONFIDENCE FROM PROBABILITY SPHERES as a definition of degrees of confidence, bypassing the intermediary C. Let us survey some features of the resulting account:

1. COMMITMENT, LOWER BOUND, and COINCIDENCE continue to hold.
2. CLOSURE$_{\text{think}}$ continues to hold.

   Note: given EXTREME WEAKENESS, it is not obvious that the same considerations that motivate rejecting CLOSURE$_{\text{conf}}$ must extend to CLOSURE$_{\text{think}}$.
3. CLOSURE$_{\text{conf/deg/=}}$ can now fail; an example is given in a footnote.[16]

How widespread are failures of CLOSURE$_{\text{CONF/DEG}}$? Examples like (4a) show that they are less common than we would expect from BAYESIAN WHEN DEFINED. Moreover, such cases suggest that, when considering a question like *how much one weighs*, CLOSURE$_{\text{CONF/DEG}}$ holds for propositions about this question. Let us briefly explore this idea. First, some definitions:

- Say that p *concerns* Q iff $p = \bigcup X$ for some $X \subseteq Q$.
- For any partition Q of W and $p, q \in Q$, say that $p \succeq_Q q$ iff $\forall w \in p \exists v \in q(w \succeq v)$.
- Say that $\succeq$ *editorializes* Q iff the preorder $\succeq_Q$ on Q is total (i.e., no incomparabilities).

[16] $W = \{w, v, u\}$, $w \succ v$, $w \succ u$, $v \not\succeq u$, $u \not\succeq v$, $Pr(\{w\}) = .8$, $Pr(\{v\}) = Pr(\{u\}) = .1$. Then $conf(\{w, v\}) = conf(\{w, u\}) = .9 > .8 = conf(\{w\})$.

The present account validates a qualified version of CLOSURE$_{\text{conf}}$ (and likewise of CLOSURE$_{\text{deg}}$):[17]

> RESTRICTED CLOSURE$_{\text{conf}}$
> Suppose $\succeq_{A,w}$ editorializes Q and both p and q concern Q. Then, in w, if A is confident that p and confident that q, then A is confident that *p and q*.

Finally, we continue to predict ANSWER EQUIVALENCE given QUESTIONS AND OPINIONS provided we accept a suitably modified pragmatic hypothesis:

> PRAGMATIC HYPOTHESIS$'$
> The contextually relevant plausibility order $\succeq$ when describing an agent who is offering their opinion in answer to Q is such that, for all w, v, $[w]_Q \succeq_Q [v]_Q$ iff $w \succeq^Q v$.

This says that the plausibility order, when lifted to cells of Q, is congruent with the order defined by PLAUSIBILITY FROM PROBABILITY. It holds given natural assumptions (see footnote).[18]

C. Combining both generalizations

This appendix shows how to combine the ideas from the previous two appendices: modeling agents who violate both PLAUSIBLE OPINIONS and CLOSURE$_{\text{conf/deg/=}}$. Again in the interest of generality, we also allow for failures of CLOSURE$_{\text{think}}$. This requires moving beyond Hintikka semantics for *think*. Instead of there being a single strongest proposition $D_A(w)$ that (in w) A thinks is true, we appeal to a set $\mathscr{D}_A(w)$ of all of the strongest propositions that (in w) A thinks are true. Formally, $\mathscr{D}_A(w) \subseteq \mathscr{P}(W)$ such that $p \not\subseteq q$ for any distinct $p, q \in \mathscr{D}_A(w)$. Then:

$$[\![A \text{ thinks that } \varphi]\!](w) = 1 \text{ iff } p \subseteq [\![\varphi]\!] \text{ for some } p \in \mathscr{D}_{[\![A]\!]}(w).$$

Again, it may be natural to impose further constraints on $\mathscr{D}$ (e.g., that $p \in \mathscr{D}_A(w)$ only if p is non-empty and closed under $\succ_{A,w}$). But for generality we again impose no such constraints.

We now modify the definition of \$ from the previous appendix by replacing $\{v : \forall u(u \not\succ_{A,w} v)\}$ (i.e. $D_A(w)$) with an existentially bound variable ranging over members of $\mathscr{D}_A(w)$:

$$\$_{A,w} = \{p : \exists q \in \mathscr{D}_A(w)(q \subseteq p) \text{ and } \forall v \in W, \forall u \in p(v \succeq_{A,w} u \Rightarrow v \in p)\}$$

As before, we then adopt CONFIDENCE FROM PROBABILITY SPHERES as a definition of *conf*.

The main change with this account is that CLOSURE$_{\text{think}}$ can now fail, and as a result so can RESTRICTED CLOSURE$_{\text{conf}}$. However, the slightly weaker principle remains valid:

> VERY RESTRICTED CLOSURE$_{\text{conf}}$
> Suppose $\succeq_{A,w}$ editorializes Q and both p and q concern Q. Then, in w, if A is confident that p and confident that q and thinks that p and q, then A is confident that *p and q*.

[17] Proof sketch: the key fact is that, if $\succeq$ editorializes Q and p and q both concern Q, then either every p-entailing sphere is q-entailing or vice versa.

[18] Suppose that $\succeq$ is determined as suggested earlier: by universally generalizing over the preorders which are probabilistically generated from the members of a contextually determined set of questions $\mathscr{Q}$. If $\mathscr{Q}$ includes the salient question Q, then we can show that PRAGMATIC HYPOTHESIS$'$ holds so long as Q is logically independent of the question that results from combining all of the remaining questions in $\mathscr{Q}$.

In other respects the resulting account leaves the situation largely unchanged as far as the principles discussed above are concerned.

We conclude by observing an interesting edge case that arises when comparative plausibility maximally incomparable, in the sense that $v \not\succeq_{A,w} u$ for any $v \neq u$. BAYESIAN WHEN DEFINED then holds, since every set of worlds trivially contains every world at least as plausible as any other world that it contains. This raises the intriguing prospect that BAYESIAN WHEN DEFINED may be true in some contexts after all, without requiring any ambiguity in *confident*.

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Revisiting kind predication in Italian[1]

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Abstract.

In this work, I present novel data form Italian, showing that the flavor of generic sentences interacts with mood. Definite plural generics may receive a law-like or an accidental flavor when the subject is modified by a relative in the indicative. However, when the subject is modified by a relative in the subjunctive, it can only receive a law-like reading. I argue that this data is explained if we extend to kinds, standardly seen as intensional plural entities, the tools already used in the treatment of referential plurals, and specifically the distributive operator. I propose that the interaction between the flavor of generic sentences and the presence of the subjunctive is due to a structural ambiguity in Italian definite plural generics. The optional insertion of the distributive operator in plural definite generics gives rise to two LFs. (i) If *DIST* is not inserted, the kind is interpreted in the restriction of GEN, and we get the usual LF. The modal nature of this structure yields the law-like reading, and licenses the subjunctive. (ii) If it is inserted, it distributes the predicate over actual members of the kind, yielding the accidental reading. The subjunctive is then not licensed, as it cannot be interpreted in the modal environment provided by the restriction of GEN. This also predicts that singular indefinite generics cannot receive accidental readings, as they don't denote kinds. I finally argue that a similar reasoning provides a fresh perspective on English bare plurals.

Keywords: kind predication, genericity, plurals.

1. Introduction

Consider the previously unobserved contrast in (1): in Italian, while law-like generalizations allow for relatives both in the subjunctive and in the indicative, accidental ones only allow for the indicative:

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(1) I candidati che si {**presentano/presentino**} con molto anticipo non vengono
The candidates that REFL. {present-**ind.**/present-**subj.**} with much advance not get-ind.
assunti.
hired.
*'Candidates that {show up-**ind.**/show up-**subj.**} far in advance don't get hired.'*

a. *Nervous people unwanted. A rule disqualifies whoever shows up too early.*
hfill {**ind.**✓ **/subj.**✓ }

b. *'Oh, how funny!...People who showed up very early happened not to get hired.'*
{**ind.**✓ **/subj.**#}

In this work, I propose that this is due to a structural ambiguity in Italian definite plural generics. Assuming that definite plurals can denote kinds, and that kinds are plural entities (cf. Chierchia, 1998), we expect the distributive operator *DIST* to operate on kinds just like it does on sums denoted by referential plurals.

Its optional insertion then gives rise to two structures.

(i) If *DIST* is not inserted, the kind is interpreted in the restriction of GEN, and we get the usual LF. The modal nature of this structure yields the law-like reading, and licenses the subjunctive.

(ii) If it is inserted, it distributes the predicate over actual members of the kind, yielding the accidental reading. The subjunctive is then not licensed, as it cannot be interpreted in the modal environment provided by the restriction of GEN.

This also predicts that singular indefinite generics in Italian cannot receive accidental readings, as they don't denote kinds. Finally, I argue that a similar reasoning provides a fresh perspective on English.

2. Background

It has long been noticed that English singular indefinites have a more restricted distribution than bare plurals.

(2) a. # A madrigal is popular. (ACCIDENTAL)
b. A madrigal is polyphonic. (LAW-LIKE)

(3) a. Madrigals are popular. (ACCIDENTAL)
b. Madrigals are polyphonic. (LAW-LIKE)

The same holds for Italian singular indefinites and plural definites, as well as for other Romance languages like French: plural definites, but not singular indefinites, are compatible with accidental readings.

(4) a. #Un madrigale è popolare. (ACCIDENTAL)
A madrigal is popular.
'A madrigal is popular.'
b. Un madrigale è polifonico. (LAW-LIKE)
A madrigal is polyphonic.
'A madrigal is polyphonic.'

(5) a. I madrigali sono popolari. (ACCIDENTAL)
The madrigals are popular.
'Madrigals are popular.'
b. I madrigali sono polifonici. (LAW-LIKE)
The madrigals are polyphonic.
'Madrigals are polyphonic.'

There is no consensus analysis of this contrast, which is puzzling on classical views, as (2a) and (3a) were thought to have the same LF involving GEN. Krifka *et al.* (1995) raised the possibility that (3a) is felicitous because it involves kind predication as in (6) (cf. Carlson, 1977, too), and not generic quantification, as in (7).

(6) $popular(^{\cap}madrigals)$

(7) $\text{GEN}_x[madrigal(x)][popular(x)]$

Cohen (2001) argues against this: clear direct kind predication with bare plurals resists modification by Q-adverbs, as shown in (8), unlike characterizing sentences, as in (9). Since GEN is a silent Q-adverb, this appears to suggest that it is absent in kind predication, but present in (3a).

(8) *Lions are usually extinct.

(9) Madrigals are usually popular.

Others have argued against Krifka *et al.*'s idea by invoking the behavior of bare plurals with respect to binding: (10a) does not mean that the cat kind likes the cat kind, as in (10b) (Chierchia, 1998 a.o.).

(10) a. Cats like themselves. b. $like(^{\cap}cats, ^{\cap}cats)$

Subsequently, two families of views developed. A good representative of 'ambiguity' theories is Cohen (2001), who proposes that bare plural generics are ambiguous between a 'rule' reading and a probabilistic reading, while singular indefinite generics can only refer to rules (see also Krifka, 2003; cf. Mari *et al.* (2012)). Greenberg (2004) is a good representative of 'one meaning' theories: accordingly, bare plural generics unambiguously involve GEN, just like singular indefinites. However, bare plurals induce a more 'tolerant' accessibility relation for GEN than singular indefinites.

3. Proposal

I combine insights from these theories. In the spirit of Cohen, I propose that definite plural generics are ambiguous between an LF yielding law-like readings and one that results in accidental readings. With Cohen and Greenberg, I take the LF giving rise to the law-like reading to involve GEN.

Crucially however, in the spirit of Krifka *et al.* and *contra* Greenberg and Cohen, I take the accidental reading of definite plurals to be the result of kind predication, which is mediated via a distributive operator.

To set the stage, following Chierchia (1995;1998) (a.o.), I assume that GEN is a conditional-like operator that is part of the verbal aspect: it gives rise to both habitual readings like (11) and generic quantification, as in (12). Its scope is its c-command domain, its restriction what locally c-commands it.

(11) Gianni fuma.
Gianni smokes.
'*Gianni smokes*'.
$\text{GEN}_{x,s}\big(x \leq \mathit{gianni} \wedge \mathit{in}(x,s) \wedge C(x,s)\big)\big(\mathit{smoke}_s(x)\big)$

(12) I leoni cacciano.
The lions hunt.
'Lions hunt'
$\text{GEN}_{x,s}\big(x \leq {}^{\cap}\mathit{lions}_s \wedge \mathit{in}(x,s) \wedge C(x,s)\big)\big(\mathit{hunt}_s(x)\big)$

'*C*' in (11) and (12) is a variable whose value is contextually supplied, restricting the domain of GEN to appropriate individuals and situations.

Italian definite plurals can denote kinds, since they support predication of kind-specific predicates like 'extinct' (Carlson, 1977; Chierchia, 1998).

(13) I leoni sono estinti.
The lions are extinct.
'Lions are extinct.'

I assume that kinds are plural entities (cf. Chierchia, 1998; Dayal, 2004 a.o.): ${}^{\cap}\mathit{lions}$ denotes, at a given world, the plural individual made up by all lions. When dealing with referential plurals, the distributive operator is used to capture the behavior of distributive predicates (as opposed to collective ones). In sentences like (14), the observed ambiguity can be seen as structural, i.e. deriving from the optional insertion of *DIST*.

(14) The children lifted the piano.
(each of them separately, in subgroups, or all of them together)

(15) a. $[\![\mathit{DIST}]\!] = \lambda P.\lambda x.\forall y\big(y \leq_{\mathit{atom}} x\big) \rightarrow \big(P(y)\big)$ (Roberts, 1987)

The novel contribution of this work is that since kinds are plural entities, it is possible to distribute predicates over them via *DIST* when they are interpreted with respect to the actual world.[2] Then we expect sentences like (12) to be structurally ambiguous between a reading like (16a) and one like (16b), depending on whether *DIST* is insterted above ***gen***.

(16) I leoni cacciano.
The lions hunt.
'Lions hunt.'

a. ***Bona fide generic***:
$\textsc{Gen}_{x,s}\big(x \leq {}^{\cap}lions_s \wedge in(x,s) \wedge C(x,s)\big)\big(hunt_s(x)\big)$

Paraphrase: *'Generally, if x is a member of the lion kind, it hunts'*

b. ***Distributive kind predication***:
$[DIST[\lambda x.\textsc{Gen}_{x,s}\big(y \leq x \wedge in(y,s) \wedge C(y,s)\big)\big(hunt_s(y)\big)]]({}^{\cap}lions)$
$=$
$\forall x\Big(x \leq {}^{\cap}lions_s\Big) \rightarrow \Big(\textsc{Gen}_{y,s'}\big(y \leq x \wedge in(y,s') \wedge C(y,s')\big)\big(hunt_{s'}(y)\big)\Big)$

Paraphrase: *'All individuals that are lions <u>in the actual world</u> have the habit of hunting'*

4. Explaining the puzzles.

4.1. Flavors of genericity.

Now we can explain the difference between Italian definite plurals and singular indefinites.

- In the *bona fide generic* reading, the NP is in the restriction of GEN, whose modality results in the law-like reading.
- In the *Distributive kind predication* reading, we have quantification over *actual* lions; whence the accidental reading.

As is standard, *DIST* is weaker than a universal quantification such as the one expressed by *each*. Rather, it is the source of homogeneity and non-maximality when combining with definites (Schwarzschild, 1996; Križ, 2016; Križ and Spector, 2021).

What about the singular indefinite? The fact that it does not support kind predication, as shown in (17), shows that it cannot denote a kind (cf. Carlson, 1977; Chierchia, 1998, a.o.):

(17) #Un leone è estinto.
A lion is extinct.
'A lion is extinct.'

[2]Notice that the same could be achieved by adopting, instead of Roberts' *DIST*, Schwarzschild's (1993) $*$ operator. As standard, the $*$ operator would have to be always inserted. In this case, in the (16a) the cover function would simply return the whole kind, while in (16b) it would return atoms composing the kind.

In (18), the singular indefinite can thus provide a property for the restriction of GEN (cf. (18a)) or scope out and get an existential reading (cf. (18b)).

(18) a. $\text{GEN}_{s,x}\big(lion_s(x) \wedge in(x,s) \wedge C(x,s)\big)\big(hunt_s(x)\big)$
b. $\exists x.lion_s(x) \wedge \text{GEN}_{y,s'}\big(y \leq x \wedge in(y,s') \wedge C(y,s')\big)\big(hunt_{s'}(x)\big)$

This derives the constrast, as shown in the table below:

Table 1.

	BONA-FIDE GENERIC (☞Law-like flavor)	DISTRIBUTIVE PREDICATION (☞Contingent flavor)
SINGULAR INDEFINITE	✓	*
DEFINITE PLURAL	✓	✓

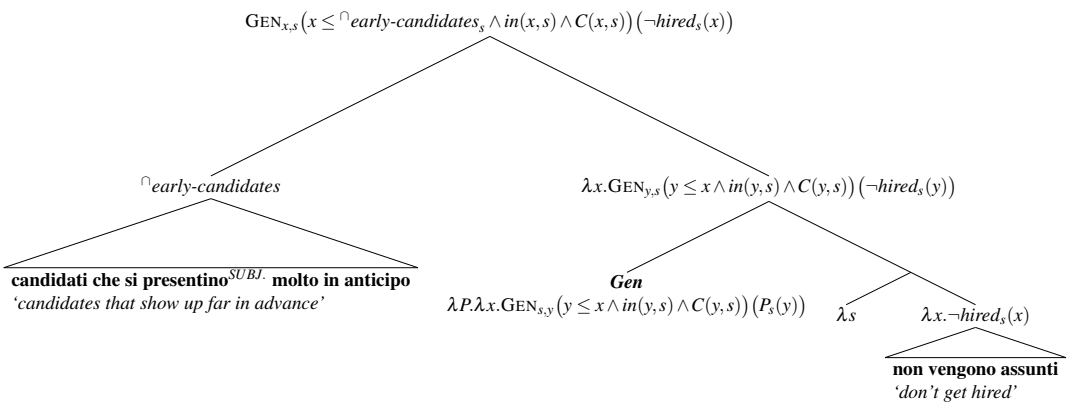
4.2. Subjunctive licensing in Italian

Getting to the contrast in (1) from which we started, now we can explain why relatives in the subjunctive are felicitous only in the case of law-like generalizations. The Italian subjunctive is licensed by modal environments such as the restrictor of GEN (cf. Farkas, 1981; Panzeri, 2006). In the structure that gives rise to the *Distributive Kind Predication* reading (cf. the structure (20)), the relative inside the subject DP cannot be interpreted in the restrictor of GEN: the subjunctive is thus not licensed, and that structure is ruled out. As a result, when the subject is restricted by a subjunctive, the only possible structure is (19), leaving the *bona fide Generic* reading as the only outcome.

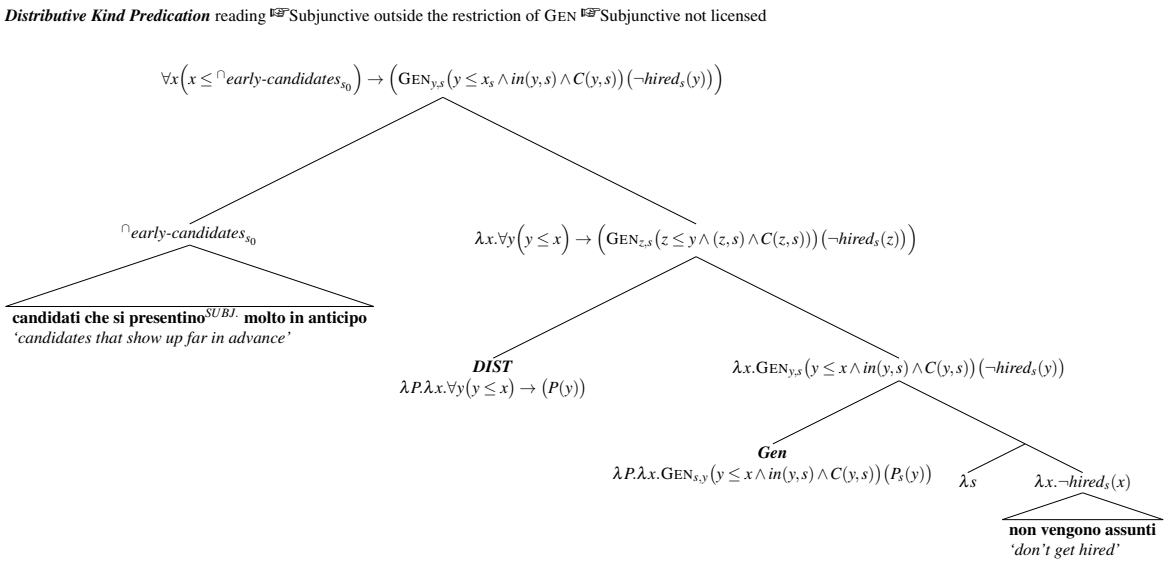
Notice that the present account is immune to the criticisms of the idea of kind predication from (8)-(10). The felicity of explicit Q-adverbs in sentences like (9) is explained by the fact that they can modify the *bona fide Generic* reading. Concerning binding, because we resort to *DIST*, we do not predict wrong LFs like (10b).

(19)

Bona-fide Generic reading ☞Subjunctive in the restriction of GEN ☞Subjunctive licensed



(20)



5. An extension to English

English bare plurals can denote kinds, as (21) is acceptable (cf. Carlson, 1977, a.o.):

(21) Lions are extinct.

An extension of the present account to English derives the contrast in (2)-(3) in essentially the same way as for Italian: bare plurals support distributive kind predication, singular indefinites don't.

This also straightforwardly explains universal readings of bare plurals in episodic contexts (cf. Condoravdi, 1994; Dayal, 2013; Chierchia, 2022), where verbal aspect does not provide GEN. This results in a perspective that is close to what Dayal (2013) and Chierchia (2022) propose for such cases.

(22) Bears are hibernating.
$[DIST[\lambda x.hibernating(x)]]({}^{\cap}bears)$

If we replace the bare plural with a singular indefinite in a sentence like (22), the singular indefinite can only be interpreted existentially. This is expected, since it cannot denote a kind.

(23) A bear is hibernating. {∃, *∀}

The only data point that is left to explain are existential readings of English bare plurals, such as the most salient reading of (24):

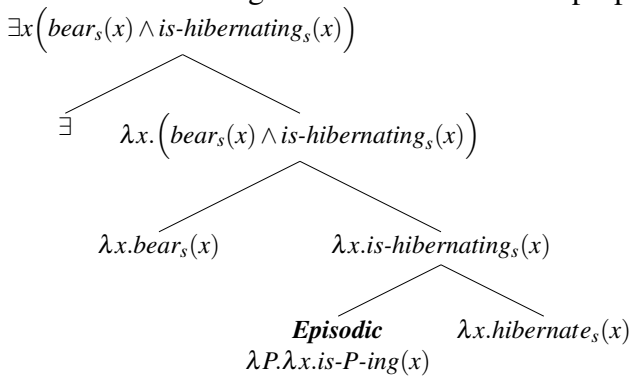
(24) Bears are destroying my garden.

Kind-based theories (e.g. Chierchia, 1998) view English bare plurals as denoting kinds in most environments: in kind readings, in generic environments, and in existential readings (via Type-Shifting via the operation of Derived Kind Predication). The only case in which they receive a property-level interpretation is when providing a restriction for quantifiers (as in e.g. 'all bears'). Property-based theories (e.g., Krifka, 2003) view bare plurals as always denoting properties, except in kind readings. Mixed theories like Longobardi (2001) and Cohen (2020) view English bare plurals as systematically ambiguous between a weak indefinite and a kind reading, but do not provide an account of universal readings of bare plurals in episodic readings. Given the arguments laid out in this paper, we can put forward an account of such readings within a mixed theory. We know that English bare plurals can denote properties (alongside kinds) as, for instance, they can provide restrictions for quantifiers, or be the coda of copular constructions:

(25) a. Three bears are playing.
b. Those are bears.

Then, it is possible that bare plurals are *systematically* ambiguous between kinds and properties, and that when they denote a property, they get existentially closed. As is standard, existential closure only applies to properties (or free variables in analyses as Heim, 1982). *DIST*, instead, only applies to sums.[3]

(26) Bears are hibernating property-denoting bare plural, $\exists$ reading

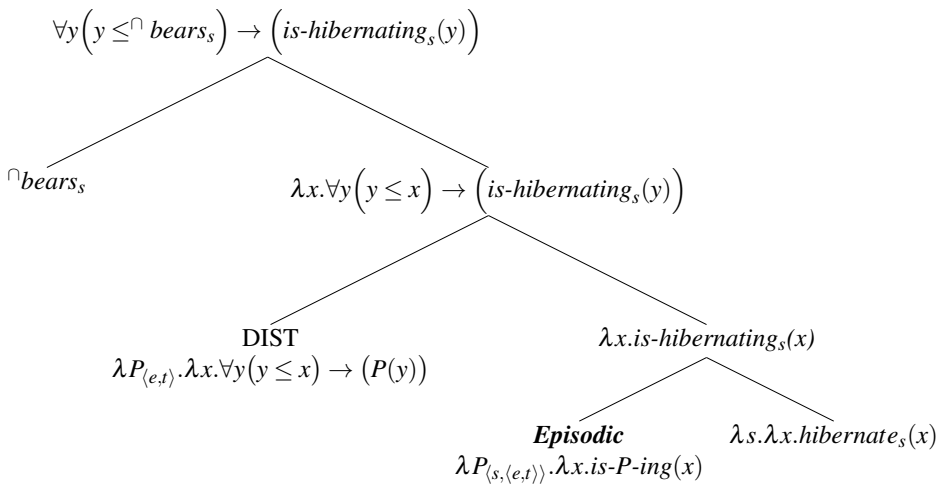


(27) Bears are hibernating kind-denoting bare plural, $\forall$ reading

[3]It is well known that bare plurals cannot take wide scope, as shown by the classical example in (i). which does not have the reading in (ia).

(i) I've been killing mosquitos for an hour.
a. **Cannot mean:** there are some mosquitos I have been killing for an hour

This is handled by the standard assumption that existential closure should apply as low as possible (cf. Krifka 2003, Cohen 2007, a.o.).



This view predicts that existential and universal episodic interpretations should be both systematically available, and their salience should be modulated by context. This seems to be the case. A sentence such as “students are celebrating" more naturally receives a (near-)universal interpretation in a context like (28), while the context in (29) seems to favour an existential interpretation.

(28) Context: it is the beginning of the academic year, and there is an opening ceremony at the university of Bochum.
   a. (Today...), students are celebrating. $\forall$

(29) Context: there is a lot of noise outside the classroom, so A asks B what is going on. B doesn’t know either, goes out, checks, comes back, and says:
   a. (Oh, it’s nothing...) Students are celebrating. $\exists$

6. Conclusion

This paper has argued that a number of puzzling facts in the interpretation of definite plurals in Italian and bare plurals in English can be quite straightforwardly explained if we assume that *DIST* can apply to kinds just like it applies to sums denoted by referential plurals. This is independently motivated by the fact that (i) definite plurals in Italian and bare plurals in English can denote kinds, as they support kind-specific predicates, and (ii) kinds are taken to denote intensional sums, i.e. functions from worlds to plural entities. This assumption strightforwardly explains the fact that definite plurals in Italian and bare plurals in English are compatible with ‘accidental’ generalizations, which are yielded by distribution of a property over actual members of the kind, while singular indefinites cannot have this reading, as they cannot denote kinds. It also explains why relatives in the subjunctive are only compatible with law-like generalizations: the subjunctive is licensed by the restrictor of the generic quantifier, but in the case of accidental generalizations, distributivity prevents the subject DP from being interpreted inside the restrictor of GEN.

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Object mass nouns and comparative judgements[1]

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Abstract. The mass/count distinction is often semantically manifested in comparative judgements as a difference between counting and measurement. Thus, the count nouns in *more stones*/*packs* trigger counting whereas the mass nouns in *more stone*/*sugar* involve measuring. *Object mass nouns* (OMNs) like *furniture*, *weaponry* and *baggage* are exceptional among mass nouns in showing strong counting effects in comparatives. There is little agreement on the interpretation of this fact. Some works propose that OMNs have discrete meanings while others attribute their countability in comparatives to other reasons. Deciding between these approaches is challenging, partly because it has remained unclear if OMNs in comparatives show any semantic distinction from count nouns. In this paper we demonstrate that they do. We report experimental findings showing that in contexts that favor measurement, counting with OMNs is less frequently preferred than with count nouns. We analyze these results by proposing that although referents of both common nouns and OMNs are perceived as discrete objects, OMN denotations are continuous. The tolerant mass/count syntax of the comparative leaves the discrete perception of both kinds of nouns as the prominent factor in their interpretation. However, when the context primes measurement, the continuity of OMN denotations allows them to trigger non-discrete measures more easily than count nouns. This proposal retains the advantages of semantic theories of the mass/count distinction while employing them in a model that is also sensitive to biases coming from pragmatics and the perception of real-world objects.

Keywords: mass nouns, count nouns, comparatives.

1. Introduction

The distinction that many languages make between count nouns (CNs) and mass nouns (MNs) is most blatantly manifested with simple numerals as in the following examples:

(1) a. one tree, two trees, ...
b. #one timber, #two timbers, ...

CNs as in (1a) are primarily used for counting individual entities. Parallel MN collocations with numerals as in (1b), to the extent they are acceptable, primarily count sub-kinds of the noun category (e.g. sub-kinds of timer: oak, mahogany etc.) rather than a total quantity. Such contrasts in countability have been analyzed by postulating a semantic distinction between MNs and CNs. There are different proposals, but they all boil down to assuming that CNs denote discrete objects, while meanings of MNs are continuous or have unspecified atomic elements (Bunt 1985; Chierchia 1998; Rothstein 2017, among others).

A well-known challenge for this kind of semantic analysis comes from so-called *object mass nouns* (OMNs, Erbach 2021). These are MNs like *furniture*, *weaponry* and *baggage* that resist numeral counting like other MNs, although they intuitively refer to discrete objects. What

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is the source of the typical 'mass' behavior of OMNs in constructions like #*one/three furniture*(*s*)? Why don't they allow counting in the same way as CNs like *tables* or *chairs*? There are two approaches to this question. One approach hypothesizes that OMNs denote discrete objects, and their infelicity with numerals follows from independent morpho-syntactic mechanisms. Another approach argues that OMN meanings are continuous like other MNs, and that their intuitive discreteness does not follow from semantic mechanisms. The "discrete OMN" approach puts the emphasis on the way OMNs are pragmatically used, while the "continuous OMN" approach focuses on their syntactic status as mass terms. Deciding between these approaches on empirical grounds has proved quite challenging. Since (McCawley, 1975), various phenomena have been known to distinguish OMNs from other MNs, but without full overlap between different criteria (Erbach, 2021).

One key empirical phenomenon was experimentally studied in (Barner and Snedeker, 2005). In Barner & Snedeker's experiments, OMN-based comparatives (*more silverware*) supported counting as strongly as CN-based comparatives (*more forks*). They conclude that the "discrete OMN" approach is on the right track, as do Bale and Barner (2009) and Wellwood (2019: p.90), among others. Other works object to this line, and propose to see counting with OMNs as an epiphenomenon of measurement processes: of the functionality of objects (Grimm and Levin, 2012) or as estimations of numerosity (Rothstein, 2017). These proposals maintain the analysis of all MN meanings as continuous, hence the general semantic distinction between MNs and CNs. However, despite the centrality of the mass/count distinction for current semantic theory, no clear evidence has been shown that allows us to decide between the "continuous OMN" approach and the "discrete OMN" approach.

The aim of the present paper is to empirically distinguish the "discrete OMN" and the "continuous OMN" approaches. To do that, we are interested in the extent to which there are observable semantic differences between OMNs and CNs in comparatives. More specifically: do OMNs support counting as strongly as CNs? First, we note that although both OMNs and CNs favor counting in comparatives, both kinds of nouns also support measurement in exceptional situations. For example, Rothstein points out that the sentence *John has more furniture, so he should use the larger moving truck* primarily favors measurement of the volume of John's furniture rather than counting the number of pieces he has. Similar observations were made for CNs: when asking whether someone ate *a lot of beans* or *more beans*, we may be interested in the weight or volume of the beans, and not in their number (McCawley, 1975). Measurement-based readings of CNs were also pointed out in other syntactic environments (Snyder, 2021; Winter, 2022). Thus, the critical question for the "continuous OMN" approach is: do comparatives give us a sound empirical basis for semantically distinguishing OMNs from CNs?

We propose a positive answer to this question. In agreement with Barner & Snedeker and Scontras et al. (2017), we assume that the perception of OMN referents as discrete strongly primes counting. For example, with no special reason to measure bags, both questions *who has more baggage* and *who has more bags* primarily require attention to the number of bags. Notwithstanding, in agreement with Grimm & Levin and Rothstein, we hypothesize that a 'mass' morphosyntax boosts measurement with OMNs in contexts where it is pragmatically more likely than counting. We report experimental findings that support this view. This allows us to retain the assets of semantic theories of the mass/count distinction. The emerging picture adopts the traditional assumption that the semantic of certain environments – numeral determiners, bare

singular arguments etc. – is sensitive to the discreteness of the noun's denotation. This accounts for contrasts as in *three bags*/#*baggage*(*s*). However, the discreteness or continuity of a denotation does not fully reflect the way objects are perceived. While syntax and semantics are not sensitive to the perception of OMN referents as discrete, pragmatics is. Accordingly, mapping a continuous OMN denotation to a discrete meaning is especially easy in environments like the English comparative, which licenses both discrete and continuous meanings. This accounts for the special properties of OMNs in the class of MNs. At the same time, as MNs, the continuous denotation of OMNs allows semantic mechanisms to immediately interpret them using measurement. This accounts for the distinctions between OMNs and CNs in comparatives as shown by our experiments.

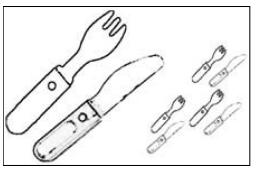
The paper is structured as follows: section 2 shortly discusses previous relevant findings, section 3 describes our experimental work, section 4 discusses the theoretical implications of the results, and section 5 concludes.

2. Previous findings

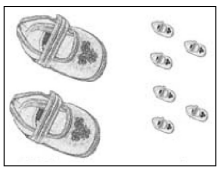
The following examples involve quantity judgements on OMNs in comparatives:

(2) Anna has more furniture/weaponry/baggage than Ben.

As McCawley (1975) observed, introspective judgements on sentences as in (2) usually favor counting. Similar judgements were shown experimentally by Barner and Snedeker (2005), who presented participants with comparative questions on visual stimuli. For instance, questions like *who has more shoes*/*silverware* were presented in relation to visual stimuli as in Figure 1. In these drawings, two people have shoes or items of silverware. One of the people has a smaller number of items whose total size is larger. Thus, counting and measurement should lead to different answers. The OMNs that were studied (*furniture, clothing, jewelry, silverware, mail*) all showed the same (near-unanimous) level of counting-based answers as the CNs (*shoes, candles, cups, plates*). Barner & Snedeker conclude that these results support assigning discrete denotations to both CNs and OMNs.



who has more silverware?



who has more shoes?

(Barner and Snedeker, 2005)

who has more?

(Scontras et al., 2017)

Figure 1: stimuli from previous work

This conclusion is not fully warranted by the evidence. First, comparing quantity judgements on OMNs and CNs should better rely on cases where the semantic content of the nouns is as similar as possible. However, most of the examples that Barner & Snedeker used are associated with different concepts and different visual stimuli. Pairs of nouns such as *baggage-bags* or *weaponry-weapons* might be more decisive tests, as they allow us to keep the visual stimuli

constant for an OMN and the corresponding CN, thus reduce undesirable confounds. Another factor that weakens Barner & Snedeker's conclusions has to do with effects of non-linguistic cues on comparative judgements. As has been observed in other works, judgements of counting vs. measurement are affected by the objects that are presented also without naming them (Middleton et al., 2004; Scontras et al., 2017). In Scontras et al.'s experiment, answers to the question *who has more* showed preference for measurement when the visual stimulus contained puddles of milk (Figure 1), dirt or fabric. However, when the items that were shown are commonly perceived as discrete (cups, flowers, jars etc.), the participants' tendency was to count them. These tendencies were significantly strengthened when the items were explicitly described using nouns as in Barner & Snedeker's experiments (e.g. *who has more milk/cups*). Scontras et al. did not study OMNs. However, on the basis of their results we can hypothesize that possible effects of the CN/OMN distinction on comparative judgements might have been masked in Barner & Snedeker's experiments because counting was triggered already by the visual stimuli. For further experimental work, especially on the relevance of context, see the recent review in (Gafni, 2022).

3. Experiment: counting in comparatives with OMNs and CNs

From Scontras et al.'s experiments we learn that there is a strong tendency of comparative expressions to trigger counting of certain objects and measuring of others even when these objects are not referred to explicitly. The presence of the noun was shown to strengthen this tendency across the board. How does this bear on the contrast between OMNs and CNs? Under the "discrete OMN" approach, OMNs should contribute the same discrete semantic content as CNs. This approach was advocated by Barner and Snedeker (2005), Bale and Barner (2009) and Wellwood (2019: p.90), among others, and it leads us to our null hypothesis:

(H_0) OMNs and CNs equally support counting in comparatives.

The alternative, "continuous OMN" approach maintains a semantic difference between OMNs and CNs. Thus, it expects non-cardinal measurement (of volume, size etc.) to be more easily tolerated with OMNs than with CNs, which gives rise to the following alternative hypothesis:

(H_{alt}) CNs support counting in comparatives more strongly than OMNs.
Equivalently: OMNs support non-cardinal measurement more strongly than CNs.

Our goal is to distinguish between hypotheses (H_0) and (H_{alt}). In Barner & Snedeker's stimuli (Figure 1), counting and measurement lead to different truth-value judgements. Barner & Snedeker used their stimuli for probing the discreteness of a noun's denotation. However, comparative judgements as in Figure 1 do not constitute an optimal test of hypothesis (H_{alt}). Following Scontras et al.'s results, we may also hypothesize that such drawings, which contain items that are commonly perceived as discrete, prime counting independently of the noun within the comparative. Thus, Barner & Snedeker's results may be interpreted as falsifying hypothesis (H_{alt}) only because their stimuli favored counting to begin with. Hypothesis (H_0) may be more effectively challenged by (H_{alt}) when pragmatics favors measurement. To this end, we used drawings as in Figure 2 with questions like the following:

(3) Does Ben have more baggage/bags than Anna?

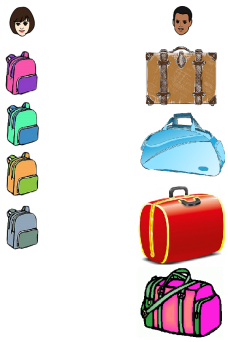


Figure 2: visual stimulus from experiment (*M,C,N,P* conditions)

In Figure 2, the female and the male characters ('Anna' and 'Ben') have the same number of bags. However, the total volume of Ben's bags that the drawing represents, as well as their assumed functionality, is reasonably larger than that of Anna's bags. Thus, similarly to Barner & Snedeker's experiments, counting and measurement lead to different answers: a 'yes' answer on question (3) unequivocally indicates measurement while a 'no' indicates counting.[2] The question in (3) primes participants to look for a contrast between the two sets of bags in Figure 2. This priming and our everyday assumptions about sizes and functionality of bags, make hypothesis (H_{alt}) expect measurement, hence 'yes' responses, to be more frequent with the OMN *baggage* than with the CN *bags*. The null hypothesis (H_0) expects no such contrast.

3.1. Materials and procedure

We selected the following ten OMN-CN pairs:

(4) *baggage-bags, clothing-clothes, dishware-dishes, equipment-instruments, furniture-sofas, housing-houses, machinery-machines, post-packages, stationery-stationery items, weaponry-weapons*

For each such pair and a corresponding drawing (Figure 5) we presented participants with questions using OMNs and CNs as in (3), where counting and measurement are expected to result in different answers. The pairs of nouns in (4) were selected in consideration of two criteria: (i) minimal referential differences between the OMN and the CN in each pair; (ii) the ease of depicting two sets of four different items, where the items in one set are of a greater size and/or of more diverse functionality. The drawings were depicted so that the nouns in each pair intuitively refer to the same objects. In seven of the ten noun pairs, the nouns are referentially synonymous, hence our assumption that in the drawing they refer to the same objects is straightforward (though not a priori certain, as explained below). In two pairs (*furniture-sofas* and *post-packages*) the OMN is a hypernym of the CN, but the CN and its hypernym OMN intuitively refer to the same entities in the corresponding drawing, since all the pieces of furni-

[2]Under Rothstein's or Grimm & Levin's theoretical approaches, a negative answer might also indicate non-dimensional measurement (of functionality or numerosity) whose observed effect would be equivalent to counting. However, support for alternative hypothesis (H_{alt}) would clearly indicate that any "pseudo-counting" effect with OMNs is not as strong as counting with CNs. Teasing apart different possible strategies that amount to counting is not one of our present aims.

ture in one drawing are sofas, and all the post items in the other drawing are packages. For one OMN (*stationery*), finding a hyponym CN suitable for the drawing proved hard, and the CN construct *stationary items* was used instead as a 'CN' correlate.

In addition to the two types of questions in (3), we also presented participants with questions like the following:

(5) Does Ben have a greater number of bags than Anna?

This *number of* condition is expected to hold measurement-based comparisons at a minimum despite the pragmatic pressure to answer positively. In total, three yes/no questions as in (3) and (5) were presented with each drawing, with the person having the larger and more diverse items serving as subject, e.g. *Ben* in (3) and (5) in relation to Figure 2. These three conditions per drawing were named *M*, *C* and *N*, where:

M = OMN, e.g. *baggage* in (3)
C = bare CN, e.g. *bags* in (3)
N = *number of* CN, as in (5)

We collected answers on these *M*, *C* and *N* conditions for each of the ten nouns pairs in (4) and the corresponding drawing (Figure 5). The aim of these items was to examine the null hypothesis (H_0) against the null hypothesis (H_{alt}) by comparing the reactions to the *M* and the *C* conditions, and to compare both conditions to the baseline for counting that is established using the reactions to the *N* condition.

Two additional conditions were tested as 'follow-up' conditions with seven of the nouns pairs that in a pilot showed the strongest trends in differences between the *M* and *N* conditions: (*baggage, clothing, equipment, furniture, housing, machinery* and *stationery*). One condition was similar to the *N* condition above, but instead of a CN like *bag* it involved a countable nominal with the corresponding OMN, e.g. *pieces of baggage*. Thus, participants received questions like the following:

(6) Does Ben have a greater number of pieces of baggage than Anna?

We refer to this condition as the *P* ('piece') condition. For *stationery*, where the 'CN' item was *stationery items*, this *P* condition was identical to the *N* condition. The aim of this trial was to verify our assumption about referential identity between the CN and the OMN, by comparing reactions to *P*-questions like (6) and *N*-questions like (5). If the CN and the OMN refer to the same objects in the drawing, we expect the *P* and *N* conditions to lead to similar levels of positive reactions.

Another condition involved comparative questions with OMNs and graphical stimuli similar to Barner & Snedeker's experiment. For instance, question (7) was presented together with Figure 3.

(7) Who has more baggage?

We refer to such items as the *BS* condition. The aim of these items was to replicate Barner & Snedeker's results with the OMNs tested in our main experiment. If pragmatics plays an important role in quantity comparisons, we expect that the different setup might lead to differences

in the ubiquitousness of counting in the *BS* and the *M* conditions, although both conditions test counting with the same OMNs.

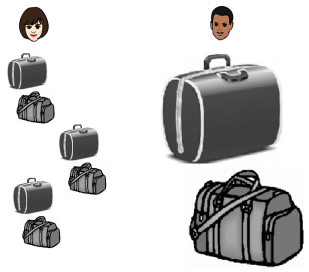


Figure 3: bags in a stimulus similar to (Barner and Snedeker, 2005)

Using *Prolific*, we recruited 520 participants (400 female, age M=39.2), native speakers of British English. Each participant received no more than four target items in a between subject design: 1-2 mass (M/BS) comparatives and 1-2 count (C/N/P) comparatives in a pseudo-random order. The 2-4 nouns in the target items that each participant received were all from different noun pairs in (4). After answering a training question with a simple comparative judgement,[3] each participant was requested to answer questions like (3), (5), (6) and (7) based on the corresponding drawing. In total, between 39-41 responses were collected for each condition. To distract from the goal of the experiment, each participant was also given three filler items different from the main task.

3.2. Results

For each noun pair and condition, Table 1 shows the number of positive and negative answers with conditions *M*, *C*, *N*, and *P*. Recall that a "yes" response in these conditions indicates the use of measurement rather than counting, agreeing that the character with the larger and/or more diverse items (e.g. Ben in Figure 2) has more than the other character. With respect to the *BS* condition, Table 1 shows the number of answers indicating measurement and counting, e.g. the answers *Ben* and *Anna* respectively in relation to question (7) on Figure 3.

Table 2 shows the frequency of positive and negative responses on the questions in the main conditions *M*, *C* and *N*. As Table 2 shows, the majority of responses on each of these conditions relied on the cardinality of the two collections. However, with the OMNs in the *M* condition the tendency to rely on measurement (26%) was considerably increased compared to the bare CNs in the *C* condition (12%). Also the reactions per item in Table 1 show a consistent trend of higher or equal frequency of measurement in the *M* condition compared to the *C* and *N* conditions. As expected, the levels of measurement in *C* and *N* conditions were low (12% and 8%), and items showed no consistent trend between these two conditions.

The data on conditions *M*, *C*, and *N* were analyzed with a mixed models binary logistic regression with response ("yes" or "no") as the target dependent variable, Condition (*M*, *C* or *N*) as a Fixed Effect, and Participants and Noun Pair as random effects. The effect of Condition

[3] *is there more cereal than pasta*, where the pieces of cereal and pasta are of about the same size, and the volume of cereal is obviously larger.

OMN	**CN**	**M+**	**M−**	**C+**	**C−**	**N+**	**N−**	**P+**	**P−**	**BS(m)**	**BS(c)**
baggage	*bags*	16	24	8	32	0	40	0	40	1	40
clothing	*clothes*	9	31	9	31	2	37	6	34	1	40
dishware	*dishes*	4	36	4	36	4	36	-	-	-	-
equipment	*instruments*	15	25	9	31	4	36	9	32	0	41
furniture	*sofas*	13	28	2	39	4	37	6	34	0	40
housing	*houses*	15	25	1	39	3	36	4	36	4	37
machinery	*machines*	7	33	1	39	5	35	4	37	0	40
post	*packages*	3	37	0	39	2	37	-	-	-	-
stationery	*st.items*	17	24	12	28	4	36	-	-	0	39
weaponry	*weapons*	4	36	1	38	3	37	-	-	-	-

Legend: **M**+/−: OMN (e.g. *baggage*) **C**+/−: CN (e.g. *bags*) **N**+/−: *number of* CN **P**+/−: *number of pieces of* OMN **BS(m/c)**: measuring/counting OMNs under Barner & Snedeker's test

Table 1: number of positive and negative answers per noun pair and condition

	Response		
Condition	**No** (%)	**Yes** (%)	**Total**
M (OMN, e.g. *baggage*)	299 (74%)	103 (26%)	402
C (bare CN, e.g. *bags*)	352 (88%)	47 (12%)	399
N (*number of* CN)	367 (92%)	31 (8%)	398

Table 2: totals of positive and negative answers per noun pair and condition (*M*/*C*/*N*)

was significant ($F(2,1196) = 26.26$, $p < .001$). Condition *C* was taken as the baseline, compared to which Condition *M* was significantly different ($b = -.98$, 95% CI $= \{-1.37, -.60\}$, $p < .001$), and Condition *N* was not ($b = .47$, 95% CI $= \{-.01, .94\}$, $p = .056$). Figure 2 shows the 95% Confidence Interval for Odds Ratios with each of the 10 word-pairs comparing the *M* (Mass) and *N* (Number Of) conditions. Six of the text word-pairs showed significantly increased "yes" responses for OMNs (*M* condition) compared to *number of CN* (*N* condition) according to Fisher's exact test, with the remaining four showing no significant effect.

Possible differences in reference between OMNs and corresponding CNs were tested by the first "follow-up" *P* condition (e.g. *number of pieces of baggage*), which was used in comparison to the *N* condition (e.g. *number of bags*). Based on the six word pairs tested in both conditions, the *P* condition led to 29 out of 242 "yes" responses (12%), compared to 18 out of 239 "yes" responses in the *N* condition (8%). A mixed model logistic regression comparing the two conditions showed no significant difference between these conditions ($F(1,479) = 2.682$, $p = .102$, $b = .520$, 95% CI= $\{-.104, 1.143\}$).

Possible pragmatic differences between our setup and Barner & Snedeker's experiment were tested by the second "follow-up" *BS* condition. In the *BS* condition there were 6 responses out of 283 (2%) indicating lack of counting (e.g. answering *Ben* to question (7) on Figure 3). This is compared to 92 "yes" responses out of 282 (33%) in the *M* condition, which indicate lack of counting for the same seven OMNs. A mixed model logistic regression was run with intercept included and participants and word-pairs as random effects. The fixed effect of Condition was significant ($F(1,563) = 52.07$, $p < .001$), and taking *BS* as baseline: $b = -3.119$, 95% CI = $\{-3.967, -2.270\}$.

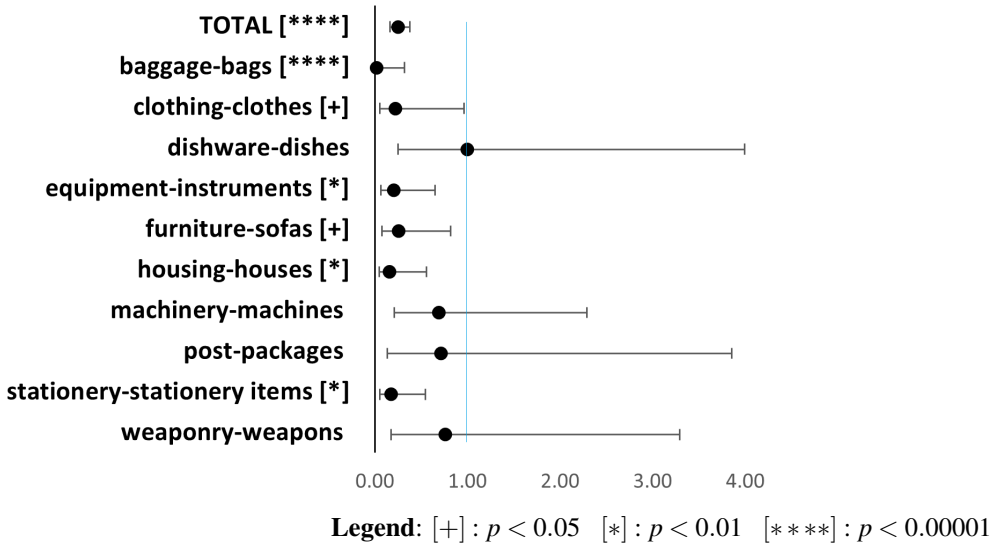


Figure 4: 95% Confidence Interval for Odds Ratios with the 10 word-pairs comparing the *M* (Mass) and *N* (Number Of) conditions

3.3. Discussion

The results show that when measurement is pragmatically preferred, participants use it more often in comparatives with OMNs than with CNs or *number of* nominals. Bare CNs showed a similar level of counting as *number of* phrases. These results support hypothesis (H_{alt}) that counting is favored with CNs compared to OMNs. The conclusion is that some semantic or pragmatic distinction should be made between these two noun classes. Section 4 discusses the theoretical implications of this conclusion.

One possible confound that could have led us towards premature rejection of the null hypothesis (H_0) might be that we had overlooked some referential distinctions between OMNs and CNs. For instance, in a pilot study it turned out that the nouns *jewelry* and *jewels* are hard to compare since the latter term, but not the former, also refers to precious stones that may be part of jewelry items. However, among the noun pairs in (4), for no pair did our results show any significant difference between the *N* condition (with CNs) and *P* condition (with OMNs). This suggests that potential referential differences between OMNs and CNs cannot explain our results.

Another possible discrepancy might concern our selection of OMNs. Since the experiment aimed at comparing OMNs and CNs that are referentially identical, the OMNs we selected are different than those in Barner & Snedeker's experiment, which did not aim at such a comparison. These difference in our selection of nouns might be used to explain why our study showed contrasts in counting between OMNs and CNs whereas Barner & Snedeker's experiment did not. However, such an explanation would be highly unlikely. The *BS* condition involved the OMNs we selected using the same kind of stimuli as in Barner & Snedeker's experiment, and showed counting effects at ceiling similar to their results. We conclude that Barner & Snedeker's results are likely to be robust among MNs that are commonly classified as OMNs, and that the significant differences we found between the *BS* and *M* conditions result from the different pragmatic pressures that these two conditions introduce: while Barner & Sneder's

stimuli do not pragmatically favor measurement over counting, our three main conditions (*M*, *C* and *N*) do.

4. General discussion

We classified two general theoretical approaches to OMN semantics. The "discrete OMN" approach takes the denotation of OMNs to be discrete like that of common nouns. The "continuous OMN" approach takes their denotation to be continuous like that of other mass nouns. In this section we consider how each of these two approaches may account for the results of our experiments.

According to the "discrete OMN" approach, there is no denotational difference between OMNs and CNs. Syntactically, both OMNs and plural CNs are perfectly grammatical in comparatives. Accordingly, any observed distinction between the OMNs and CNs in comparatives has to be attributed to pragmatics. Let us consider a possible line for such a pragmatic account of our results. Suppose that a speaker intuitively recognizes the syntactic similarity between OMNs like *baggage* and other MNs, e.g. substance MNs like *air*. Such a speaker might be more inclined to use measurement with the OMN *baggage* than with the corresponding CN *bags*. This kind of reasoning may be used to account for our results.

According to the "continuous OMN" approach, the stronger tendency to measure denotations of OMNs can be viewed as a matter of conflicting semantic and perceptual preferences. In ordinary circumstances, the perception of OMN referents as discrete creates a strong pressure to count them. Thus, the continuous denotation of an OMN has to be "packaged" according to the discrete perception of its referents. This assumed packaging with OMNs may occur by default, when no contextual preferences go against it. It is similar to exceptional packaging processes that also happen with SMNs like *three beers*, which is interpreted as "three bottles of beer" (Wiese and Maling, 2005). The denotation of an OMN like *furniture* is as continuous as that of an SMN like *beer*, but in normal circumstances a comparative like *more furniture* is interpreted as if it meant "more pieces of furniture". Despite this default interpretation, since the denotation of OMNs is lexically continuous, measurement comes more easily with them than with CNs whenever the context favors it.

Let us illustrate how these two approaches can be formalized. In the "continuous OMN" approach, we recognize three factors that potentially prime measurement:

- A continuous lexical denotation of the noun, which by assumption characterizes OMNs similarly to SMNs.
- Perceiving the referent of the noun as continuous, which by assumption characterizes SMNs but not OMNs.
- Pressures of the linguistic context to measure quantities, which by assumption characterizes our experiment but not Barner & Snedeker's experiment.

Let us suppose that each of these factors is a binary variable that equally contributes to the decision on measurement vs. counting.[4] For convenience, let us assume that each of the three

[4]The assumption about binary variables is suitable when it comes to the lexical denotation of the noun (which by

variables contributes a value of 0 or 3 towards the measurement decision. The three values are arithmetically averaged. Summarizing these assumptions, we get the situation in Table 3.

	SMN	OMN	CN	
Denotation:	3	3	0	
Perception:	3	0	0	
Context A:	0	0	0	no priming of measurement (Barner and Snedeker, 2005)
Context B:	3	3	3	priming of measurement (our experiment)
Average Context A:	2	1	0	
Average Context B:	3	2	1	

Table 3: factors affecting measurement (3=strong bias towards measurement, 0=no bias)

The Denotation factor in Table 3 describes whether the assumed denotation in the "continuous OMN" approach is continuous (with OMNs and SMNs) or discrete (with CNs). The Perception factor models whether the referent of the noun is by default perceived as continuous (with SMNs) or discrete (with CNs and OMNs). The Context factor models the contribution of the linguistic context towards measurement. In Barner & Snedeker's experiments (context A), where speakers are simply asked "who has more SMN/OMN/CN", we assume that the context does not contribute any bias towards measurement. In our experiment (context B), we assume this bias is positive. These assumptions lead to the following formal results. First, in all contexts, the bias towards measurement is stronger with SMNs than with OMNs, and is stronger with OMNs than with CNs. Second, in the context of our experiment (B), the bias towards measurement with OMNs may reach a relatively high level, whereas in the context of Barner & Snedeker's experiment (A) the bias towards measurement is relatively low with OMNs. Assuming a threshold model as in (Hampton, 2007), this situation can explain the near unanimous counting with OMNs in Barner & Snedeker's experiment, and the increased tendency towards measurement with OMNs in our experiment as compared to CNs. The counting/measurement decision is a categorical decision. Let us suppose that for all speakers, the threshold value for making this decision lies between 1 and 3. Thus, for some threshold value $t \in (1,3)$, if the total average of the measurement biases is greater than or equal to t, the speaker will use measurement, and if it is below t, the speaker will count. When using this threshold, it follows from Table 3 that all speakers will equally use counting with CNs and OMNs in Barner & Snedeker's experiments (context A), since their threshold for measurement is above 1, while both OMNs and CNs have an average measurement bias that is 1 (with OMNs) or lower (with CNs). In our experiment (context B), the same model expects a difference between OMNs and CNs. With OMNs, a speaker may or may not measure quantities, depending on whether her threshold t is below 2 or not. With CNs, all speakers are expected to use counting since their threshold is above 1, thus above the measurement bias for CNs.

A similar model could be developed within the "discrete OMN" approach, but it would be less plausible. In this approach the denotations of both OMNs and CNs are discrete. Thus, the denotation of the noun aligns with the perceptual preferences for discreteness/continuity.[5] As

all accounts is either discrete or continuous), but not to perceptual and contextual factors, which are reasonably non-categorical. This however does not affect the main point of our analysis here. A similar caveat holds with respect to our tentative assumption that all three factors equally contribute to the decision.

[5]This alignment cannot be assumed to be complete even under the "discrete OMN" approach. As Rothstein

mentioned above, in the "discrete OMN" approach any difference between OMNs and CNs can only come from pragmatically assimilating OMNs to SMNs. Adding such an "assimilation" factor would allow the "discrete OMN" approach to emulate the model that is considered above using the "continuous OMN" approach. However, this kind of account would be inelegant. It would require one to encode the syntactic difference between OMNs and CNs in the pragmatics rather than in their denotation. Contrary to what most theories would assume, the mass/count syntax in this analysis would affect pragmatic considerations without having any effect on the semantics. Thus, we believe that given the results of our experiment, a semantic account that is based on the overt syntactic mass/count distinctions in languages like English, as in the "continuous OMN" approach, is preferable.

5. Conclusions

With the aim of understanding better the semantics of object mass nouns (OMNs), we reported an experiment where their counting effects in comparatives were contrasted with common nouns (CNs). Our results show a stronger tendency to avoid counting with OMNs compared to CNs. The key to this result was in the use of referentially close OMNs and CNs in contexts that prime measurement. Barner & Snedeker's uniform counting effects with OMNs were replicated with the same nouns. We conclude that the context of the comparative sentence strongly affects whether it is interpreted using counting or measurement of OMN referents. We presented a model where three elements affect the counting vs. measurement decision: semantic denotation, perception of referent, and linguistic context. This type of model is easily implemented within the traditional approach, where denotations of OMNs are continuous similar to other mass terms. While it is evident that measurement effects with OMNs in comparatives are not the preferred option, they show up quite often when the context favors them, which we did not discover with CNs in the same contexts. We believe that potential measurement effects with CNs, although we did not detect them in our study, may appear in contexts that favor measurement more strongly. We also did not address potential counting effects for substance mass nouns like *flour*. However, we believe that further work might show that the syntactic flexibility of comparatives in English, which tolerate both count nouns and mass nouns, may also support this additional semantic flexibility when contextual factors favor it. Further work might be needed in order to test these hypotheses.

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(2017) points out, CNs like *cloud* or *fence* may have a bias towards a non-discrete perception since the borderlines between different clouds or fences are often fuzzy.

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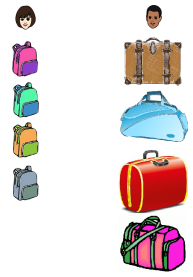
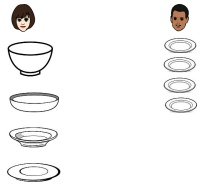


baggage-bags

clothing-clothes



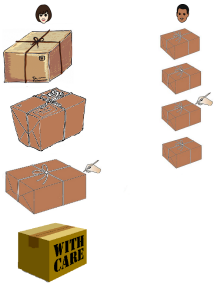
dishware-dishes

equipment-instruments

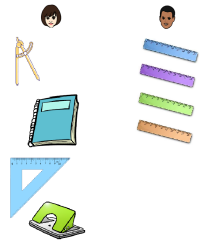
furniture-sofas

housing-houses

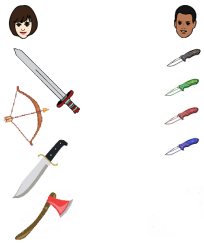
machinery-machines



post-packages



stationery-stationery items



weaponry-weapons

Figure 5: graphical stimuli in main experiment

Imprecision, structural complexity and the Gricean maxim of Manner[1]

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Abstract. Several recent approaches to imprecision in the plural domain entail that it is possible for a sentence with a definite plural and its alternative with an *all*-type quantifier to express contextually equivalent truth conditions. This raises the question of why we can use *all* in such contexts, given that "needless" structural complexity leads to unacceptability in other cases, such as Hurford disjunctions. This paper proposes an account in terms of trade-offs between pragmatic preferences, including a preference for simpler structures and a preference for avoiding imprecision. When combined with certain assumptions about when two sentences compete, this perspective can account for the markedness asymmetry between plural definites and *all*-type QPs, and the lack of a similarly consistent asymmetry between definites and indefinites.

Keywords: imprecision, non-maximality, universal quantifiers, structural complexity, Manner

1. Introduction

The question of how different aspects of Gricean pragmatic reasoning are implemented in the grammar has given rise to a productive research program, but most work in this vein has focused on the Maxim of Quantity. The question arises how natural language grammars implement the preferences underlying Grice's (1975) **Maxim of Manner** in case a speaker has to choose between potential utterances whose truth conditions are contextually equivalent. This paper addresses a form of Manner-based competition that has received relatively little attention—the choice between imprecise expressions and their precise counterparts. My focus will be on the contrast between definite plurals as in (1a), which permit so-called **non-maximal** construals that allow exceptions, and plural universal quantifiers as in (1b), which do not.

(1) a. The switches are on.
b. All the switches are on.

I will analyze the choice between the alternatives in (1) in terms of a trade-off between a preference for precision and a preference for syntactically simple structures. The Manner principle I will propose would require us to choose the more precise (1b) if it weren't for the fact that (1a) has the advantage of being structurally simpler (cf. also Krifka 2007 a.o. on numeral imprecision). This trade-off requires certain meanings to systematically correspond to more complex structures than others and therefore has far-reaching consequences for the way the grammar is organized. This is not a new idea; for a related proposal in the Rational Speech Act framework, see Spector (2017). My contribution here is to spell out a version of this idea in a more conventional neo-Gricean setting and bring out some of its empirical advantages.

[1]This paper is a revised version of certain parts of chapters 3 and 5 of my PhD thesis (Haslinger, 2024). I would like to thank Clemens Steiner-Mayr and Viola Schmitt for the incredible amount of time and effort they invested in supervising my PhD project. I have also benefited a lot from discussions with my committee members Daniel Büring and Benjamin Spector, as well as helpful comments by many others, including Keny Chatain, Daniel Gutzmann, Roni Katzir, Gurmeet Kaur, Jan Köpping, Andrea Matticchio, Adi Behar Medrano, Mathieu Paillé, Emil Eva Rosina, Maik Thalmann, Ekaterina Vostrikova, Thomas Weskott and Valerie Wurm. I would also like to thank my audiences at the Göttingen English Linguistics Oberseminar, the Bochum Language Colloquium, The Ad Hoc Reading Group at Institut Jean Nicod, and of course SuB28. Needless to say, all errors are my own.

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The paper is structured as follows. Section 2 provides some theoretical background on imprecision in plural semantics, focusing on a system due to Križ and Spector (2021). Section 3 argues that on this proposal, there are contexts in which the two structures in (1) convey the same truth conditions, which is a challenge for the common view that natural language pragmatics bans "needless complexity", and spells out an account of this puzzle in terms of interacting, defeasible constraints. Section 4 shows how, when combined with certain assumptions about when two sentences compete, this proposal derives a structural asymmetry between *all*-type QPs and plural definites (cf. Matthewson 2001). Section 5 addresses the puzzle of why there is no similarly consistent asymmetry between plural definites and indefinites, and suggests that this reflects yet another Manner-related preference, which is motivated independently by **Maximize Presupposition** effects (Heim, 1991; Sauerland, 2008). Section 6 concludes.

2. Background: Imprecision in plural predication

To provide the necessary background on the semantics of definite plurals and *all*-QPs, I will first informally introduce the phenomena of imprecision and homogeneity and then summarize one particular formal theory of these phenomena, due to Križ and Spector (2021).

2.1. Definite plurals vs. *all*-QPs

Much of the recent literature on plural definites concentrates on two striking properties that distinguish them from *all*-QPs (e.g. Lasersohn 1999; Löbner 2000; Malamud 2012; Križ 2015; Križ and Spector 2021; Bar-Lev 2021 a.o.).[2] First, (1a) exhibits a so-called **homogeneity** effect—a gap between the default interpretations available in upward- and downward-entailing environments: When embedded in a DE environment, the definite in (1a) receives an existential interpretation (2a) which is not available for an *all*-QP (2b).

(2) a. I don't think the switches are on.
✓ 'I don't think any of the switches are on.'
b. I don't think all the switches are on.
✗ 'I don't think any of the switches are on.'

Second, definite plurals exhibit a specific form of context-dependency known as **imprecision** (or **non-maximality** in the plural domain), which is removed by *all*. As a first illustration, consider the two minimally contrasting scenarios in (3a)/(3b). While (4b) is clearly false in both scenarios, (4a) expresses something appropriate in scenario (3b), but something misleading in (3a). In what follows, I will use the term **p-truth conditions** for the conditions under which an imprecise sentence is perceived to be true in a given context (i.e. 'true enough' in the sense of Križ 2015). In (3a), the p-truth conditions of (4a) appear to require all the switches to be on, while in (3b) its p-truth conditions seem to be merely existential.

[2]There is a third difference: *all*-type quantifiers impose a distributive construal on certain subclasses of predicates. This paper abstracts away from this additional issue by focusing on cases in which the alternatives with and without *all* do not contrast with respect to distributivity.

(3) SWITCHES: Abe and Bert just installed a set of 10 new light switches, but made an error that might lead to an electrical fire. Since their shift has already ended, they do not have time to fix the problem right away and decide to leave.
   a. MAXIMAL scenario: ... They know that there can be a fire only if all 10 switches are on at the same time. Abe realizes he left two of the switches on.
   b. NON-MAXIMAL scenario: ... They know that there can be a fire whenever any of the switches are on. Abe realizes he left two of the switches on.

(4) a. Abe: Oh no, the switches are on! ?? MAXIMAL, ✓ NON-MAXIMAL
   b. Abe: Oh no, all the switches are on! ✗ MAXIMAL, ✗ NON-MAXIMAL

Clearly, definite plurals show a form of context-dependency which *all*-QPs lack, and which therefore cannot simply be domain restriction. Recent work by Malamud (2012), Križ (2015) a.o. has argued that the relevant aspect of the context is the implicit QUD or **salient issue**. Descriptively, (4a) can be p-true in a 'some but not all' world, but only if that world is on a par with an 'all' world for the purposes of the salient issue (Križ, 2015). Given the issue 'Is there a chance of a fire?' in (3), this is the case in the NON-MAXIMAL scenario, but not in the MAXIMAL one. Hence, only the NON-MAXIMAL scenario licenses an existential interpretation of (4a). In sum, the hallmarks of imprecision are 1) the existence of a 'strong' default construal and 2) the possibility of licensing weaker construals by manipulating the salient issue.

2.2. From contextual parameters to imprecise truth conditions

Starting with Križ (2015), several authors have attempted to derive imprecision and homogeneity from a common source (Križ and Spector 2021; Bar-Lev 2021; Feinmann 2020; Paillé 2022 a.o.). Here I introduce one such proposal, due to Križ and Spector (2021). In this system, the crucial property of imprecise sentences is that the compositional system does not map them to a unique proposition in a given context c. Instead, they express different propositions depending on the values of certain additional parameters of the semantic evaluation function. The p-truth conditions are determined by selecting a subset of these propositions on the basis of the salient issue I_c, which accounts for the QUD effect illustrated in (3). Homogeneity effects are due to the way the truth definition works in case there are multiple such propositions.

To formalize these ideas while abstracting away from the exact nature of the extra parameters, we will relativize the evaluation function to **parameter vectors**—mappings from a certain set of parameters to their values—so that an expression ϕ is mapped to an extension $[\![\phi]\!]^{c,w,v}$ relative to context c, world w and parameter vector v. An expression ϕ has **potential for imprecision** iff $[\![\phi]\!]^{c,w,v}$ depends on v for some c and w. The semantics then needs to ensure that definite plurals, but not *all*-QPs, introduce potential for imprecision. There are many ways of achieving this; here I follow the implementation of Križ and Spector (2021), but this choice is not crucial.[3] Following them, I take the relevant parameters to be functions f^i_v that map a

[3]The important properties of this system for my purposes are 1) that the different construals of imprecise sentences can be generated by varying certain evaluation parameters and 2) that these parameters are chosen based on the salient issue. Since these properties are shared by exhaustification-based theories that reduce imprecision to alternative pruning (e.g. Bar-Lev 2021), where the relevant parameter is the restricted alternative set, my proposal translates into such frameworks.

plurality x to an upward-closed subset of the parts of x, a notion defined in (5).[4] When an expression referring to a plurality x combines with a predicate bearing the index i, the predicate is not required to hold of x itself, but merely of some subplurality of x in the set $f_v^i(x)$. (6a) illustrates this for the switches example[5], and (6b) gives a general schema.

(5) a. An **upward-closed subset** of a set S is a nonempty subset S' of S such that for any $x, y \in S$, if $x \in S'$ and $x \leq y$, then $y \in S'$.
b. The values of the f_v^i parameters are drawn from the set $\mathscr{F}$ of functions from D_e to $\mathscr{P}(D_e)$ such that for any $x \in D_e$, $f(x)$ is an upward-closed subset of $\{x' : x' \leq x\}$

(6) a. $[\![\textit{The switches } [\textit{are on}]_2]\!]^{c,w,v} = 1$ iff $\exists x[x \in f_v^2(\bigoplus({}^*\textbf{switch}_w)) \wedge {}^*\textbf{on}_w(x)]$
b. Given a plural predicate P affixed with an index i:
$[\![P_i]\!]^{c,w,v} = \lambda y_e.\exists x[x \in f_v^i(y) \wedge [\![P]\!]^{c,w,v}(x)]$

Given (6a), we obtain a maximal construal if f_v^2 returns a singleton set containing the maximal plurality (7a), and an existential construal if f_v^2 returns the set of all subpluralities as in (7b). Various intermediate choices are also possible; for instance, the parameter choice in (7c) produces a construal that requires at least half of the switches to be on.

(7) Given the LF [[*the switches*] [*are on*]$_2$]:
a. MAXIMAL construal: $f_v^2(\bigoplus({}^*\textbf{switch}_w)) = \{\bigoplus({}^*\textbf{switch}_w)\}$
b. EXISTENTIAL construal: $f_v^2(\bigoplus({}^*\textbf{switch}_w)) = \{x : {}^*\textbf{switch}_w(x)\}$
c. INTERMEDIATE NON-MAXIMAL construal:
e.g. $f_v^2(\bigoplus({}^*\textbf{switch}_w)) = \{x : {}^*\textbf{switch}_w(x) \wedge |x| \geq \frac{1}{2} \cdot |\textbf{switch}_w|\}$

The semantic effect of *all*, on this approach, is to require the plural predicate to hold of its argument under every possible parameter value. This means, in particular, that it must hold of its argument on a maximal construal (8). (The notation $v[f^2 \leftarrow f]$ in (8) stands for the parameter vector v' that is like v except that $f_{v'}^2 = f$.)

(8) $[\![\textit{All the switches } [\textit{are on}]_2]\!]^{c,w,v} = 1$ iff $\forall f \in \mathscr{F}[[\![on_2]\!]^{c,w,v[f^2 \leftarrow f]}([\![\textit{the switches}]\!]^{c,w,v})]$
$= 1$ iff $\forall f \in \mathscr{F}[\exists x[x \in f(\bigoplus({}^*\textbf{switch}_w)) \wedge {}^*\textbf{on}_w(x)]]$
$= 1$ iff ${}^*\textbf{on}_w(\bigoplus({}^*\textbf{switch}_w))$

Having spelled out how imprecision is introduced in the compositional semantics, let us now turn to the defining property that distinguishes it from other forms of context-dependency—the way the parameter values are selected in a given context c. Essentially, we choose v so that the proposition $[\lambda w.[\![\phi]\!]^{c,w,v}]$ is **strongly relevant** to the salient issue I_c. Viewing I_c as a partition of the logical space (Groenendijk and Stokhof, 1984), a strongly relevant proposition is one that eliminates at least one partition cell without being overinformative, i.e. without making subdivisions within a cell. This is formally defined in (9).

[4] I assume that pluralities are elements of the individual domain D_e, which is closed under an operation $\bigoplus$ that maps a nonempty set of individuals to a single individual, its sum. Further, D_e contains a subset A of atomic individuals such that there is a one-to-one correspondence between the individuals in D_e and nonempty subsets of A, i.e. $(D_e, \bigoplus)$ is isomorphic to $(\mathscr{P}(A)\backslash\{\emptyset\}, \bigcup)$. On this basis, we can define the part-whole relation $\leq$: $x \leq y$ iff $x \oplus y = y$.

[5] Following Link (1983), the pluralized version ${}^*P$ of a predicate extension P is defined as follows: ${}^*P = [\lambda x_e.\exists S[\bigoplus(S) = x \wedge \forall y \in S.P(y)]]$, i.e. ${}^*P$ is true of all sums of one or more P-individuals.

(9) A proposition p is **strongly relevant** to an issue I iff there is a set $I' \subset I$ such that $p \cap \bigcup I = \bigcup I'$. (Križ and Spector, 2021)

Consider an utterance of *The switches are on* in the SWITCHES context in (3), with the issue I_c = 'Is there a risk of a fire?'. In the MAXIMAL variant of the context, the construal in (10a) (generated by choosing v as in (7a)) is the only strongly relevant one, resulting in p-truth conditions that are not met in the scenario. In the NON-MAXIMAL variant, the only construal that is strongly relevant is the existential one in (10b), derived by choosing f_v^2 as in (7b).

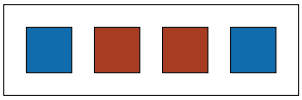
(10) a. $\lambda w.{}^*\mathbf{on}_w(\bigoplus({}^*\mathbf{switch}_w))$
b. $\lambda w.\exists x[x \leq \bigoplus({}^*\mathbf{switch}_w) \wedge {}^*\mathbf{on}_w(x)]$

What happens if there are multiple parameter choices that produce a strongly relevant construal? Križ and Spector (2021) propose that in such cases, ϕ is perceived to be true only if all its strongly relevant construals are true, and false only if all of them are false:

(11) Given a sentence ϕ, a context c and a world w, and writing $\mathscr{V}$ for the set of all parameter vectors, we define the **p-truth value** $[\![\phi]\!]_{\mathbf{p}}^{c,w}$ of a sentence ϕ as follows:

$$[\![\phi]\!]_{\mathbf{p}}^{c,w} = \begin{cases} 1 & \text{iff } \forall v \in \mathscr{V}[[\lambda w'.[\![\phi]\!]^{c,w',v}] \text{ strongly relevant to } I_c \rightarrow [\![\phi]\!]^{c,w,v} = 1] \\ 0 & \text{iff } \forall v \in \mathscr{V}[[\lambda w'.[\![\phi]\!]^{c,w',v}] \text{ strongly relevant to } I_c \rightarrow [\![\phi]\!]^{c,w,v} = 0] \\ \# & \text{otherwise} \end{cases}$$

This supervaluation principle derives homogeneity effects, but crucially only in certain contexts. As an example of a context that induces homogeneity, consider an out-of-the-blue utterance of (12b) or (12c) relative to the picture in (12a). Intuitively, neither sentence is straightforwardly true here. Why is this? Presumably, a decontextualized truth-value judgment task involving a picture leads us to accommodate the issue 'What is going on in the picture?'. Relative to this issue, any two worlds that differ in the color of even just one square end up in distinct partition cells. The resulting partition makes $[\![\textit{The squares are blue}]\!]^{c,w,v}$ strongly relevant for any v. As a result, the sentence ends up being p-true only if it is true on its strongest (maximal) construal and p-false only if it is false even on its weakest (existential) construal.

(12) a. 
b. The squares are blue.
c. The squares are not blue.

The predictions of the system are summarized visually in Figure 1. The first two rows correspond to the SWITCHES (MAXIMAL) and SWITCHES (NON-MAXIMAL) scenarios. Since these scenarios involve binary issues, they make only one construal strongly relevant, resulting in complementary truth and falsity conditions. The third row illustrates out-of-the-blue cases like (12), in which multiple propositions are strongly relevant, which gives rise to a gap.

Besides the role of the issue parameter in generating the different construals of an imprecise sentence, two properties of this account will become relevant for us. First, since fully precise sentences (e.g. *all*-sentences) are mapped to the same proposition regardless of the parameter vector, their p-truth conditions cannot be manipulated by changing the salient issue. Presumably, if we hear an *all*-sentence and the unique proposition it expresses is not strongly relevant, we have to make it relevant by tacitly accommodating a new issue.

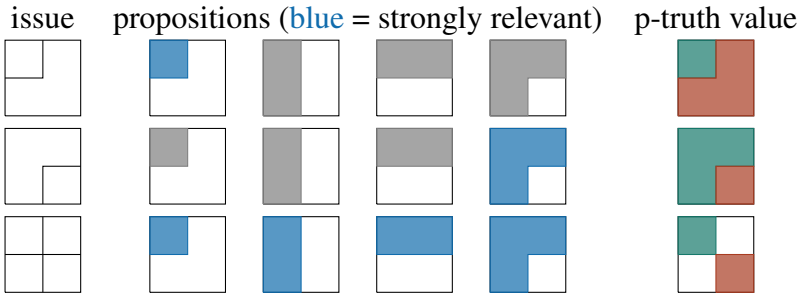


Figure 1: Mapping a set of propositions to p-truth/falsity conditions given an issue I_c (**green** = p-true, **red** = p-false)

Second, the truth-value gaps underlying homogeneity effects are a side effect of how the truth definition deals with the extra parameters and are explicitly not modeled as presuppositions. This is motivated by the observation that homogeneity differs from standard presuppositions in its projection behavior (Spector, 2013; Križ, 2015). Since the system therefore requires a distinction between two kinds of truth-value gaps, the question arises whether homogeneity gaps and presuppositions also differ pragmatically. I will return to this issue in Section 5.

3. Imprecision and "needless" structural complexity

3.1. The puzzle: Competition in the case of equivalent p-truth conditions

On the theory just presented, the proposition expressed by a precise *all*-sentence is among the possible construals of its definite-plural alternative. For instance, in the SWITCHES (MAXIMAL) context, (13a) and (13b) are assigned contextually equivalent p-truth conditions, a relation I will refer to as **p-equivalence** (14).

(13) a. The switches are on.
b. All the switches are on.

(14) Two sentences ϕ and ψ are **p-equivalent** in context c iff $\{w \in C_c : [\![\phi]\!]^{c,w} = 1\} = \{w \in C_c : [\![\psi]\!]^{c,w} = 1\}$ (where C_c is the context set in c).

For the SWITCHES context, the claim that the two alternatives are p-equivalent might be too strong, since the context does not rule out other reasons to worry about the switches besides the risk of a fire, leaving us with some uncertainty about I_c. However, more clear-cut examples can be constructed. For instance, consider (15), adapted from Krifka (1996). The salient issue here is whether there was a path to the storeroom, which licenses an existential construal in the NON-MAXIMAL scenario (depicted on the left of Figure 2). In the MAXIMAL scenario (on the right), we predict a maximal interpretation for (16a), which makes it p-equivalent to (16b).

(15) ROBBERY: Ann and Sue made a plan to steal a safe from a storeroom. They bribed someone to let Ann in, but in the end their plan failed. Sue wants to know how it went.
a. MAXIMAL scenario: The floor plan is as depicted in part (i) of Figure 2.
b. NON-MAXIMAL scenario: The floor plan is as depicted in part (ii) of Figure 2.

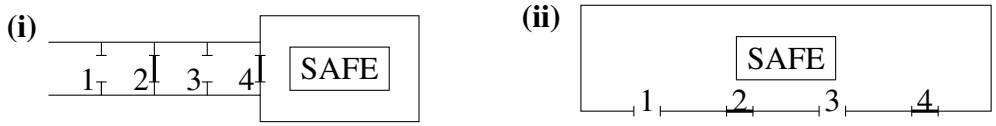
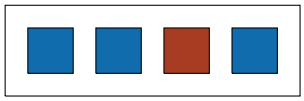


Figure 2: MAXIMAL (left) and NON-MAXIMAL scenario (right) for the ROBBERY example (15)

(16) a. **The doors were open**, but there was another problem … ✗ (15a), ✓ (15b)
b. **All the doors were open**, but there was another problem … ✗ (15a), ✗(15b)

Another class of contexts with this property are out-of-the-blue contexts with a small number of visually salient atomic parts. A single exception as in (17) is sufficient for us to no longer accept (18a) as true, which makes it p-equivalent to (18b) (although its p-*falsity* conditions are different due to homogeneity; see Križ and Chemla 2015).

(17) 

(18) a. The squares are blue. ??/✗ in (17)
b. All the squares are blue. ✗ in (17)

In sum, there are contexts in which a definite-plural sentence and its *all*-alternative coexist peacefully and seem to express the same p-truth conditions. From a pragmatic perspective, this situation is rather surprising, because there is evidence that natural language grammars disallow needless structural complexity (cf. Grice's (1975) submaxim "Be brief!"). The most prominent example are **Hurford disjunctions** such as (19a), which is blocked because it is contextually equivalent to the simpler (19b) (Hurford 1974; Gazdar 1979; Chierchia et al. 2012; Meyer 2014 a.o.). But if the existence of a contextually equivalent, simpler structure leads to oddness in (19a), why aren't the uses of *all* in (15) and (18) similarly odd?

(19) a. #Ann is in Paris or in France.
b. Ann is in France.

It is natural to suspect that the crucial difference has something to do with imprecision, since the alternatives in (19) are both fully precise. There are two possible ways of exploiting imprecision to distinguish between (18) and (19). Let us call those sentences that are semantically close enough to a sentence ϕ to compete with it for the purposes of Manner its **Manner alternatives**. Then one option is to assume that p-equivalence is not sufficient for a sentence to count as a Manner alternative of another; instead, the two sentences have to be p-equivalent regardless of context. If so, definite plurals and *all*-sentences would not compete at all. Here I will explore a second approach, on which definite plurals are Manner alternatives of the corresponding *all*-sentences, but the submaxim "Be brief!" that favors the definite alternative interacts with another submaxim, roughly "Be precise!", that favors the *all*-alternative. Before I return to the question of how to characterize Manner alternatives, let me first show how the two submaxims and the relevant notion of constraint interaction can be formalized.

3.2. Spelling out the imprecision/complexity trade-off

To implement the informal idea just presented, we need 1) a way of ordering sentences according to their structural complexity, 2) a way of ordering sentences according to their potential for imprecision and 3) a way for these two orderings to interact.

Be brief! Recent formalizations of the constraint "Be brief!" typically make use of an ordering relation $\leq$ defined in Katzir (2007), a variant of which is given in (20).[6]

(20) Let ϕ, ψ be parse trees.
   a. If we can transform ϕ into ψ in zero or more steps such that each step involves
      (i) either replacing a constituent α with a proper subconstituent of α
      (ii) or replacing a constituent α with a syntactic terminal,
      then $\psi \leq \phi$ ('ϕ is at least as complex as ψ'). [...]
   b. If $\psi \leq \phi$ but not $\phi \leq \psi$, then $\psi < \phi$. (adapted from Katzir 2007)

Given this definition, we have the complexity asymmetry in (21), assuming that definite plurals do not contain a covert Q element (22).[7] If p-equivalence is sufficient for a sentence to be a Manner alternative of another, a non-violable version of "Be brief!", such as (23), would correctly block Hurford disjunctions, but also incorrectly block the use of *all* in contexts like (15a) and (17). We will now introduce an imprecision-based preference ordering that will help us draw the right distinction between the Hurford case and the *all* case.

(21) All the squares are blue $>$ The squares are blue

(22) $[_{QP}$ all $[_{DP}$ the NP]] vs. $[_{DP}$ the NP]

(23) A sentence ϕ is blocked in context c if $\phi > \psi$ for some ψ that is a Manner alternative of ϕ in c.

Be precise! Given the close connection Križ and Spector (2021) assume between imprecision and homogeneity (see Section 2.2), one could in principle define a 'more precise' relation by directly comparing the homogeneity gaps of the competing sentences.[8] However, it is unclear whether this link with homogeneity generalizes across all instances of imprecision; round numerals are a potential counterexample (Solt 2023). Here, I will therefore give a definition that relies more directly on the semantic source of imprecision in the present framework—semantic dependence on the parameter vector, which is selected based on the salient issue.

Intuitively, an imprecise sentence ϕ provides many different ways of drawing a distinction in the logical space, depending on the salient issue, whereas a precise sentence makes the same distinction regardless of the issue. Definition (24) exploits this idea by considering the partition $\mathscr{P}_c(\phi)$ of the context set that is induced by the propositions ϕ expresses under different parameter vectors. This must be a bipartition if ϕ is fully precise, but will be more fine-grained otherwise. (24b) then defines an ordering in which sentences that are mapped to more fine-grained partitions by (24a) rank lower.

[6] Katzir (2007) restricts lexical replacements to items of the same category, an assumption I will not make here.
[7] Following the literature, I use the symbol $\leq$ both for the part-of relation on D_e and for Katzir's complexity ordering; I hope this will not lead to confusion.
[8] This is what I did in my SuB presentation, but I have since become convinced that it is not the right approach.

(24) Given a context c and sentences ϕ and ψ:
   a. $\mathscr{P}_c(\phi)$ is the partition of the context set C_c induced by the set $\{[\![\phi]\!]^{c,w,v} : v \in \mathscr{V}\}$ of propositions ϕ can express under different parameter vectors.
   b. $\phi \trianglelefteq_c \psi$ iff any two worlds in C_c that are distinguished by $\mathscr{P}_c(\phi)$ are also distinguished by $\mathscr{P}_c(\psi)$.

Equipped with this definition, we can now view the competition between definite plurals and *all*-QPs in terms of conflicting preferences: $\leq$ favors the definite, while $\trianglelefteq_c$ favors the *all*-QP. In other words, we cannot satisfy "Be brief!" without violating "Be precise!", and vice versa. This contrasts with the Hurford case, in which the disjunctive alternative violates "Be brief!", but the alternatives are on a par with respect to $\trianglelefteq_c$ so that there is no reason to use the disjunction.

Constraint interaction More generally, I assume that a sentence can be acceptable even if it has an alternative that is superior on one of the preference orderings relevant for Manner, but only if that alternative is inferior or incomparable on one of the other orderings. Put differently, only the 'Pareto-optimal' alternatives are acceptable. This way of combining a set $\mathscr{O}_c$ of preference relations into a single relation $\preceq_c$ is formalized in definition (25) (cf. Katzir and Singh 2015; Solt 2018 a.o., where the same idea is applied to interactions between Manner and Quantity). For the time being, $\mathscr{O}_c$ contains just the two orderings $\leq$ and $\trianglelefteq_c$. The blocking principle we need can then be defined as in (26).

(25) Given a set $\mathscr{O}_c$ of preference orderings in a context c and two sentences ϕ and ψ:
   a. $\phi \preceq_c \psi$ iff $\forall \preceq \in \mathscr{O}_c . \phi \preceq \psi$
   b. $\phi \prec_c \psi$ iff $\phi \preceq_c \psi$, but not $\psi \preceq_c \phi$

(26) NO NEEDLESS MANNER VIOLATIONS
A sentence ϕ is blocked in a context c iff it has a Manner alternative ψ such that $\phi \succ_c \psi$.

This gives us an account of why *all*-sentences are acceptable in contexts where they are p-equivalent to their simpler definite-plural alternatives: Using *all* removes the potential for imprecision, which counterbalances its complexity disadvantage. Of course, from a functional perspective, the question arises why potential for imprecision should matter if the issue I_c already demands a precise interpretation. One potential reason might be that an actual discourse context can involve uncertainty about the exact issue I_c the speaker is addressing, and using *all* reduces this uncertainty even if it has no truth-conditional effect (Haslinger, 2024).

4. From pragmatic preferences to morphosyntactic patterns

This section argues that, when combined with a certain very weak notion of what counts as a Manner alternative, the proposed trade-off between Manner constraints can account for an attested morphosyntactic asymmetry between definite plurals and *all*-QPs.

4.1. Blocked syntactic configurations

Given the pragmatic proposal in the previous section, the fact that English *all*-QPs involve extra morphology on top of a plural definite is more than an accident of the English lexicon. This is because on this account, for an *all*-sentence and its definite alternative to freely coexist in

	all-QP (PRECISE)	definite plural (IMPRECISE)
(i)	[Q [D NP]]	[D NP]
(ii)	[Q NP]	[D [Q NP]]
(iii)	[Q NP]	[D NP]

Table 1: Logical possibilities for the structural relation between definites and *all*-QPs

contexts that make them p-equivalent, the *all*-QP must be syntactically more complex, as in row (i) of Table 1. To see this, imagine a hypothetical language that shows the opposite asymmetry, as in row (ii), or no asymmetry at all, as in row (iii). Consider the competition between an *all*-sentence S_{all} and its definite-plural alternative S_{pl} in such a language. By hypothesis, the meanings of the two alternatives are the same as in English, so that $S_{all} \blacktriangleleft_c S_{\text{pl}}$, but unlike in English, we additionally have $S_{all} \leq S_{\text{pl}}$, so that neither of the two preference relations favors S_{pl}. The blocking principle in (26) then predicts that in such languages, S_{pl} should be unavailable in any context c in which it counts as a Manner alternative of S_{all}. It therefore derives a principled relation between the extent of imprecision a sentence permits and its internal morphosyntactic structure. A definite-plural sentence that is less complex than its *all*-alternative can freely coexist with it regardless of whether the two sentences are Manner alternatives, while a definite plural that is equally or more complex would be subject to blocking by the *all*-alternative.

The exact conditions under which this blocking takes place however, depend on how Manner alternatives are characterized. A natural possibility suggested above is that two sentences are Manner alternatives only if they are p-equivalent. This would predict that it is possible for a language to show the structural pattern in row (ii) or (iii) in Table 1, but the structure with a definite-plural semantics would be blocked in contexts that demand a maximal interpretation. In all other contexts, it would not compete with the *all*-structure and would therefore be usable. In other words, we would expect such languages to have expressions that have the full range of construals definite plurals have—existential and proportional construals as well as construals sensitive to specific exceptions—except that they lack a genuinely maximal interpretation.

To my knowledge, it is an open question whether this pattern is attested, since an expression with this behavior would likely be misanalyzed as a vague quantifier along the lines of 'many', and descriptive grammars typically do not provide the subtle contextual manipulations that would let us distinguish these two options. But since I am not aware of a clear example, I want to pursue the stronger hypothesis that definite plurals and *all*-QPs are Manner alternatives regardless of the immediate issue at hand. In other words, the Manner alternatives of a sentence ϕ are those sentences that are p-equivalent to ϕ on *some* way of choosing the issue parameter:

(27) Two sentences ϕ and ψ are **potentially p-equivalent** in a context c iff there is a context c' that is like c except for the issue parameter $I_{c'}$ and ϕ and ψ are p-equivalent in c'.

On this view, S_{pl} and S_{all} are Manner alternatives even if I_c does not demand a maximal construal of S_{pl}. As a consequence, the definite-plural structure in a language following pattern (ii) or (iii) in Table 1 would be pragmatically deviant in almost all contexts regardless of the choice of I_c. We therefore do not expect to find these structural patterns at all. More generally, if potential p-equivalence is the only precondition for Manner-based competition, NO NEEDLESS MANNER VIOLATIONS makes the following prediction:

(28) **Imprecision/complexity correlation**
If two potentially p-equivalent alternatives ϕ and ψ are both acceptable in a context c and $\phi \blacktriangleleft_c \psi$, then either $\phi > \psi$ or ϕ and ψ are incomparable wrt. $\leq$.

4.2. Realizations of definite plurals and *all*-QPs across languages

Looking beyond English, some languages with overt definite determiners nonetheless do not realize an overt determiner in *all*-QPs. Taken at face value, this pattern poses a problem for (28). In German, for instance, the default way of expressing the meaning of an English *all*-QP does not transparently involve a definite determiner (30).[9] The fact that the German quantifier form *all-e* in (30a) is bimorphemic could be taken as an indication of a more complex structure, but there are languages with analogous structures in which the quantifier is not transparently decomposable at all, such as Wolof ((31); see Tamba et al. 2012).[10]

(29) a. [$_{QP}$ *all* [$_{DP}$ *the switches*]]
b. [$_{DP}$ *the switches*]

(30) German
a. *all-e* *Schalter*
all-PL.NOM switches
'all the switches'
b. *die* *Schalter*
the.PL.NOM switches
'the switches'

(31) Wolof (Tamba et al., 2012)
a. *xale y-epp*
child NCL.PL-all
'all of the children' (Tamba et al., 2012: 917, (72a))
b. *xale y-i*
child NCL.PL-DEF.PROX
'the children' (Tamba et al., 2012: 893, (2a))

Rather than taking the surface morphology in such examples at face value, however, we could also maintain that plural universal quantifiers generally contain a D-head below the quantifier, even in languages lacking an overt realization of D in this position. On this view, which goes back to Matthewson (2001), the Wolof pattern is simply an instance of an intransparent syntax/morphology mapping in which a single exponent can realize two syntactic head positions.

One simple way of achieving this is to posit an allomorph of D conditioned by the presence of Q, which would be *-e* in German and null in Wolof. An arguably more principled option is provided by morphosyntactic frameworks that permit a single exponent to realize a complex subtree or a sequence of multiple heads, such as Nanosyntax (see e.g. Caha 2018, Blix 2021; see

[9] Of course, English *all* can also take a plural NP complement without a determiner, but this structure is commonly described as favoring generic interpretations (see e.g. Löbner 2000: 279, Gajewski 2005: 113), which makes me doubt that it is a direct pragmatic competitor of definite plural DPs.
[10] According to Tamba et al. (2012), some speakers also accept a structure with an overt definite determiner.

spell-out of S_{all} spell-out of S_{pl}	α+β+NP β+NP	α+NP β+NP	α+NP β+α+NP
expected given $S_{all} > S_{\text{pl}}$	✓	✓	✗
expected given $S_{all} \equiv S_{\text{pl}}$	✓	✓	✓
expected given $S_{all} < S_{\text{pl}}$	✗	✓	✓

Table 2: Syntactic containment patterns and the surface patterns they lead us to expect

Bobaljik 2012 for similar ideas within Distributed Morphology). For instance, in the framework of Blix (2021), it is possible for a vocabulary item to spell out a contiguous 'span' of heads within a functional sequence, even if these heads do not form a constituent. This allows us to formulate the lexical entry in (32a), which jointly spells out Q and its adjacent D in Wolof. In such frameworks, a vocabulary item matches a structure only if it has a superset of the features contained in the structure. Hence, (32b) matches the subtree [D NP], but not [Q [D NP]], whereas (32a) matches both subtrees. Due to a version of the Elsewhere Condition, the structure [D NP] must be realized using (32b), which lacks the unnecessary Q feature.

(32) a. [Q[D]] ↔ *-epp*
b. D ↔ *-i*

On this view, surface forms of the kind found in German and Wolof are compatible with the imprecision/complexity correlation in (28), as the first row of Table 2 shows. However, there is another logically possible surface pattern that is not expected given the correlation—an *all*-QP that can be turned into an imprecise definite plural by adding extra morphology. Given a more complex syntactic structure for the *all*-QP, this would mean that the surface containment pattern is the inverse of the underlying syntactic asymmetry, a situation that the realizational morphosyntactic frameworks just discussed explicitly aim to block (see Bobaljik 2012 for DM and Caha 2018 for Nanosyntax). In contrast, we would expect to find such patterns if an *all*-structure does not have to exceed its definite alternative in complexity, as shown in Table 2.

A look at a small cross-linguistic dataset suggests that there is indeed a typological asymmetry of the kind predicted by the imprecision/complexity correlation. Table 3 summarizes the formal strategies for definite plurals and plural universal quantifiers in a small sample of languages taken from the "Handbook of Quantifiers in Natural Language" (Keenan and Paperno, 2012; Paperno and Keenan, 2017).[11] While the surface patterns in the first two columns of Table 2 both occur in several unrelated languages in the sample, the one in the third column does not. (I have not seen this pattern discussed elsewhere in the literature either.) Of course, a larger sample would be needed to tell whether this is a genuine typological gap or just a strong tendency, an issue I hope to address in future work.

In sum, when combined with a very liberal precondition for Manner-based competition that merely requires p-equivalence under *some* issue, our pragmatic proposal derives a structural asymmetry between definite plurals and *all*-QPs. The hypothesis that this asymmetry holds cross-linguistically is not new, but has mostly been implemented in terms of lexical constraints

[11]Most of the languages discussed in this handbook do not overtly mark definiteness. Since it is an open question whether bare plurals in such languages are imprecise in the same way as overtly marked definites, I did not include them in Table 3. I also omitted those languages for which the authors of the handbook chapters expressed doubts about the quantificational force of the items glossed as 'all'.

Language	**universal quantifier**	**definite**	**containmt.**
Basque	N *guzti-ak* 'N all-D.PL'	N-*ak* 'N-D.PL'	⊐
	N *den-ak* 'N all-D.PL'	N-*ak* 'N-D.PL'	⊐
	N *oro-k* 'N all-ERG'	N-*ek* 'N-D.PL.ERG'	≡
	N-*ek oro-k* 'N-D.PL.ERG all-ERG'	N-*ek* 'N-D.PL.ERG'	⊐
Dan-Gwɛɛtaa (South Mande)[a]	N gbṵ̀ 'N all'	N-dṵ̰ 'N-DEF.PL'	≡
	N-dṵ̰ gbṵ̀ 'N-DEF.PL all'	N-dṵ̰ 'N-DEF.PL'	⊐
German	*alle* N.PL 'all N.PL'	*die* N.PL 'the N.PL'	≡
Modern Greek	*oli* DEF.PL N.PL 'all the N.PL'	DEF.PL N.PL	⊐
Modern Hebrew	*kol ha*-N.PL 'all DEF-N.PL'	*ha*-N.PL 'DEF-N.PL'	⊐
Imbabura Quichua	(*shuj*) *tukuy(-lla)* N-*kuna* '(one) all(-LIM) N-PL'[b]	*chay/kay* N-*kuna* 'DEF.DIST/DEF.PROX N-PL'	≡
Italian	*tutti* DEF.PL N.PL	DEF.PL N.PL	⊐
Malagasy	*ny* N *rehetra* 'DET N *all*'[c]	*ny* N 'DET N'	⊐
Persian (Farsi)	*hame=ye* N=*(h)â* 'all=EZ N=DEF.PL'[d]	N=*(h)â* 'N=DEF.PL'	⊐
Western Armenian[e]	*amen* N 'all N'	N-PL-*ə*	≡
	polor N-PL-*ə* 'all the N'	N-PL-*ə*	⊐
	amen N-PL-*ə* 'all the N'[f]	N-PL-*ə*	⊐
Wolof	N NCL.PL-*i/a* NCL.PL-*epp* 'all the N'[g]	N NCL.PL-*i/a*	⊐
	N NCL.PL-*epp* 'all the N'	N NCL.PL-*i/a*	≡

[a] Judging by the description, the determiner-less form might be generic. Vydrin (2017) suggests -dṵ̰ adds 'distributivity' but seems to mean maximality, as it is compatible with collective predicates.
[b] LIM = so-called 'limitative' marker that has various other uses including 'only'
[c] Nouns are said to be number-neutral throughout the language.
[d] EZ = *ezafe* (linking affix)
[e] Unlike with the other languages discussed in Keenan and Paperno (2012), it is not conclusively shown that the quantifiers glossed as 'all' (rather than 'every') are not distributive.
[f] said to be 'dispreferred' relative to the *polor* strategy
[g] acceptable only for some speakers

Table 3: Examples of 'all'-type quantifiers (i.e. universal quantifiers that are not obligatorily distributive) and plural definites from Keenan and Paperno (2012) and Paperno and Keenan (2017). In the last column, ⊐ means the *all*-QP formally contains the definite, and ≡ means neither form contains the other.

on the argument type of quantifiers (Matthewson, 2001), or in cartographic terms. Unlike these alternatives, the pragmatic approach makes somewhat weaker predictions, since it does not require the extra structure in an *all*-QP to take the form of a D head. But it arguably brings us closer to the goal of saying something explanatory about *why* we find a structural asymmetry.

5. Plural indefinites and presuppositions

Presumably, the factors that determine how we choose between Manner alternatives are not limited to reducing complexity and avoiding imprecision. Generalized to more than two preference relations, the logic behind the imprecision/complexity correlation in (28) takes the following weaker form: If we find two Manner alternatives ϕ and ψ that are both acceptable, and ϕ is preferred to ψ under one of the orderings in $\mathscr{O}_c$, then there must be some other ordering in $\mathscr{O}_c$ that either favors ψ or makes the two sentences incomparable. This logic will now be applied to plural indefinites, which are problematic for generalization (28) in its current form.

As we saw in Section 2, a definite-plural sentence can quantify existentially over all the pluralities in the NP-domain, given the right context. This makes most sentences with plural definites potentially p-equivalent to an indefinite alternative. For instance, the SWITCHES (MAXIMAL) scenario (3a) demands an existential construal of (33a) that makes it p-equivalent to (33b).

(33) a. The switches are on.
b. Some of the switches are on.

In order to see how these two alternatives are ordered by $\underline{\blacktriangleleft}_c$, we need to distinguish imprecision from logical weakness. (33b) expresses a weaker proposition than (33a) in most contexts. But since the interpretation of (33b) is existential regardless of the salient issue, it has less potential for imprecision than (33a). For instance, it is not possible to get (33b) to convey that all the switches were on, or e.g. that at least half of them were on, by varying the issue. If we disregard the optional 'not all' implicature, the proposition conveyed by (33b) therefore does not co-vary with the issue parameter I_c at all. But even if we take the optionality of this implicature to be an imprecision phenomenon (cf. Bar-Lev 2021), we arguably still have (33b) $\blacktriangleleft_c$ (33a): Taken together, the strengthened and non-strengthened construals of (33b) allow us to distinguish between 'none'-worlds, 'some, but not all'-worlds and 'all'-worlds. But these three classes are also distinguished by the existential and the universal construal of (33a), and (33a) additionally has construals sensitive to specific exceptions (Križ and Spector, 2021; Bar-Lev, 2021), which are unavailable for (33b). Therefore, (33a) is associated with a more fine-grained partition.

Given this imprecision asymmetry, generalization (28) predicts plural existentials to have more complex structures than plural definites. This is borne out in the case of (33), but cannot be correct in general: Existential uses of bare plurals provide a systematic counterexample. For instance, the German bare-plural sentence in (34a) seems true in both versions of the SWITCHES scenario in (3), which suggests that its p-truth conditions, unlike those of (34b), are insensitive to the issue parameter.[12] We then expect (34a) to block (34b) unless we assume that despite appearances, (34a) is the structurally more complex alternative. But this would make the lack of an overt determiner in (34a) an accidental property of the German vocabulary, which is implausible given that bare-plural indefinites are common cross-linguistically.

(34) a. *Oh nein, da drinnen sind noch Schalter an!*
oh no there indoors are still switches on

[12]Generally speaking, bare-plural sentences are often not p-equivalent to their alternatives with plural definites because the definite imposes an additional restriction on the quantificational domain. But one can find contexts in which the quantificational domains happen to coincide; the SWITCHES context, in which the ten switches are explicitly introduced, is a case in point.

'Oh no, some switches in there are still on!'
✓ SWITCHES (NON-MAXIMAL) scenario, ✓ SWITCHES (MAXIMAL) scenario

b. *Oh nein, da drinnen sind noch die Schalter an!*
oh no there indoors are still the switches on
'Oh no, the switches in there are still on!'
✓ SWITCHES (NON-MAXIMAL) scenario, ✗ SWITCHES (MAXIMAL) scenario

Bare plurals therefore pose a genuine problem for the imprecision/complexity correlation. In principle, the problem could be addressed by weakening the notion of a Manner alternative so that (34a) and (34b) do not compete. But there is a potentially more insightful way out. Given the general view that acceptable utterances must be Pareto-optimal relative to a set $\mathscr{O}_c$ of preference relations, we could interpret the free coexistence of (34b) and (34a) as indicating that there must be another preference relation in $\mathscr{O}_c$ that favors definites over bare plurals. The question then arises whether there is a suitable relation with independent empirical motivation.

Given that (34b) presupposes the existence of switches in the building, whereas (34a) merely asserts it, a natural candidate for such an independently motivated preference ordering is the preference for utterances with stronger presuppositions ('**Maximize Presupposition**'; Heim 1991; Sauerland 2008). While **Maximize Presupposition** is not usually discussed in the context of Manner, it can be fit easily into the picture of constraint interaction proposed here. This would amount to adding an ordering relation along the lines of (35) to the set $\mathscr{O}_c$:

(35) $\phi \trianglelefteq_c \psi$ iff the set of worlds in which ϕ is a presupposition failure in c is a superset of the corresponding set of worlds for ψ.

On this proposal, the outcome of the competition between plural definites and indefinites depends on whether the indefinite carries the same existential presupposition as the definite, as shown in Table 4. In the partitive case (33), the alternatives should arguably be on a par with respect to (35); since the imprecision ordering $\underline{\blacktriangleleft}_c$ favors the indefinite, the definite must then be less complex to avoid being blocked. In the bare-plural case (34), $\underline{\blacktriangleleft}_c$ favors the indefinite, but $\trianglelefteq_c$ favors the definite, so that neither structure is blocked regardless of the complexity relation.

ϕ	ψ	imprecision	presupposition	complexity prediction
non-presuppositional INDEF	DEF	$\phi \blacktriangleleft_c \psi$	$\phi \rhd_c \psi$	no prediction
presuppositional INDEF	DEF	$\phi \blacktriangleleft_c \psi$	$\phi \equiv_c \psi$	$\phi >_c \psi$

Table 4: Presuppositions interfere with the imprecision/complexity interaction

The idea that **Maximize Presupposition** is a defeasible preference that interacts with our preference for simpler structures predicts that we should find sentences ϕ that are acceptable despite having a p-equivalent simpler alternative ψ, as long as ψ has a weaker presupposition. Arguably, this pattern is exemplified by indefinites with and without partitives: Both sentences in (36) entail the existence of female panelists, but only (36b) presupposes it, so while the complexity ordering $\leq$ favors (36a), the presupposition ordering $\trianglelefteq_c$ favors (36b), with the result that neither structure is blocked. As in the imprecision case, the notion of constraint interaction is crucial to understand why (36b) is not unacceptable in the same way Hurford disjunctions are, even though it has a structurally less complex and truth-conditionally equivalent alternative.

(36) a. John talked to some female panelists at the conference.

b. John talked to some of the female panelists at the conference.

To summarize, extending the competition mechanism with a preference for stronger presuppositions allows us to accommodate some counterexamples to generalization (28) and additionally accounts for the lack of blocking in cases like (36). Two other non-obvious consequences of this move are worth pointing out. First, standard versions of **Maximize Presupposition** (e.g. Sauerland 2008) apply only if the presuppositions of both alternatives are satisfied prior to the utterance, whereas our $\trianglelefteq_c$ relation favors a presuppositional sentence over its non-presuppositional alternative even if it requires some accommodation. I take this to be unproblematic, since Anvari (2018) argues independently that the standard view is too restrictive in this respect.

Second, the present proposal is incompatible with the idea that homogeneity effects reflect an 'all or nothing' presupposition, such that e.g. *The switches are on* is a presupposition failure if some, but not all switches are on (e.g. Löbner 2000). Following the logic of the present account, homogeneity effects are systematically associated with smaller structures and therefore a pragmatically dispreferred property, while presuppositions are a preferred property that is systematically associated with bigger structures. If so, there need to be two distinguishable ways for a sentence to be 'neither true nor false', which could be implemented e.g. by distinguishing between genuine undefinedness and truth value #, as in (37). This might be needed independently, since homogeneity gaps differ from typical presuppositions both pragmatically and in terms of their projection behavior (see e.g. Spector 2013).

(37) $[\![\textit{The switches are on}]\!]^{c,w}_{\mathbf{p}}$

$$= \begin{cases} 1 & \text{iff there is at least one switch in } w \text{ and all switches are on in } w \\ 0 & \text{iff there is at least one switch in } w \\ & \quad \text{and none of the switches are on in } w \\ \# & \text{iff there is at least one switch in } w \\ & \quad \text{and some, but not all of the switches are on in } w \\ \text{undefined} & \text{iff there are no switches in } w \end{cases}$$

However, the question arises why the Maxim of Manner should favor one type of truth-value gap while disfavoring the other. In Haslinger (2024: ch. 5), I speculate that the orderings $\blacktriangleleft_c$ and $\trianglelefteq_c$ can both be viewed as special cases of a general preference for reducing uncertainty about the values of contextual parameters, but this suggestion still lacks a full implementation.

6. Conclusion and outlook

The starting point of this paper was the question of why the existence of a less complex, contextually equivalent alternative leads to unacceptability in some cases, but not in others. I proposed that by looking at pairs of contextually equivalent sentences ϕ and ψ such that $\phi > \psi$, we can learn which semantic properties are preferred or dispreferred for the purposes of Manner: If both ϕ and ψ are acceptable, then ϕ must have some preferred semantic property that counterbalances its higher complexity. Further, I argued that given a sufficiently weak precondition for Manner-based competition, such trade-offs between structural complexity and certain preferred semantic properties can provide a principled account for cross-linguistic markedness

asymmetries that are usually attributed to cartography or lexical semantic universals.

Here, I only discussed one application of this reasoning in detail—the syntactic asymmetry between *all*-QPs and definite plurals. But we seem to find analogous imprecision/complexity tradeoffs elsewhere in semantics: Bare conditionals and *would*-conditionals exhibit imprecision and homogeneity-like gaps, which can be removed by adding an overt modal or situation quantifier (38) (von Fintel 1997; Križ 2015 a.o.). Similarly, so-called summative singular predicates exhibit homogeneity and imprecision (Löbner 2000; Križ 2015; Paillé 2022 a.o.), both of which are removed by overt modifiers such as *completely* or *partly* (39).

(38) a. They play soccer when the sun shines.
b. They **always** play soccer when the sun shines.

(39) a. The shirt is red.
b. The shirt is **completely** red.

Both of these asymmetries are expected on the present account, although their cross-linguistic stability beyond European languages still needs to be established. In contrast, a syntactic approach to the *all*/definite asymmetry or an approach based on a lexical universal about quantifier meanings would not immediately extend to these other constructions.

Besides the cross-linguistic predictions, another aspect that requires further study is how the present account compares empirically to related proposals such as the Rational Speech Act model in Spector (2017), which also encodes an imprecision/complexity trade-off. First, unlike my 'neo-Gricean' implementation, Spector's account makes quantitative predictions about how the prior probabilities of different issues might affect our choice between precise and imprecise alternatives. Second, the RSA approach models complexity in terms of a numerical cost for each utterance, whereas Katzir's $\leq$-relation is not a total ordering. In principle, different predictions might therefore result in case two structures are incomparable with respect to $\leq$. Comparing these two proposals might shed light on the broader issue on how 'modular' and quantitative a model of our pragmatic preferences should be.

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The interaction of gender marking and perspective-taking in German[1]

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Abstract. This paper addresses a phenomenon regarding the interaction of perspective-taking with morphosyntactic gender that to the best of our knowledge has not been discussed in previous literature. In *Free Indirect Discourse* (FID), a vivid style of reported speech and thought, we observe a strong preference for a *de se* pronoun, i.e. a pronoun that refers to an individual whose thoughts or utterances are represented, to match the gender identity / biological sex (by default) of that individual rather than the morphosyntactic / grammatical gender of the DP functioning as its immediate antecedent in discourse. We propose that the preference for semantic agreement in FID is due to the interplay of three factors: First, in FID the gender features of pronouns are interpreted with respect to the protagonist's rather than the narrator's context. Second, the introduction of a protagonist's context leads to a strong preference for pronouns referring to that protagonist to project interpretable gender features matching their gender identity / biological sex. Third, the overtly realized grammatical gender features of a pronous, in contrast with lexical nouns, have to agree with the interpretable gender features.

Keywords: free indirect discourse, perspective-taking, gender, pronouns.

1. Introduction

This paper deals with a phenomenon regarding the interaction of perspective-taking with morphosyntactic gender that to the best of our knowledge has not been discussed in previous literature on the topic. In *Free Indirect Discourse* (FID), there is a strong preference for a *de se* pronoun, i.e. a pronoun that refers to an individual whose thoughts or utterances are represented, to match the social gender identity/biological sex (henceforth: *referential gender*) of that individual rather than the *grammatical gender* of the DP functioning as its immediate antecedent in discourse. Of course, for this phenomenon to be observed, a language must exhibit so-called *hybrid nouns*, in which the grammatical gender is distinguished from its referential gender and both types of gender are available for morphosyntactic agreement realtions, sometimes simultaneously (Corbett 1991). Perhaps the most well-known and widely discussed case of gender mismatch in hybrid nouns in German is *Mädchen* ('girl'), a noun which refers to female individuals, but whose grammatical gender is neuter. In addition, there are cases of unspecified referential gender, e.g., nouns such as (*die*) *Person* ('person') or (*der*) *Mensch* ('human being'), whose morphosyntactic gender is female or male, respectively, but which can be used to refer to female as well as male individuals.

The analysis that we will develop in this paper relies on the following two sets of core assumptions, each of which is rooted in established literature. First, we adopt a layered approach to agreement with DPs, in which nouns and pronouns have an *optional layer* where referential gender is encoded in addition to an *obligatory layer* where grammatical gender is

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encoded (cf. Panagiotidis 2019 and Trutkowski & Weiß 2023). Second, we adopt a dual context approach to FID, in which two contexts are simultaneouslty active: the narrator's context, C_U, and a protagonist's context, C_T (Doron 1991; Schlenker 2004; Sharvit 2008; Eckardt 2014, among others). In particular, we adopt a version of the dual context approach where person features of pronouns are interpreted with respect to the narrator's context, but gender (and number) features are interpreted with respect to the protagonist's context (Delfitto et al. 2016). These approaches are summarized in turn in the following sections.

The central observation of this paper concerns self-ascribing *de se* pronouns, i.e., pronouns referring to the protagonist or attitude holder of the report, that corefer with hybrid nouns in FID reports. We find a strong bias for *de se* pronouns to agree with the referential gender of the hybrid noun antecedent, instead of grammatical gender. We argue that the gender features of *de se* pronouns in FID cannot remain uninterpreted, i.e. taken to simply agree with the grammatical gender of their most recent antecedent, as is possible outside of FID. Rather, they must be interpreted with respect to the protagonist's context, as to be compatible with the attitude holder's self-concept. Therefore, FID is strongly biased towards pronouns referring to the perspective-taker encoding the latter's referential gender rather than the grammatical gender of its (most recent) antecedent.

The remainder of the paper is structured as follows. In Section 2.1 we provide background on hybrid nouns and pronominal agreement in German, and in Section 2.2 on FID. The data that are crucial for our analysis are discussed in Section 3.1, and the analysis itself is presented in Section 3.2. Related issues regarding the gender fetures of pronouns referring to the attitude holder in Standard indirect discourse (SID) are discussed in Section 3.3 and 3.4. Section 4 summarizes the paper and discusses some open questions and directions for future research.

2. Background

2.1. Hybrid nouns and pronominal agreement

Nouns and pronouns are marked with certain features (person, number, gender) that enter into agreement relations with other elements in the structure. Across languages, noun classes are assigned according to semantic factors of the referent, such as animacy, humanness, and/or social gender or biological sex, but may also be entirely arbitrary (e.g., Corbett 1991 and Kramer 2020 for review). Grammatical gender refers to the inflectional class to which a nominal belongs.

In German, nouns are obligatorily assigned one of the following types of grammatical gender: *feminine* [+fem, -masc]*, masculine* [-fem, +masc] and *neuter* [-fem, -masc]. Grammatical gender is not visible on nouns themselves, but on determiners and adjectives they are combined with in the formation of DPs. Crucially, grammatical gender does not always correspond to referential gender: social gender in the case of humans, and to biological sex in the case of animals. This distinction is perhaps most obvious for nouns denoting (sets of) inanimate objects, which are not always marked for neuter (as one would expect given their being inanimate and hence neither male nor female by definition), but for feminine as well as masculine gender: (*der*) *Löffel* (*masc*) ('the spoon'), (*die*) *Brücke* (*fem*) ('the bridge'), (*der*) *Stuhl* (*masc*) ('the chair') and (*die*) *Tür* (*fem*) ('the door'). We assume that no speaker of German considers spoons and chairs to be male and bridges and doors to be female in any meaningful sense, and so, in these cases, morphosyntactic gender features are not interpretable.

Concerning nouns with human referents, in contrast, there is a strong tendency for morphosyntactic gender to match referential gender, in line with Kramer's (2020) claim that morphosyntactic gender is always assigned to at least a subset of a language's nouns on the basis of semantic criteria. It is therefore no coincidence that, for instance, *Frau* ('woman'), *Schwester* ('sister') and *Mutter* ('mother') are marked as feminine, while *Mann* ('man'), *Bruder* ('brother') and *Vater* ('father') are marked as masculine.
There are, however, exceptions called *hybrid noun*, in which mismatch is either unavoidable or at least possible. One example already discussed is (*das*) *Mädchen* ('girl'), which is grammatically neuter, but denotes female individuals. Other examples include (*die*) *Person* ('the person') and (*der*) *Mensch* ('the human being'), which are grammatically female and male, respectively, but which can denote both female and male individuals. Hybrid nouns also apply to animal kinds such as (*der*) *Hund* ('the dog') and (*die*) *Katze* ('the cat'), which are grammatically male and female, respectively, but likewise can denote indviduals with either male or female referential gender. Hybrid nouns are no peculiarity of German, but are found in many other languages such as Dutch, Spanish, French, Russian, Serbo-Croation, among many others. For example, a well-studied case is a small class of Russian nouns that include *vrač* ('doctor'). Though masculine by default, *vrač* can also refer to feminine individuals, in which case it agrees with feminine marked adjectives (*xorošaja* 'good').

(1) Ona xoroš-ij/aja vrač
She good-MASC/FEM doctor
She is a good doctor.
(Corbett 1991, p. 238)

In German, determiners and relative pronouns must agree with morphosyntactic gender of the noun that they combine with. As *Mädchen* ('girl') is grammatically neuter, it agrees with the neuter forms of the definite determiner and relative pronoun (*das*), despite referring to an individual with female referential gender.

(2) Paul kennt das/*die Mädchen, das/??die im fünften Stock wohnt.
*Paul knows the$_{neut}$/*the$_{fem}$ girl who$_{neut}$/?? who$_{fem}$ lives on the fifth floor.*

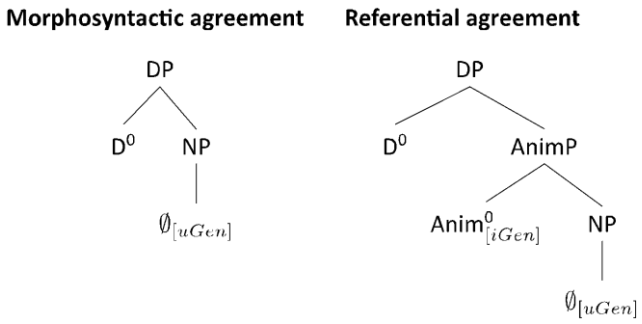
Pronouns, in contrast, may in principle agree either with the morphosyntactic gender of the antecedent noun (neuter, in the case below: *Es*) or with its referential gender (the feminine 3P pronoun *Sie*)[2].

(3) Das Mädchen betrat den Raum. Es/Sie trug einen roten Mantel.
The girl entered the room. It/She wore a red coat.

[2] The preferred choice of pronouns across sentences has been well studied. For instance, it is well known that factors such as linear distance (Thurmaier 2006, Panther 2009) and the importance of social gender identity or biological sex in the context favor referential agreement (Hübner 2021). However, we will leave discussion of these factors aside.

We now turn to how the pronouns agree in gender with their antecedents. Following similar claims in Panagiotidis (2019) and Trutkowski & Weiß (2023), we make two key assumptions regarding hybrid nouns (see also Mathushanksy 2013 and others for related proposals). First, nouns denoting inanimate entities nouns project only a functional layer, encoding uninterpretable gender [*uGen*]. Second, nouns denoting animate entities project an additional functional layer Animate Phrase (*AnimP),* encoding interpretable referential gender [*iGen*]. Only grammatical features are required. For pronouns we additionally assume that the NP is phonologically null and the respective feature bundle is spelled out on the head of the DP, which is overt (cf. Panagiotidis 2019). While uninterpretable gender features [*uGen*] are obligatory for pronouns, too, interpretable features [*iGen*] are possible only with animate referents, and are generally (i.e. even in cases where a pronoun refers to an animate entity) optional. Crucially, in the case of pronouns, *uGen* and *iGen* must match, i.e. there are no hybrid pronouns. Given the absence of lexical content in pronouns, we assume this to be a rather natural assumption.
Now recall that in the general case, grammatical and referential features, i.e. [*uGen*] and [*iGen*], match in the NP. For this case we assume that the empty NP of the pronoun and the NP of its antecedent DP have parallel functional structures, and therefore parallel feature specifications.

However, in the case of hybrid nouns, grammatical and referential gender do not match. For this case, we assume there to be two possible resolutions. The first possibility is that the pronoun matches the grammatical gender of the antecedent DP. It projects neither an *AnimP* nor its associated referential gender features, so that the value assigned to the variable introduced by pronoun is unrestricted (or underdetermined) with respect to referential gender. The second possibility is that the pronoun projects a referential gender feature with *AnimP*, in which the gender feature is interpreted, and the pronoun must reflect the referential gender of its antecedent. The first option results in morphosyntactic agreement, the second in referential agreement. The two options are shown schematically below:



We will return to a more detailed discussion of the two resolution options in Section 3.2, first introducing the data that are our main concern in this paper. The data indicate that referential agreement is obligatory (or at least very strongly preferred) in cases where the pronoun occurs in a sentence that is interpreted as FID from the perspective of the antecedent's referent. But first, we will give some background on FID in the following section.

2.2. Free Indirect Discourse

Free Indirect Discourse (FID) is a vivid form of narrative report. Although it is often found in literature (Banfield 1982), it is also observed in everyday speech (Fludernik 1992) and newspaper reports (Redeker 1996). It is used to adopt or more directly depict the perspective of an attitude holder, while retaining elements of speech or thought report. No single construction unambiguously identifies a report as an instance of FID; rather, multiple cues serve to indicate FID reports. Cues include *macro* or *discourse* level information, such as the beliefs and dispositions of the narrator and protagonist, and *micro* or *morphemic* cues, such as tense or mood morphemes, perspectivally rich terms (e.g., epithets, speaker-oriented adverbs, subjective predicates, and particles) and specific constructions (e.g., questions and exclamations); see Eckardt (2014), among others for a list of potential cues.
FID is distinguished from Standard indirect discourse (SID) and Direct discourse (DD) in numerous ways. The set of sentences in (4) from Sharvit (2008) illustrates the point:

(4) a. DD: As he looked at my picture, John thought: ''Yes, I want to marry her today.''
b. SID: As he looked at my picture, John thought that **he** want**ed** to marry **me** that day.
c. FID: John looked at my picture. Yes(, he thought,) **he** want**ed** to marry **me** today.

Intuitively, FID shares features of DD and SID. In FID and DD, the time referred to by the adverb *today* is located within the content of John's thought. However, in FID and SID, pronouns and tenses are anchored to the narrator, where the third person pronoun *he* self-refers to John and the past tense is used to refer to John's current thought, unlike in DD.
While FID has long been of interest to narratologists and literary scholars (e.g., Fleischman 1990), since the pioneering work of Banfield (1982), it has more recently received attention in formal semantics (see Delfitto et al. 2016 for review) and experimental linguistics (Harris 2012, 2021; Kaiser, 2015). Among the various accounts of FID, most follow Doron (1991) and assume that there are separate contexts corresponding to the narrator and the attitude holder, the context of utterance and the context of thought, respectively (Schlenker 2004; Sharvit 2008; Eckardt 2014; but see Maier 2015 for a different view on which FID is a special, highly conventionalized form of mixed quotation). In dual context approaches, the *context of utterance* (C_U) corresponds to the context of the narrator or the speaker, whereas the *context of thought* (C_T) represents the context of the attitude holder, whose speech or thought is being expressed in the report. The central claim is that pronouns and tenses are resolved to the context of utterance, while other perspectival elements, including deictics (e.g., temporal adverbs like *now*, *yesterday*, and locational adverbs like *here*) and demonstratives, are resolved to the context of thought.
For example, in (5), the pronoun *he* refers to John in the third person through the narrator's context, rather than via the first person, as would be expected if the form of the pronoun were determined via the context of thought. Similarly, the choice of past tense *was* in (5) seems to reflect not the time of the protagonist's inner speech, but rather an alternative time span located outside of his present. In contrast, other context-sensitive terms intuitively reflect the point of view of the protagonist: *now* is cotemporaneous with John's thought, *tomorrow* refers to the day after the thought, and the judgments conveyed by the speaker oriented adverb *thankfully* and the predicate of personal taste *horrid* each reflect John's viewpoint, not the narrator's.

(5) Thankfully$_{CT}$ he$_{CU}$ was$_{CU}$ now$_{CT}$ leaving tomorrow$_{CT}$ and would never speak to that horrid$_{CT}$ person again, thought John.

However, the *gender* of a pronoun appears to agree with the perspective of the protagonist. Taking a case discussed by Doron (1991) and Schlenker (2004), the masculine gender on the pronoun *he* agrees with the content of Mary's thought in (6a), even if the narrator knows that Mary has mistakenly identified Robin as male. In fact, using the feminine gender *she* appears to be illicit in this context (6b).

(6) Context: Mary wrongly believed that Robin was male. In fact, Robin was a woman.
a. Where was he this morning, for instance? (Mary wondered.)
b. #Where was she this morning, for instance? (Mary wondered.)

Apparently, grammatical features of pronouns are sensitive to different contexts, as well. Only person features are resolved within the narrator's context of utterance; the grammatical gender of the pronouns is instead subject to the protagonist's context of thought.
Accounts of mistaken gender in pronouns range widely, from hidden definite descriptions (Schlenker 2004) to deleted features (Sharvit 2008). Rather than detail the approaches, we now turn to a discussion of the resolution options of pronouns in FID whose antecedents are hybrid DPs referring to the protagonists whose thoughts are rendered.

3. The interaction of gender marking and perspective taking

3.1. The crucial data

Consider the contrast between (7a), on the one hand, and (7b-c), on the other, regarding the acceptability of the neuter possessive pronoun *seinen* ('its') as opposed to the female possessive pronoun *ihren* ('she'), interpreted as co-referential with the individual introduced by the proper name Maria in the opening sentence and picked up by the definite DP *das Mädchen* ('the girl'). The crucial sentences are underlined and the pronouns of interest are marked in bold.

(7) a. **FID context.** Maria war völlig fertig von der Fahrt auf dem stürmischen Meer. Das elegant gekleidete Mädchen stieg mit wackligen Beinen aus dem Boot. Wahnsinn, der Boden schwankte wie verrückt unter ??**seinen/ihren** Füßen! Zum Glück dauerte die Illusion nur einen Augenblick.
Maria was totally exhausted from the trip on the stormy sea. The elegantly dressed girl stepped out of the boat with shaky legs. Gosh, the ground was shaking like mad beneath ?? ***its/her*** *feet like mad! Luckily, the illusion lasted only a moment.*

b. **SID context.** Maria war völlig fertig von der Fahrt auf dem stürmischen Meer. Das elegant gekleidete Mädchen stieg mit wackligen Beinen aus dem Boot und dachte für einen Augenblick, dass der Boden unter **seinen/ihren** Füßen schwanken würde. Zum Glück dauerte die Illusion nur einen Augenblick.

Maria was totally exhausted from the trip on the stormy sea. The elegantly dressed girl stepped out of the boat with shaky legs and thought for a moment that the ground was shaking beneath ***its/her*** *feet. Luckily, the illusion lasted only a moment.*

c. **Neutral narration context.** Maria war völlig fertig von der Fahrt auf dem stürmischen Meer. Das elegant gekleidete Mädchen stieg mit wackligen Beinen aus dem Boot. Der Bootssteg schwankte wegen des Wellengangs heftig unter **seinen/ihren** Füßen. Zum Glück beruhigte sich das Meer nach wenigen Sekunden wieder.
Maria was totally exhausted from the trip on the stormy sea. The elegantly dressed girl stepped out of the boat with shaky legs. Due to the heavy sea, the boat bridge was shaking heavily beneath ***its/her*** *feet. Luckily, the sea calmed down again after a few seconds.*

Although the feminine pronoun *ihren* ('her') may well be preferred for most speakers in all three conditions, the neuter pronoun *seinen* ('its) is clearly acceptable in (7b) and (7c). In (7a), in contrast, it is very awkward. Intuitively, the neuter pronoun conveying grammatical agreement seems to be incompatible with construing the sentence as FID, in which Maria's inner thought is rendered from her own perspective. At the same time, a non-FID construal is clearly not viable, as there are many cues pointing towards an FID interpretation. First, the final sentence makes clear that the shaking of the ground is not really happening in the story worlds, preventing an interpretation on which the content of the sentence is attributed to the narrator rather than Maria. Second, the expressive elements *Wahnsinn* ('Gosh') and *wie verrückt* ('like mad') are much more naturally understood as portraying Maria's emotional state, rather than the narrator's.
The unacceptability of the neuter pronoun in (7a) is particularly striking in light of the fact that the second conjunct of the second sentence in (7b) renders exactly the same thought of Maria. Indeed, the only difference between (7a) and (7b) is that (7b) is an instance of SID rather than FID, and, yet, the pronoun can agree with either referential or grammatical gender in (7b). This example shows that a pronoun referring to protagonist whose thoughts are rendered does not automatically have to agree with the referential gender rather than the grammatical gender of the antecedent DP.
Finally, the acceptability of the neuter pronoun in (7c) is expected, since the sentence containing it is most naturally interpreted as neutral narration, and, as we have seen in (3) above, pronouns may in principle agree with the referential as well as the grammatical gender of their antecedent. Note that there is no relevant difference regarding the distance between pronoun and antecedent in the three conditions, i.e. the contrast between (7a), on the one hand, and (7b) and (7c), on the other, cannot plausibly be attributed to the pronoun being too far removed from the antecedent in (7a) as opposed to (7b) and (7c).
One might be concerned that the noun *Mädchen* ('girl') is rather special in that its grammatical gender is neuter, but it nonetheless denotes human beings with female social gender. In order to determine whether the contrast between the conditions in (7a-c) exemplifies a general pattern, we consider the contrast between (8a), on the one hand, and (8b-c), on the other. Just like in (7a-c), a female protagonist is introduced by a proper name (*Frida*) in the opening sentence and then picked up by a definite DP with a hybrid noun whose grammatical gender is neuter (*Ferkel*, 'pig'). Again, in the first case (8a), the sentence containing the self-ascribing pronoun is an instance of FID, reporting a thought of Frida the pig. In (8b), the critical sentence is an instance of SID reporting the same thought, and in (8c) it is an instance of neutral narration. The contrasts are the same as in (7a-c): In the FID condition, only the pronoun

matching the antecedent's referential gender is acceptable, while in the other two conditions the pronoun matching the antecedent's grammatical gender is acceptable as well (although there may well be a general preference for the pronoun matching the referential gender across all three conditions).

(8) a. **FID context.** Frieda grunzte triumphierend. Das tatendurstige Ferkel rannte schnaufend durchs Unterholz. Oh je, was war das für ein Ungeheuer, das mit seiner schreckliche Klaue nach ??**ihm/ihr** griff? Zum Glück war es in Wirklichkeit nur ein harmloser Zweig.
Frieda grunted triumphantly. The piglet that was burning for action ran through the underbrush panting. Huh, what kind of munster was trying to grab ***??it/her*** *with his horrible claw? Luckily, it was actually just a harmless twig.*

b. **SID context.** Frieda grunzte triumphierend. Das tatendurstige Ferkel rannte schnaufend durchs Unterholz und dachte für einen Augenblick, dass eine Klaue nach **ihm/ihr** greifen würde. Zum Glück war es in Wirklichkeit nur ein harmloser Zweig.
Frieda grunted triumphantly. The piglet that was burning for action ran through the underbrush panting and thought for a moment that a frightening claw was trying to grab ***it/her****. Luckily, it was actually just a harmless twig.*

c. **Neutral narrative context.** Frieda grunzte triumphierend. Das tatendurstige Ferkel rannte schnaufend durchs Unterholz. Dabei schlug **ihm/ihr** ein scharfer Gegenstand mit großer Wucht gegen die Flanke. Zum Glück war es nur ein harmloser Zweig.
Frieda grunted triumphantly. The piglet that was burning for action ran through the underbrush panting. A sharp object struck against ***its/her*** *flank. Luckily, it was actually just a harmless twig.*

The data discussed in this section show a crucial asymmetry. In FID, on the one hand, only pronouns matching the referential gender of the protagonist whose thoughts (or utterances) are reported are acceptable. In SID and in neutral narration, on the other, either pronouns matching the protagonist's referential gender and pronouns matching the grammatical gender of the antecedent DP are acceptable. In Section 3.2 we will propose an analysis accounting for this contrast.

3.2. The analysis

3.2.1. The basic ingredients

To summarize the background discussed above, the assumptions on which our analysis is based fall into two groups: analyses of (i) gender features on nouns and pronouns, and (ii) FID. Regarding the morphosyntax of gender features and agreement, we assume a dual layer approach to (hybrid) nouns in which two sets of features project from NP in separate layers: obligatory but uninterpretable gender features for grammatical agreement, as well as interpretable gender features associated with an optional *AnimP*, available only for NPs denoting animate entities (Panagiotidis 2019; Trutkowski & Weiß 2023). Hybrid nouns demonstrate that referential gender features encoded in *AnimP* do not have to match the

grammatical gender for lexical nouns, resulting in mixed patterns of agreement. While we assume that pronouns may also optionally encode two layers of features, we propose that interpretable gender features projected in *AnimP* and the uninterpretable grammatical gender features have to match (i.e. there are no hybrid pronouns). In addition, we will adopt a relatively standard approach to the interpretation of pronouns, for which interpretable features are presupposed, but uninterpretable features are not (e.g., Cooper 1983; Sudo 2012, among many others).
Regarding FID, we adopt a dual context approach, in which FID introduces a protagonist's context of thought C_T as well as the narrator's context of utterance C_U (Doron 1991; Schlenker 2004; Sharvit 2004; Eckardt 2014, among others). We further assume that gender (and number) features of pronouns are interpreted with respect to C_T, while person features are interpreted with respect to C_U (Delfitto et al. 2016; see also Stokke 2020), an assumption based on early examples like (6) discussed already in Doron (1991) and Schlenker (2004).

(9) **Empirical generalizations:** (i) Referential agreement with pronouns referring to the protagonist (*de se* pronouns) is strongly preferred, if not required, in FID contexts (7a), whereas (ii) pronouns may agree in either referential or grammatical gender in SID contexts (7b).

Our account makes the following proposal (10) in order to account for the generalization in (9):

(10) **Primary proposal:** FID invokes a perspective which is anchored to the self-reflexive perspective of the protagonist in the context of thought C_T.

Assuming that self-reflexive thought requires consciousness, a *de se* interpretation of any pronoun referring to the protagonist is required; thus, pronouns with an *AnimP* are strongly preferred, if not required, in FID contexts. As *AnimP* projects interpretable features, these features are evaluated (as presuppositions) within the context that is associated with the protagonist's perspective, namely C_T.
With respect to hybrid nouns, this means that only *de se* pronouns which use referential agreement are permitted in FID contexts, i.e., the first half of the empirical generalization above (9.i). Again, the basic argument here is that FID invokes a perspective shift, in which expressions are evaluated with respect to a context that supports the protagonist's own self-concept. As such contexts require an *AnimP*, the interpretable gender features of the pronoun must also cohere with their self-concept; otherwise, a presupposition clash between the pronoun and that self-concept would result. More simply put: as a representation of a protagonist's state of consciousness, interpretable features associated with pronouns must represent that protagonists view of their own gender, as a natural consequence.
In the following section, we concentrate on accounting for (9.i), reserving speculation on the reason why both referential and grammatical agreement with pronouns might be possible in SID (9.ii) for a later section. We first turn to an illustration of the claim that FID obligatorily supports *de se* pronouns.

3.2.2. The obligatoriness of *de se* in FID

While SID allows *de re* as well as *de se* readings of pronouns referring to the perspective taker, FID only allows *de se* readings (Delfitto et al. 2016, Charnavel 2019). To illustrate, consider

the contrast between (11a) and (11b): (11a) has a true reading, since Claudine thinks of the person that is in fact identical to herself that she is brilliant, although she does not realize this. Consequently, the thought reported by (11a) on its true reading cannot have been 'I am brilliant', which corresponds to the *de se* reading, but only 'She is brilliant'. This is the *de re* reading of (11a). The FID report in (11b), in contrast, is distinctly awkward; it seems to be impossible to report a thought via FID in which the respective protagonist does nor recognize herself and consequently uses a third rather than a first person pronoun for self-reference.

(11) Claudine was listening to a radio interview that she had given many years ago and that she had completely forgotten. She was so drunk that she did not recognize her own voice, but she was very impressed by the interviewee's responses.
a. Claudine$_i$ thought that she$_i$ was brilliant.
b. #Damn, she$_i$ was brilliant, Claudine$_i$ thought.

Since, as we have already argued above, the referential gender of a person is a crucial part of their self-concept, it is plausible to assume that the referential gender of a pronoun must be represented correctly in the context of thought C_T. Consequently, projecting *AnimP* with the a referential gender specification for the pronoun referring to the attitude holder would be required for FID.
For SID, in contrast, one could assume that projecting *AnimP* is optional, since the respective thought does not have to be interpreted *de se*. Consequently, the respective LF as well as the semantic representation it gives rise to would simply be ambiguous with respect to the *de se*/*de re* distinction, in keeping with much prior literature. At the end of the paper, we return to this issue and discuss the viability of an alternative analysis, in which *de se* construals would be necessarily associated with referential gender.

3.2.3. A sketch of the analysis

Let us now see in detail how the asumptions outlined in section 3.2.1 account for the contrasts introduced in Section 3.1. Consider again the two variants of (7a), repeated here as (12).

(12) **FID context.** Maria war völlig fertig von der Fahrt auf dem stürmischen Meer. Das elegant gekleidete Mädchen stieg mit wackligen Beinen aus dem Boot. Wahnsinn, der Boden schwankte wie verrückt unter $^{??}$**seinen/ihren** Füßen! Zum Glück dauerte die Illusion nur einen Augenblick.
Maria was totally exhausted from the trip on the stormy sea. The elegantly dressed girl stepped out of the boat with shaky legs. Gosh, the ground was shaking like mad beneath $^{??}$its/her feet like mad! Luckily, the illusion lasted only a moment.

On its most plausible reading, the third sentence in (7a)/(12) is an expression of the protagonist Maria's thought rendered in FID. Consequently, it is interpreted not only with respect to the narrator's C_U, but also with respect to Maria's C_T. Let us start with the variant containing the neuter pronoun *seinen* ('its'). Since the only sensible reading is the one on which it is resolved to Maria, *AnimP* is necessarily projected in the pronoun, in keeping with the perspective shift assocatied with FID. As AnimP includes referential and hence interpretable gender features, the pronoun has the denotation in (13):

(13) $[[\text{seinen}_i]]^{g,CU,CT}$ = g(i) iff g(i) is distinct from author(C_U) and addressee(C_U) and neither female nor male in the world of C_T.

Since the world of C_T is the world of Maria's perspective and all interpretable features in FID are evaluated with respect to C_T, the individual assigned to the index *i* has to be neither male nor female according to Maria. Consequently, assigning Maria to *i* would lead to a presupposition failure, since Maria presumably is female according to her self-concept. Without another sensible resolution option for *i*, no well-formed, sensible and coherent interpretation of the FID report is available.
We now turn to the variant of (12) with the female pronoun *ihren* ('her'). The denotation of the pronoun is given in (14). Unlike the neuter pronoun, there is no presupposition clash; all of the presuppositions associated with the pronoun are satisfied in C_U and C_T. Maria can thus be assigned to the index *i* and the relevant sentence is interpreted as shown in strongly simplified form in (15).

(14) $[[\text{ihren}_i]]^{g,CU,CT}$ = g(i) iff g(i) is distinct from author(C_U) and addressee(C_U) and female in the world of C_T.

(15) $[[\text{Wahnsinn, der Boden schwankte wie verrückt unter ihren Füßen!}]]^{g,CU,CT}$ =
$\lambda w\ .\ \exists e[\text{shake}(e)(w) \wedge \text{Theme}(e, \text{ground})(w) \wedge \text{beneath}(e, \text{maria's feet})(w) \wedge \tau(e) < \text{time}(C_U)]$

Recall that we are assuming that FID contexts require an AnimP on *de se* pronouns and that only *de se* pronouns are available when the protagonist refers to themself. That is, *seinen* in (13) is interpreted as the variant with interpretable features, thus producing a presupposition clash. As we will discuss in the following section, pronouns with grammatical agreement are available in SID reports, and may also have a *de se* interpretation.

3.3. Pronouns in SID reports

Although our focus thus far has centered on FID reports, we have also presented examples of SID in which pronouns that agree with a hybrid noun in referential or grammatical gender are possible. In this section, we address an alternative account in which choice of pronoun form diagnosis the *de re* / *de se* construal. Under this alternative, (i) referential gender would necessarily associate with *de se* interpretations, whereas (ii) grammatical gender would necessarily associate with *de re* interpretations.
Appealing as such a direct one-to-one correspondence might be, the central problem is that it is not supported emprically. The complement clauses in SID reports (7b) and (8b), repeated here as (16a) and (16b), respectively, are plausibly interpreted *de se*, i.e. as reporting a first-person thought that either Maria or Frieda has about herself, irrespective of whether the pronouns referring to them are marked for neuter or female gender.

(16) a. Maria war völlig fertig von der Fahrt auf dem stürmischen Meer. Das elegant gekleidete Mädchen stieg mit wackligen Beinen aus dem Boot und dachte für einen Augenblick, dass der Boden unter **seinen/ihren** Füßen schwanken würde. Zum Glück dauerte die Illusion nur einen Augenblick.

Maria was totally exhausted from the trip on the stormy sea. The elegantly dressed girl stepped out of the boat with shaky legs and thought for a moment that the ground was shaking beneath ***its/her*** *feet. Luckily, the illusion lasted only a moment.*

b. Frieda grunzte triumphierend. Das tatendurstige Ferkel rannte schnaufend durchs Unterholz und dachte für einen Augenblick, dass eine Klaue nach **ihm/ihr** greifen würde. Zum Glück war es in Wirklichkeit nur ein harmloser Zweig.
Frieda grunted triumphantly. The piglet that was burning for action ran through the underbrush panting and thought for a moment that a frightening claw was trying to grab ***it/her****. Luckily, it was actually just a harmless twig.*

One possible response is that SID is, in some way, underspecified with respect to *de re / de se* status. However, there is now an additional conceptual problem with such a response. Percus and Sauerland (2003) argue convincingly that distinct LFs give rise to *de se* readings rather than underspecified LFs that are compatible with *de se* as well as *de re* readings. Consider the scenario described in (17a):

(17) a. A group of drunken election candidates watching campaign speeches on television do not recognize themselves in the broadcast. John, the only confident one, thinks "I'll win," but does not recognize himself in the broadcast. Bill and Sam, both depressive, think "I'll lose" but are impressed by the speeches that happen to be their own and are sure "that candidate" will win. Peter, also depressive, happens to be impressed not by his own speech but by John's.
(Percus and Sauerland 2003: 7, ex. (18))
b. Only John thinks that he will win the election.

The only reading on which (17b) is true with respect to the scenario in (17a) is a specific *de se* reading. While it is true that John is the only one who thinks 'I will win the election', it is clearly not true that John is the only *x* such that *x* thinks that *x* will win the election: The property *λx. x thinks that x will win the election* applies to Bill and Sam, too, since they both in effect have the thought (about themselves) that they will win the election. The same holds for a more sophisticated analysis on which the *de se* reading is a special case of the mechanism that account for *de re* readings.
On this alternative, the complement clause of *thinks* in (17b) has the denotation in (18a): the function from individuals *x* to functions from possible worlds *w* to truth values that yield the value *true* if there is some acquaintance relation *R* that *x* bears uniquely to *x* such that for all pairs of worlds *w'* and individuals *y* such that *w'* is compatible with what *x* believes in *w,* and *y* is indistinguishable from *x* in *w'*, *x* wins the election in *w'*.

(18) a. λx. λw. there is some acquaintance relation R that x bears uniquely to x in w such that, for all <y, w'> in $DOX_{x, w}$, the individual that y bears R to in w' wins the election in w'.
b. λx. λw. For all <y, w'> in $DOX_{x, w}$, y wins the election in w'.

Here, the *de se* reading is derived if *R* is the identity relation, i.e. it comes about as a special case of the *de re* interpretation. As Percus & Sauerland (2003) observe, the problem is that it also does not derive the reading on which (17b) is true since for each of the election candidates

x in (17a) there is a suitable acquaintance relation *R* such that the semantic object in (18a) applies to *x*: For John, it is the identity relation. For Bill, it might be the relation that he bears to the first candidate that he hears (assuming that he is in fact the first candidate that he hears). For Sam, it might be the relation that he bears to the second candidate he hears (assuming that he is in fact the second candidate that he hears). In order to derive the specific *de se* reading on which (17b) is true, a semantic object like the one in (18b) (cf. Lewis 1979 and Chierchia 1989) is needed, since John is indeed the only one to which (18b) truthfully applies, i.e. the only individual *x* for which it is true that *x* self-ascribes the property of winning the election.

We have constructed the scenario in (19a) which is parallel to the (17a), but whose subject is a hybrid noun, to determine if the pronoun in the embedded clause agrees with either the grammatical (*es*) or referential (*sie*) gender associated with the hybrid noun subject (*Mädchen*). As predicted, sentences (19b-c) also have a true reading in this scenario, parallelling the judgments associated with (17b).

(19) a. A group of drunken girls is listening to recordings of their own voices singing their favourite song at a party. The girl with the blond hair, the only confident one, thinks, 'I have a beautiful voice', but does not recognize her own voice. The girl with the black hair and the girl with the brown hair, both depressive, think 'I have a terrible voice', but are impressed by the voices that happen to be their own and think 'That voice sounds beautiful'. The girl with the red hair, also depressive, happens to be impressed not by her own voice, but by the voice of the girl with the blond hair.
b-c. (Nur) das blonde Mädchen denkt, dass **sie**/**es** eine schöne Stimme hat.
(Only) the blond girl thinks that ***she/it*** *has a beautiful voice.*

The example above shows that there is no inherent connection between a pronoun's gender agreeing with the referential gender of its binder in SID and the availability of a *de se* reading for the pronoun. Rather, the availability of a *de se* reading is independent of whether the pronoun agrees with the the grammatical or the referential gender of the DP denoting the attitude holder. In terms of the dual layer approach to gender features, a pronoun does not need to project *AnimP* to generate a *de se* reading.

While there is evidence against the idea that pronoun types are semantically associated with a particular reading, this does not necessarily mean that the choice is pragmatically innocent in SID reports. In the next section, we speculate on the possible pragmatic impact of selecting one pronominal form over another.

3.4. Pragmatic impact of pronoun choice

In the case of SID with a hybrid noun that refers to an attitude holder, both types of agreement on a pronoun are possible, each permitting either *de se* or *de se* construals. We have argued that FID mandates a form of perspective shifting in which interpretable content, including the presuppositions associated with pronouns, is interpreted with respect to the (centered) world associated with the protagonist's viewpoint. In contrast, SID does not specify a viewpoint and it is in fact often semantically underdetermined whether the narrator or speaker shares the assessment of the clause (as with *epistemic parenethical* verbs, e.g, Urmson 1952, Simons 2007, among others). However, we have observed, in both informal judgments and a formal pilot experiment, that comprehenders prefer referential gender across the board, even with SID and neutral narration. Although the bias towards referential gender may be due to a global

reorganization of the language (see Audring 2006 for discussion of Dutch), we speculate that the choice of pronoun permits a subtle inference, and is thus not pragmatically innocent.

To take example (19b-c) above for illustration, either referential or grammatical agreement is possible. By hypothesis, referential agreement requires that the pronoun project *AnimP*,wheras grammatical agreement does not. The interpretable features in *AnimP* ensure that the attitude holder has the requisites for conscious, self-reflexive thought. While grammatical agreement does not entail that the attitude holder is incapable of self-reflexive thought, it does not ensure that they are portrayed as being fully capable of such thought, either. In other words, the use of grammatical agreement for such pronouns allows the possibility in which the speaker or narrator portrays the mental state of the attitude holder as, in a sense, less than fully conscious. We might then explain the general preference for referential pronouns as a preference to avoid being associated with a potentially charged inference. If so, speakers might be guarding against pragmatic leakage in a fashion reminiscent of Harris & Pott's (2009) broadly game-theoretic explanation for why epithets tend to be speaker oriented: speakers understand that the listener might associate the not-at-issue content of epithets, e.g. *the bastard* or *the jerk*, with the speaker, instead of the attitude holder, unless sufficient evidence is provided on their behalf. Speakers are liable, as it were, for the negative attitude associated with the epithet and must provide sufficient clues for a non-speaker interpretation.
As argued by Harris & Potts (2009), nothing in this line of reasoning is spefically limited to attitude reports. And there is certainly anecdotal evidence that the use of grammatical gender, when referential gender is also a possibility, invites an inference that the speaker holds the referent in some level of disdain. Example (20) illustrates the case with pets. The sentence contains a definite DP with the noun *Hund* ('dog'), whose grammatical gender is masculine, though the name *Amy* makes it clear that the dog is biologically female:

(20) Amy, der Hund, wird unruhig. Sie/Er will spazieren gehen.
Amy, the dog, is getting anxious. She/He wants to go for a walk.

The intuition is subtle but clear. Using a feminine pronoun *Sie* ('she') that agrees with the biological gender of the referent conveys warmth towards the dog, but using a masculine pronoun *er* ('him') that agrees with the grammatical gender conveys apathy or disdain, or at least a less-than-human status.
It may be worth noting that a similar inference pattern can be found even in langauges without systematic gender marking. In English, it is possible to use a pronoun that is marked for referential gender or a neuter pronoun in a context like (21).

(21) Amy, the dog, is getting anxious. She/It wants to go for a walk.

As before, the use of the neuter pronoun, especially when one knows what biological sex the pet is, conveys a subtle yet systematic point of view of mild degradation and disdain (perhaps for the specific dog or for dogs in general).
And as tenuous as such a line of argumentation may appear, it does predict that the choice of whether to use referential or grammatical agreement with a pronoun should be modulated by the extent to which the narrator empthasizes with the protagonist. Intuitively, the greater the evidence that the narrator or speaker regards the attitude holder in SID contexts with empathy, the more likely they will be to use referential agreement, given an option. A detailed

exploration of such an pragmatic impact is beyond the scope of the present paper and must be delayed for another occasion.

4. Summary of proposal and further issues

In this paper, we have proposed an analysis for a phenomenon that to the best of our knowledge has not been discussed in the semantic literature on perspective taking before. In FID reports, there is a strong tendency for *de se* pronouns to agree with referential gender and not grammatical gender of the (most recent) antecedent DP referring to the protagonist whose thoughts are rendered. In contrast, both options are available in neutral narration and SID reports (although referential agreement may be preferred in general).
Our account combines a particular version of the dual context approach, in which the person features of pronouns are interpreted with respect to C_U, while their gender features are interpreted with respect to C_T (Defiltto 2016), with a natural extension of the dual layer analysis of nouns (Panagiotidis 2019, Trukowski & Weiß 2023) to pronouns. On this extension, pronouns again optionally project *AnimP* with interpretable gender features, but referential and grammatical gender features have to agree (unlike the case of lexical nouns).
We have combined these assumptions with the assumption that the introduction of C_T invokes a perspective which is anchored to the self-reflexive perspective of the protagonist in the context of thought C_T. Since that self-reflexive thought requires consciousness, a *de se* interpretation of any pronoun referring to the protagonist is required, and thus pronouns with an *AnimP* projection are strongly preferred, if not required, in FID contexts. As *AnimP* projects interpretable features, these features are evaluated (as presuppositions) within the context that is associated with the protagonist's perspective, namely C_T. Concerning SID, in contrast, we have assumed that since it does not involve the introduction of an attitude holder's context, *AnimP* does not have to be projected, and so the pronoun's gender features may remain uninterpreted, agreeing with the grammatical gender of the DP denoting the attitude holder (although there may be pragmatic reasons to prefer entailntial agreement in SID, as we have seen in Section 3.4). Our main claims in this paper are summarized in the table below, in which the combination of grammatical agreement with a *de se* pronoun in FID (the cell marked in gray) is ruled out.

Agreement on pronoun	**Aspect**	**Standard Indirect Discourse (SID)**	**Free Indirect Discourse (FID)**
Grammatical agreement	*Features*	Uninterpretable features only	Would contribute uninterpretable features only
	Presupposition	No presupposition	Would not have presupposition
	Availability	Available with multiple acquaintance relations	Unavailable as perspective shift requires *AnimP*
Referential agreement	*Features*	Contributes interpretable features via *AnimP*	Contributes interpretable features via *AnimP*

	Presupposition	Presupposition of pronoun	Presupposition of pronoun interpreted in C_T
	Availability	Available with multiple acquaintance relations	Available only with perspective of protagonist

We conclude this paper by briefly mentioning two related issues that we leave to future research. First, in SID reports whose subject is a quantificational DP, at least for some speakers (including the first author) there is a clear preference for pronouns whose gender agrees with the grammatical rather than the referential gender of the subject DP, as shown in (22a-b), irrespective of whether the pronoun receives a *de se* or a *de re* reading.

(22) a-b. Kein Mädchen glaubt, dass es/?sie eine schöne Stimme hat.
No girl believes that it/she has a beautiful voice.

This contrast raises a number of intriguing questions regarding the interaction of syntactic binding, the transmission of referential as opposed to grammatical gender features, and the mechanisms by which *de se* and *de re* redings of pronouns come about.
The second issue concerns a different kind of perspective-taking, dubbed *Viewpoint Shifing* (VS) in Hinterwimmer (2017) and *Protagonist Projection* (VS) in Stokke (2013, 2021) and Abrusán (2021), which involves *perceptions* rather than conscious thoughts of protagonists. There is preliminary evidence from a pilot study that this form of perspective-taking is also sensitive to the distinction between (i) pronouns that agree with the referential and (ii) pronouns that agree with the grammatical gender of the antecedent. Consider the variant of (7a) in (23):

(23) Maria war völlig fertig von der Fahrt auf dem stürmischen Meer. Das elegant gekleidete Mädchen stieg mit wackligen Beinen aus dem Boot. Der Boden schwankte heftig unter ??**seinen/ihren** Füßen. Zum Glück auerte die Illusion nur einen Augenblick.
*Maria was totally exhausted from the trip on the stormy sea. The elegantly dressed girl stepped out of the boat with shaky legs. The ground was shaking heavily beneath **her/its** feet. Luckily, the illusion lasted only a moment.*

As the final sentence makes clear, the third sentence does not describe an event that is happening in the story, but rather an illusionary perception of Maria. Although the effect is not quite as strong as in FID, such a reading is more difficult to get if the pronoun agrees with the grammatical than when it agrees with the referential gender of the most recent DP referring to the perspective taker. In future research, we are planning to pursue the question of whether (and if, how) our analysis of the preference for referential pronominal agreement in FID can be adapted to account for a similar, but slightly weaker preference in other forms of perspective-shifting, such as VS/PP.

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On the peculiar distribution of the Japanese epistemic adverb *masaka*[1]

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Abstract. This study addresses the distribution of the Japanese epistemic adverb *masaka*. In declaratives, it must co-occur with a negated epistemic modal. It can occur in polar questions but not in *wh*-questions. We propose that *masaka* differs from ordinary epistemic adverbs in that it expresses the modal claim that the prejacent is certainly at the not-at-issue level, while leaving the at-issue content intact. This semantics predicts that the at-issue and not-at-issue contents contradict each other in cases where *masaka* is not licensed. Furthermore, several remaining issues are discussed. First, negated epistemic attitude verbs such as *omow* 'believe' also license *masaka*. Second, the Japanese exclamative markers *nante/towa* also license *masaka*. Herein we present tentative ideas for accommodating these cases. Finally, we demonstrate that the projection properties of *masaka*'s semantic contribution as not-at-issue content is complicated.

Keywords: modality, epistemic adverbs, epistemic modals, two-dimensional semantics,

1. Introduction

The primary aim of this study is to capture a peculiar distribution of the Japanese epistemic adverb *masaka* (approximately, 'by any chance' in English), whose semantic properties have never been analyzed intensively in the formal literature. Typically, as we will see in Section 2, *masaka* is used in combination with the epistemic modal *hazu* 'should' and the negation *nai*:

(1) *Masaka ame-ga huttei-ru hazu-nai.*
masaka rain-NOM falling-PRES should-NEG.PRES
(Approx.) 'It should NOT be raining.'

Intuitively, the presence of *masaka* indicates that the probability of rain is even lower than expressed without *masaka* (we call this the strengthening effect). Below, we show that this epistemic adverb can only be licensed by a limited number of expressions, of which our primary focus is on epistemic modals and questions. Specifically, *masaka* is licensed not by negation alone or an epistemic modal alone but by a combination of the two, and *masaka* is licensed in polar questions, but not in *wh*-questions.

Several previous studies have addressed *masaka* in the descriptive Japanese linguistics. Morita (1989) states that *masaka* expresses the speaker's desire to deny the possibility that a proposition that might or will be true actually becomes true. Hida and Asada (1994) mention that *masaka* conveys that the probability is remarkably low. Makino and Tsutsui (1995) state that *masaka* expresses the speaker's strong belief that what is unexpected actually happened. Sug-

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imura (2000) argues that *masaka* expresses the speaker's unexpectedness, not a low possibility or denial of possibilities. These previous studies have discussed what kind of expression can be used with *masaka* but have never tackled the issue of why *masaka* shows such restrictions. Therefore, this study is the first attempt to provide a formal analysis of *masaka* within the theoretical framework.

However, note in advance that the proposed analysis does not capture the whole picture of *masaka*; our analysis is intended to explain how *masaka* interacts with (negated) modals and questions. As we will see in Section 5, other linguistic expressions also license *masaka*. It is a task for future research to cover these cases, although we will discuss tentative ideas on how our analysis can be revised to accommodate them. In this sense, the secondary purpose of this study is to establish a stage for a more comprehensive formal analysis of *masaka* by showing what has been explained and what remains to be explored in future research.

The remainder of this paper is organized as follows. Section 2 provides the data set and claims that *masaka* can be licensed by negated epistemic modals and that it is also licensed in polar questions, but not in *wh*-questions. Section 3 proposes an analysis of *masaka*, where [*masaka-p*] asserts that *p* is true as at-issue content and implies that *p* is almost certainly false as not-at-issue content. Section 4 demonstrates how our analysis captures the data set. Section 5 presents the implications and remaining issues. Finally, Section 6 concludes the paper.

2. Data

2.1. Negated modals as licensors

First, *masaka* differs from ordinary Japanese epistemic adverbs such as *zettaini* 'definitely' and *matigainaku* 'certainly' in that it cannot occur in simple declaratives, regardless of their polarity:

(2) a. *#Masaka ame-ga futtei-[ru/nai].*
masaka rain-NOM falling-[PRES/NEG.PRES]
(Approx.)'It could/couldn't be raining.'
b. *Zettaini/Matigainaku ame-ga huttei-[ru/nai].*
definitely/certainly rain-NOM falling-[PRES/NEG.PRES].
'Definitely/Certainly, it is/isn't raining.'

In declaratives, *masaka* can only be licensed by a co-occurring epistemic modal when the modal is negated:

(3) *Masaka ame-ga huttei-ru hazu-nai.* (= (1))
masaka rain-NOM falling-PRES should-NEG.PRES
'It should NOT be raining.'

Japanese has an inherently-negative modal *mai* 'will not'. This modal also licenses *masaka*:

(4) *Masaka ame-ga huttei mai.*
masaka rain-NOM falling will.not
'It must NOT be raining.'

If there is no negation or if what is negated is the prejacent rather than the modal, *masaka* is not licensed:[2,3]

(5) a. *#Masaka ame-ga huttei-ru hazu-da.*
masaka rain-NOM falling-PRES should-COP
'(Approx.) Possibly, it should be raining.'
b. *#Masaka ame-ga huttei-nai hazu-da.*
masaka rain-NOM falling-NEG.PRES should-COP
'(Approx.) Possibly, it should not be raining.'

Thus, we conclude that *masaka* can be licensed by a co-occurring negated modal.

However, *daroo* 'will' might seem to be an exception. See (6), where the negation *nai* comes to the left of *daroo* but nevertheless *masaka* is licensed:[4]

(6) *Masaka ame-ga huttei-nai-daroo.*
masaka rain-NOM falling-NEG.PRES-will
'It must NOT be raining.'

We claim that in (6), *nai* negates *daroo* rather than the prejacent. More specifically, we assume that the configuration [*p-nai-daroo*] can have two different internal structures:

(7) a. [[*p nai*] *daroo*]
b. [*p* [*nai daroo*]]

Masaka can be licensed in structure (7b), where the modal *daroo*, rather than the prejacent *p*, is negated because *daroo* is in a sister relation with *nai*.[5] If this assumption is correct, *masaka* will not be licensed when some other element intervenes between *nai* and *daroo* to break up their constituency. This prediction is borne out:

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[2]Other epistemic modals such as *nitigainai* 'must' and *kamosirenai* 'might' cannot license *masaka*:
(i) *#Masaka ame-ga huttei-ru [nitigainai / kamosirenai].*
masaka rain-NOM falling-PRES [must / might]
'(Approx.) Possibly, it [must/might] be raining.'
Unlike the cases of *hazu* (i.e., (3) and (5a)), adding negation to the right of these modals cannot rescue (i) because they cannot be negated, probably for morpho-syntactic reasons regardless of the presence/absence of *masaka* :
(ii) **(Masaka) ame-ga huttei-ru [nitigainaku-nai / kamosirenaku-nai].*
(masaka) rain-NOM falling-PRES [must-NEG.PRES / might-NEG.PRES]
'(Intended) It must/might not be raining.'

[3]See Appendix for why we ignore the possibility that the negation *nai* in (5b) is associated with *hazu* rather than with the prejacent.

[4]Without negation, *daroo* cannot license *masaka*:
(i) *#Masaka ame-ga huttei-ru-daroo.*
masaka rain-NOM falling-PRES-will
'It must NOT be raining.'

[5]The current claim that *nai* and *daroo* can form a constituency is corroborated by the fact that the configuration *nai-daroo* can be contracted as *nakaroo* 'will.not'. This contracted form also licenses *masaka*:
(i) *Masaka ame-ga huttei-nakaroo.*
masaka rain-NOM falling-will.not.
'It must NOT be raining.'

(8) #*Masaka ame-ga huttei-nai-no daroo.*
masaka rain-NOM falling-NEG.PRES-NMLZ will
'(Intended) It must [have been / be] raining.'

In (8), *daroo* and *nai* do not form constituency because of the intervening element, that is, the nominalizer *no*. The infelicity of this sentence underpins the claim that *masaka* is licensed only when the co-occurring modal is negated.

2.2. In questions

Masaka is licensed in polar questions, with the strong implication that the speaker expects the negation of the prejacent to be true:

(9) a. *Masaka ame-ga huttei-ru no?*
masaka rain-NOM falling-PRES Q
'Is it raining, by any chance?'
Implication: The speaker expects that it is not raining.
b. *Masaka ame-ga huttei-nai no?*
masaka rain-NOM falling-NEG.PRES Q
'Isn't it raining, by any chance?'
Implication: The speaker expects that it is raining.

However, *masaka* cannot appear in *wh*-questions:

(10) #*Masaka nani-ga huttei-ru no?*
masaka what-NOM falling-PRES Q
'(Intended) What is falling, by any chance?'

Thus, the current study attempts to capture (i) why negated modals can be licensors of *masaka* in declaratives and (ii) why *masaka* can appear in polar questions but not in *wh*-questions.

3. Proposal

We follow the traditional assumption that epistemic modals quantify the set of the most ideal epistemically-accessible worlds (Kratzer, 1981):[6]

(11) a. $[\![\textit{hazu}]\!] = [\![\textit{daroo}]\!] = \lambda p.\lambda w.\ \forall w'[w' \in \textsc{best}(f, g, w) \rightarrow p(w')]$.
b. $\textsc{best}(f, g, w)$ is the set of the most ideal worlds in $\bigcap f(w)$ in terms of $g(w)$, where f is the epistemic modal base and g is the stereotypical ordering source.

The sentence in (12) indicates that it is highly probable that it is not raining. This suggests that, when *hazu* and *daroo* are negated, these modals take scope over negation, as in the English *mustn't* (*must* $>$ $\neg$) and *shouldn't* (*should* $>$ $\neg$), as in (13).[7]

[6]We abstract away the semantic differences between *hazu-da*, *nitigainai*, and *daroo*, but see Okano and Mori (2015) for the detailed analysis of *hazu* and Hara (2018) for that of daroo.
[7]It is an issue for future research why these Japanese modals show the same scopal pattern as English ones.

(12) *Ame-ga huttei [ru-hazu-nai / mai / nai-daroo]*
rain-NOM falling [PRES-should-NEG / will.not / NEG-will]
'It [shouldn't/mustn't] be raining.'

(13) $[\![\textit{hazu-nai}]\!] = [\![\textit{mai}]\!] = [\![\textit{nai-daroo}]\!] = \lambda p.\lambda w.\ \forall w'[w' \in \text{BEST}(f, g, w) \rightarrow \neg p(w')]$

Let us turn to the semantics of *masaka*. Ordinarily, epistemic adverbs are analyzed as functions that take a proposition and return a modalized statement (e.g., $[\![\textit{certainly}]\!] = \lambda p.\lambda w.$ **certain**$(p)(w)$).[8] We depart from this tradition and propose that *masaka* takes a proposition but expresses the modalized claim as *not-at-issue* content (Potts, 2003, Gutzmann, 2015, among others):

(14) $[\![\textit{masaka}]\!] = \lambda p.\lambda w.\ p(w) \bullet \exists S[\text{BEST}(f, g, w) \subseteq S \wedge \forall w'[w' \in S \rightarrow \neg p(w')]]$.

The elements following • are not-at-issue content, which do not participate in the rest of the sentence's composition. When *masaka* takes a proposition p, *masaka* leaves p intact at the at-issue level, while expressing at the *not-at-issue* level that p is false in all the worlds in S, which is a superset of BEST(f, g, w). The superset relation between S and BEST(f, g, w) means that the number of worlds quantified by *masaka* is larger than that quantified by *hazu*, *mai*, and *daroo*, which ensures that the presence of *masaka* leads to the strengthening effect seen in Section 1.

4. Deriving facts

Let us begin with simple declaratives without modals, that is, (2a), repeated here as (15):

(15) a. *#Masaka ame-ga huttei-ru.*
masaka rain-NOM falling-PRES
'(Approx.) It could be raining.'
b. *#Masaka ame-ga huttei-nai.*
masaka rain-NOM falling-NEG.PRES
'(Approx.) It couldn't be raining.'

The meaning of (15a) is obtained as in the following (henceforth, **rain** is the abbreviation for $\lambda w.$ it is raining in w.):

(16) $[\![(15a)]\!] = [\![\textit{masaka}]\!](\textbf{rain})$
$= \lambda w.\ \textbf{rain}(w) \bullet \exists S[\text{BEST}(f, g, w) \subseteq S \wedge \forall w'[w' \in S \rightarrow \neg \textbf{rain}(w')]]$.

This is contradictory: the speaker asserts that **rain** is true but at the same time implicates that it is absolutely certain that **rain** is false (just as it is odd to say 'p is true but p must certainly be false'). [9]

[8] Some authors such as Anand and Brasoveanu (2009) treat modal adverbs as modal modifiers that take the co-occurring modal as one of their arguments.

[9] This explanation might seem insufficient in theoretical terms. The not-at-issue content of (16) just says that all worlds in S (i.e., the superset of the most *ideal* accessible worlds, BEST(f, g, w)) are **rain**-worlds. The actual world can be a non-ideal world, so it does not have to be contained in S. Therefore, the formula in (16) can be non-contradictory in itself.

However, we can still maintain that (16) is infelicitous when we take pragmatic factors into consideration. Generally, when one asserts a proposition in w, she is required to know in w that it is true (a felicity condition for assertion), which means that it is true in all worlds in her epistemically-accessible worlds, i.e., $f(w)$. The at-issue

(15b) is composed as follows:

(17) $[\![(15b)]\!] = [\![masaka]\!]([\![\text{NEG}]\!](\mathbf{rain}))$
$= \lambda w.\ \neg\mathbf{rain}(w) \bullet \exists S[\text{BEST}(f, g, w) \subseteq S \wedge \forall w'[w' \in S \rightarrow \mathbf{rain}(w')]]$.

This is also contradictory for the same reason as (16).

Next, consider the case where there is a co-occurring modal that is not negated; that is, (5a), repeated here as (18a). Its composition is provided in (18b) (we assume that the copula *-da* is semantically vacuous):

(18) a. *#Masaka ame-ga huttei-ru hazu-da.*
masaka rain-NOM falling-PRES should-COP
'(Approx.) Possibly, it should be raining.'

b. $[\![(18a)]\!] = [\![hazu]\!]([\![masaka]\!](\mathbf{rain}))$
$[\![masaka]\!](\mathbf{rain}) = \lambda w.\ \mathbf{rain}(w) \bullet \exists S[\text{BEST}(f, g, w) \subseteq S \wedge \forall w'[w' \in S \rightarrow \neg\mathbf{rain}(w')]]$.
$[\![hazu]\!]([\![masaka]\!](\mathbf{rain})) = \lambda w.\ \forall w'[w' \in \text{BEST}(f, g, w) \rightarrow \mathbf{rain}(w')]$
$\bullet\ \exists S[\text{BEST}(f, g, w) \subseteq S \wedge \forall w'[w'' \in S \rightarrow \neg\mathbf{rain}(w'')]]$

This formula is also contradictory: all worlds in BEST(*f, g, w*) are required to be **rain**-worlds and ¬**rain**-worlds at the same time, since BEST(*f, g, w*) $\subseteq S$.[10]The same result is obtained even when the prejacent is negated (i.e., (5b)).

Let us now turn to the cases where the co-occurring modal is negated. We repeat (3) here as (19a). Its meaning is provided in (19b).

(19) a. *Masaka ame-ga huttei-ru hazu-nai.*
masaka rain-NOM falling-PRES should-NEG.PRES
'It should NOT be raining.'

b. $[\![(19a)]\!] = [\![hazu\text{-}nai]\!]([\![masaka]\!](\mathbf{rain}))$
$= \lambda w.\ \forall w'[w' \in \text{BEST}(f, g, w) \rightarrow \neg\mathbf{rain}(w')] \bullet \exists S[\text{BEST}(f, g, w) \subseteq S \wedge \forall w'[w'' \in S \rightarrow \neg\mathbf{rain}(w'')]]$.

There is no contradiction in (19b): both the at-issue and not-at-issue contents require all relevant worlds to be ¬**rain**-worlds (the strengthening effect is obtained since BEST(*f*, *g*, *w*) $\subseteq S$, as described in Section 3.[11]

Next, consider (9), in which *masaka* is licensed in polar questions. We repeat (36) here as (20):

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content of (16) is **rain**(*w*). Therefore, the speaker asserts **rain**(*w*). Thus, the at-issue content of (16) implicates that all worlds in $f(w)$ are **rain**-worlds while the not-at-issue content says that all worlds in *S* are non-**rain**-worlds. This is contradiction because *S* overlaps with $f(w)$ given that BEST(*f, g, w*) is a subset of $f(w)$.

[10]Note that contradiction also occurs if *masaka* takes the modalized proposition as its argument:

(i) $[\![masaka]\!]([\![hazu]\!]([\![\mathbf{rain}]\!]))$
$= \lambda w.\ [\![hazu]\!](\mathbf{rain})(w) \bullet \exists S[\text{BEST}(f, g, w) \subseteq S \wedge \forall w'[w'' \in S \rightarrow \neg[\![hazu]\!](\mathbf{rain})(w'')]]$.

In this case, the speaker asserts that $[\![hazu]\!]([\![\mathbf{rain}]\!])$ is true in *w*, but simultaneously implies that $[\![hazu]\!]([\![\mathbf{rain}]\!])$ is certainly false. Therefore, changing the order of composition in (18b) does not rescue the sentence.

[11]Some readers might find it problematic that in (19b), the not-at-issue content entails the at-issue one, because it is pragmatically odd if the presupposition of a sentence (one kind of not-at-issue meanings) entails the assertion. The not-at-issue content encoded by *masaka* should be understood as use-conditional meaning (Gutzmann, 2015), which represents the conditions that an utterance must satisfy to be felicitous. That is, (19a) becomes true iff the at-issue content in (19b) holds, and becomes a felicitous utterance iff the not-at-issue content of (19b) holds.

(20) *Masaka ame-ga huttei-ru no?*
masaka rain-NOM falling-PRES Q
'Is it raining, by any chance?'
Implication: The speaker expects that it is not raining.

Following the traditional assumption that questions denote a set of propositions (Hamblin, 1973; see Dayal, 2016 for an overview), we assume that the operator Q_{pol}, as in (21a), forms polar questions by being appended to the end of the sentence composition. The semantics of (20) is obtained as in (21b)

(21) a. $[\![Q_{pol}]\!] = \lambda p.\ \{p, \neg p\}$.
b. $[\![(20)]\!] = [\![Q_{pol}]\!]([\![masaka]\!](\mathbf{rain}))$
$= \{\mathbf{rain}, \neg\mathbf{rain}\} \bullet \exists S[\text{BEST}(f, g, w) \subseteq S \wedge \forall w'[w' \in S \rightarrow \neg\mathbf{rain}(w')]]$.

The at-issue content of (21b) is a set of polar opposites, which guarantees that (20) is a polar question. The not-at-issue content expresses the speaker's strong bias toward $\neg$**rain**, as desired. Example (9b), where the prejacent of *masaka* involves negation, provides the same result, except that the speaker's bias is oriented towards **rain**.

Finally, *masaka* cannot occur in *wh*-questions ((10), repeated here as (22)):

(22) #*Masaka nani-ga huttei-ru no?*
masaka what-NOM falling-PRES Q
'(Intended) What is falling, by any chance?'

For the treatment of *wh*s in Japanese, we follow Kratzer and Shimoyama (2002) and Shimoyama (2006); Japanese *wh*-phrases such as *nani* 'what' denote (the intension of) a set of individuals as in (23a). In this system, regular predicates denote (the intension of) a singleton set whose only element is their ordinary denotation, as in (23b). For the composition rule, we employ a variant of the pointwise functional application relativized to world arguments, as in (23c). (23d) is the result of combining (23a) and (23b) (we ignore the contribution of the case particle *-ga* for the sake of simplicity).

(23) a. $[\![nani]\!] = \lambda w.\ \{x\text{: }\mathbf{thing}(x)(w)\}$.
b. $[\![huttei\text{-}ru]\!] = \lambda w.\ \{\lambda x.\ \lambda w'.\ \mathbf{falling}(x)(w')\}$.
c. If α is a branching node with daughters β and γ, and for any world w, $[\![\beta]\!](w) \subseteq D_{\langle\delta,\tau\rangle}$ and $[\![\gamma]\!](w) \subseteq D_{\delta}$, then $[\![\alpha]\!] = \lambda w.\ \{f(x)\text{: } f \in [\![\beta]\!](w) \wedge x \in [\![\gamma]\!](w)\}$.
d. $[\![nani\text{-}ga\ huttei\text{-}ru]\!] = \lambda w.\ \{f(x)\text{: } f \in [\![huttei\text{-}ru]\!](w) \wedge x \in [\![nani]\!](w)\}$.
$= \lambda w.\ \{\lambda w'.\ \mathbf{falling}(a)(w'), \lambda w'.\ \mathbf{falling}(b)(w'), \lambda w'.\ \mathbf{falling}(c)(w'), ...\}$ such that $a, b, c, ... \in \{x\text{: }\mathbf{thing}(x)(w)\}$.

(24a) is the denotation of *masaka* modified to fit into this system. Combining this with (23d) yields (25):

(24) $[\![masaka]\!]$
$= \lambda w.\ \{\lambda p.\lambda w'.\ p(w') \bullet \exists S[\text{BEST}(f, g, w') \subseteq S \wedge \forall w''[w'' \in S \rightarrow \neg p(w'')]]\}$.

(25) $[\![masaka\ nani\text{-}ga\ huttei\text{-}ru]\!]$
$= \lambda w.\ \{\lambda w'\ \mathbf{falling}(a)(w') \bullet \exists S[\text{BEST}(f, g, w') \subseteq S \wedge \forall w''[w'' \in S \rightarrow \neg\mathbf{falling}(a)(w'')]]$,
$\lambda w'\ \mathbf{falling}(b)(w') \bullet \exists S[\text{BEST}(f, g, w') \subseteq S \wedge \forall w''[w'' \in S \rightarrow \neg\mathbf{falling}(b)(w'')]]$,
$\lambda w'\ \mathbf{falling}(c)(w') \bullet \exists S[\text{BEST}(f, g, w') \subseteq S \wedge \forall w''[w'' \in S \rightarrow \neg\mathbf{falling}(c)(w'')]]$, $...\}$,
such that $a, b, c, ... \in \{x\text{: }\mathbf{thing}(x)(w)\}$.

(25b) denotes the set of possible answers, but all of them are contradictory statements (for the same reason as in (16)). Therefore, question (22) ends up having no appropriate answer, leading to its infelicity.

Thus, *masaka*'s peculiar distribution presented in Section 2 is accounted for by positing that *masaka* expresses a negative modality at the not-at-issue level. The next section discusses the implications of our findings and remaining issues.

5. Implications and remaining issues

5.1. Implications

The first implication of our findings is *masaka*'s complicated licensing conditions. In declaratives, modality is required in addition to negation, which means that *masaka* differs from ordinary NPIs such as *any*. Furthermore, *masaka* can be embedded in polar questions but not in *wh*-questions. To our knowledge, no other lexical items have been reported to have the same properties as *masaka*.

The second implication is that several recent studies have analyzed certain modal particles in the same manner as the current study. Zimmermann (2018) addresses the German modal particle *schon*, and claims that [*schon p*] presupposes that p is more valid than $\neg p$ in terms of the circumstantial modal base, and it is true iff p is true. Davis and Matthewson (2022) address the St'át'imcets frustrative marker *-séna7*, arguing that [*-séna7 p*] conveys that p is true as at-issue content and implicates at the not-at-issue level that there is another true proposition q such that the speaker believes that both p and q cannot be true at the same time. What these two analyses and ours have in common is that *schon*, *-séna7*, and *masaka* all encode some kind of modality at the not-at-issue level while leaving the prejacent at the at-issue level intact. This suggests that there may be a natural category of the lexical items that possess this semantic structure.

5.2. Remaining issues

5.2.1. How to extend to attitude verbs

The first remaining issue is that epistemic attitude verbs such as *omow* 'think' license *masaka* when they are negated:

(26) a. #*John-wa masaka ame-ga huttei-ru to omot-ta.*
John-TOP masaka rain-NOM falling-PRES COMP think-PAST
(Approx.) 'John thought at all that it was raining.'
b. *John-wa masaka ame-ga huttei-ru to omowa-nakatta.*
John-TOP masaka rain-NOM falling-PRES COMP think-NEG.PAST
(Approx.) 'John didn't think at all that it was raining.'

In the current analysis, *masaka*'s modality is associated with the speaker's epistemic state (i.e., $f(w)$). Therefore, the current analysis predicts that (26a)/(26b) assert that John thought/didn't

think that it was raining while the speaker is certain that it is not raining. This does not match the intuitive meaning, nor does it capture the contrast between (26a) and (26b).

If *masaka*'s modality is relativized to John's doxastic state (i.e., the set of worlds compatible with John's belief in w; henceforth, $\text{DOX}_{J,\,w}$), as in (27), the contrast in (26) can be derived.

(27) $[\![\, masaka \,]\!] = \lambda p.\lambda w.\ p(w) \bullet \exists S[\text{DOX}_{J,\,w} \subseteq S \wedge \forall w'[w' \in S \rightarrow \neg p(w')]]$.

(27) and the traditional semantics of attitude verbs in (28a) give rise to (28b) and (28c):

(28) a. $[\![\, omotta \,]\!] = \lambda p.\lambda x.\lambda w.\ \forall w'[w' \in \text{DOX}_{x,\,w} \rightarrow p(w')]$. (past tense is ignored)
b. $[\![\, (26a) \,]\!] = [\![\, omotta \,]\!]([\![\, masaka \,]\!]([\![\, \textbf{rain} \,]\!]))([\![\, John \,]\!])$
$= \lambda w\, \forall w'[w' \in \text{DOX}_{J,\,w} \rightarrow \textbf{rain}(w')] \bullet \exists S[\text{DOX}_{J,\,w} \subseteq S \wedge \forall w'[w' \in S \rightarrow \neg \textbf{rain}(w')]]$.
c. $[\![\, (26b) \,]\!] = [\![\, \text{NEG} \,]\!]([\![\, omotta \,]\!]([\![\, masaka \,]\!]([\![\, \textbf{rain} \,]\!]))([\![\, John \,]\!]))$
$= \lambda w\, \neg\forall w'[w' \in \text{DOX}_{J,\,w} \rightarrow \textbf{rain}(w')] \bullet \exists S[\text{DOX}_{J,\,w} \subseteq S \wedge \forall w'[w' \in S \rightarrow \neg \textbf{rain}(w')]]$.

The at-issue content of (28c) is consistent with its not-at-issue content (the latter entails the former), where as a contradiction occurs in (28b) (for the same reason as in (16)). Thus, one avenue for future research is explore how to implement the idea that *masaka's* modality can refer either to the subject of the attitude verb or to the speaker's epistemic state, depending on the environment.

5.2.2. On the exclamative markers

The second remaining issue is the interaction between *masaka* and the Japanese exclamative markers *nante/towa* (cf. Sawada and Sawada, 2021). These markers can occur in sentence-final position and express the speaker's surprise:

(29) *Ame-ga huttei-ru nante/towa!*
rain-NOM falling nante/towa
'It is raining!'

Crucially, *nante/towa* seem to entail that their prejacent is true, as with exclamatives in general (Rett, 2011). This is evidenced by the fact that sentences marked with *nante/towa* cannot tolerate the following denial:

(30) *Ame-ga huttei-ru nante/towa! #Zissaiwa huttei-nai kedo.*
rain-NOM falling-PRES nante/towa in.fact falling-NEG.PRES though
'It is raining! In fact, it is not, though.'

Nante/towa licenses *masaka* (as in (31a)), and their combination still seems to entail the truth of the prejacent because it is incompatible with the following denial as in (31b):

(31) a. *Masaka ame-ga huttei-ru nante/towa!*
masaka rain-NOM falling-PRES nante/towa
'Unexpectedly, it is raining!'
b. *Masaka ame-ga huttei-ru nante/towa! #Zissaiwa huttei-nai kedo.*
masaka rain-NOM falling-PRES nante/towa in.fact falling-NEG.PRES though
'(Approx.) Unexpectedly, it is raining! In fact, it is not, though.'

A reviewer points out that if (31a) entails that it is raining, it should contradict its not-at-issue content, which states that it is certainly not raining (as discussed in Section 4). This may be a limitation in this study.[12]

Although we do not have a clear solution to this problem, we suggest the possibility that *nante/towa* operate on temporal information involved in *masaka*'s modality. (31a) intuitively conveys that the speaker believed that it was not raining until she learned that it was (which is compatible with the exclamative meaning of *nante/towa*). If *masaka*'s modality in (31a) expresses the epistemic state that the speaker possesses before learning that the prejacent is true, then the modality does not contradict the truth of the prejacent at the utterance time. Specifically, assume the following denotation of *masaka*, where temporal arguments are added to the original version:

(32) a. $[\![masaka]\!] = \lambda p.\lambda w.\lambda t.\ \ p(w)(t) \bullet \exists S[\text{BEST}(f,\ g,\ w,\ t) \subseteq S \wedge \forall w'[w' \in S \rightarrow \neg p(w')(t)]]$.

b. BEST(f, g, w, t) is the set of the most ideal worlds in $\bigcap f(w)(t)$ in terms of $g(w)$, where $f(w)(t)$ is the set of propositions that the speaker knows at t in w, and g is the stereotypical ordering source.

Nante/towa modify the temporal information on *masaka* as follows:[13]

(33) $[\![(31a)]\!] = \lambda w.\lambda t.\ \mathbf{rain}(w)(t) \bullet \exists S,\ t'[t' < \text{UT} \wedge sp \text{ learns } \mathbf{rain}(w)(t) \text{ at } t' \wedge \text{BEST}(f,\ g,\ w,\ t') \subseteq S \wedge \forall w',\ t''[[w' \in S \wedge t'' < t'] \rightarrow \neg \mathbf{rain}(w')(t)]]$.

(33a) is true iff it is raining at the evaluation time t in the evaluation world w, and it implicates i) that the speaker learns at some time t' (which is prior to t) that it is raining at t, and ii) that before the learning event, the speaker is certain that it is not raining at t. In this formula, *masaka* expresses the speaker's epistemic attitude prior to t; therefore, it is compatible with the truth of the prejacent at t expressed at the at-issue level. This enables us to maintain the essence of our original idea that *masaka* encodes a negative modality at the not-at-issue level. What remains is how to achieve the semantics (33) in a compositional fashion.[14]

[12] *Nante/towa* can also be used as a complementizer. Their actuality entailment seems to be alleviated when *p-nante/towa* accompanies *omow* 'think' and negation, independent of the presence/absence of *masaka*:

(i) *John-wa (masaka) ame-ga huttei-ru nante/towa omottei-nai-si zissaini huttei-nai.*
John-TOP (masaka) rain-NOM falling-PRES nante/towa thinking-NEG.PRES-and in.fact falling-NEG.PRES
'John is not thinking that it is raining, and in fact it is not raining.'

[13] Here, we omit the semantic component of *nante/towa* that expresses the speaker's surprise for the sake of simplicity. See Sawada and Sawada (2021) for the detailed analysis.

[14] The current claim that *nante/towa* operates on the modality encoded by *masaka* is also motivated by the following contrast:

(i) Context: the speaker knows that it is not raining.
a. #*Masaka ame-ga huttei-ru hazu-nai.*
masaka rain-NOM falling-PRES should-NEG
'It couldn't be raining.'
b. *Masaka ame-ga huttei-nai nante/towa.*
masaka rain-NOM falling-NEG.PRES nante/towa
'(Approx.) Unexpectedly, it is not raining!'

This contrast shows that [*masaka p hazu-nai*] is incompatible with the speaker's knowledge that *p* (this is so-called

5.2.3. On the projection property of *masaka*

It is widely agreed that the semantic contribution of not-at-issue contents projects to the global level, as they are so-designed (Potts, 2003, Simons et al., 2010, among others). For example, Zimmermann (2018) tests the projection property of the German aspectual particle *schon*, which expresses at the not-at-issue level that the prejacent is false before t_0. (the utterance time). By employing Simons et al.'s (2010) test forms, he demonstrates that this contribution of *schon* projects over negation, questions, and conditionals:

(34) a. *Es ist nicht der Fall, dass es schon regnet.*
it is not the case that it already rains
'It's not the case that it's already raining.'
At-issue: It's not raining at t_0
Not-at-issue: It wasn't raining before t_0.

b. *Regnet es schon?*
rains it already
'Is it raining already?'
At-issue: {It's raining at t_0, It's not raining at t_0}
Not-at-issue: It wasn't raining before t_0.

c. *Falls es schon regnet, müssen wir uns beeilen.*
if it already rains must we us hurry
'If it is already raining, we have to hurry up.'
At-issue: If it's raining at t_0, we have to hurry up.
Not-at-issue: It wasn't raining before t_0.

The projection status of *masaka* is not as clear as *schon*. First, it is difficult to test whether *masaka*'s contribution projects over negation because *masaka* seems unembeddable under *koto* 'that'-clause:

(35) *(*Masaka) ame-ga huttei-ru hazu-nai koto-wa*
(masaka) rain-NOM falling-PRES should-NEG.PRES fact-TOP
zizitu-de-wa-nai.
fact-COP-TOP-NEG.PRES
'(Intended) It is not the case that it should NOT be raining.'

As seen in Sections 3 and 4, the questions of the form [*masaka p*?] implies the speaker's strong bias for $\neg p$ as in (9):

(36) *Masaka ame-ga huttei-ru no?* (= (36))
masaka rain-NOM falling-PRES Q
'Is it raining, by any chance?'
Implication: The speaker expects that it is not raining.

Therefore, *masaka*'s contribution (i.e., the prejacent is certainly false) projects over the question

indirectness requirement of epistemic modals; see von Fintel and Gillies, 2010), while [*masaka p nante/towa*] is not. This suggests that the epistemic state of the speaker of (ia) at the utterance time differs from that of the speaker of (ib). The current approach captures this by postulating that the temporal argument involved in the modal base refers to different times.

operators. What is puzzling, however, is the following case, in which *hazu-nai* is embedded under a polar question in addition to *masaka*:

(37) *Masaka ame-ga huttei-ru hazu-nai no?*
masaka rain-NOM falling-PRES should-NEG.PRES Q
'Shouldn't it be raining, by any chance?'

Intuitively, (37) expresses the speaker's bias for the modalized claim ¬*hazu-nai*(**rain**), not for **rain**. This interpretation is obtained if *masaka* is interpreted above the co-occurring modal *hazu-nai*:

(38) $[\![(37)]\!] = [\![\text{Q}]\!]([\![\textit{masaka}]\!]([\![\textit{hazu-nai}]\!]([\![\textbf{rain}]\!])))$.
$[\![\textit{masaka}]\!]([\![\textit{hazu-nai}]\!]([\![\textbf{rain}]\!]))$
$= \lambda w.\ \textit{hazu-nai}(\textbf{rain})(w) \bullet \exists S[\text{BEST}(f, g, w) \subseteq S \wedge \forall w'[w' \in S \rightarrow \neg \textit{hazu-nai}(\textbf{rain})(w')]]$.
$[\![\text{Q}]\!]([\![\textit{masaka}]\!]([\![\textit{hazu-nai}]\!]([\![\textbf{rain}]\!])))$
$= \{\lambda w.\textit{hazu-nai}(\textbf{rain})(w), \lambda w.\neg \textit{hazu-nai}(\textbf{rain})(w)\} \bullet \exists S[\text{BEST}(f, g, w) \subseteq S \wedge \forall w'[w' \in S \rightarrow \neg \textit{hazu-nai}(\textbf{rain})(w')]]$

However, if *masaka* is interpreted under *hazu-nai*, (37) should have the implication that the speaker is biased for ¬**rain** not for ¬*hazu-nai*(**rain**):

(39) $[\![(37)]\!] = [\![\text{Q}]\!]([\![\textit{hazu-nai}]\!]([\![\textit{masaka}]\!]([\![\textbf{rain}]\!])))$
$[\![\textit{hazu-nai}]\!]([\![\textit{masaka}]\!]([\![\textbf{rain}]\!]))$
$= \lambda w.\ \textit{hazu-nai}(\textbf{rain})(w) \bullet \exists S[\text{BEST}(f, g, w) \subseteq S \wedge \forall w'[w'' \in S \rightarrow \neg \textbf{rain}(w'')]]$.
$[\![\text{Q}]\!]([\![\textit{hazu-nai}]\!]([\![\textit{masaka}]\!]([\![\textbf{rain}]\!])))$
$= \{\lambda w.\textit{hazu-nai}(\textbf{rain})(w), \lambda w.\neg \textit{hazu-nai}(\textbf{rain})(w)\} \bullet \exists S[\text{BEST}(f, g, w) \subseteq S \wedge \forall w'[w'' \in S \rightarrow \neg \textbf{rain}(w'')]]$.

Why (37) seems to lack the interpretation in (39) is a remaining issue.

Finally, as with *koto*-clauses, *masaka* is not readily embedded under conditionals (*mosi* is an element that marks the beginning of the conditional clause):

(40) *Mosi (??masaka) ame-ga huttei-ru hazu-nai nara, ie-ni*
mosi (masaka) rain-NOM falling-PRES should-NEG.PRES COND home-to
kaeri-tai.
go.back-want
'(Intended) If by any chance it cannot be raining, I want to go home.'

However, there are (at least marginally) acceptable cases in which *masaka* is embedded under conditionals:[15]

(41) *(?) Mosi masaka John-ga kuru-to-iu nara, paatii-wa moriagaru daroo.*
mosi masaka John-NOM come-COMP-say COND party-TOP get.exciting will.
'(Approx.) If John were to come, the party would get exciting.'

[15]The configuration *to-iu* does not license *masaka* in the matrix clause. It is to be explored in future research why *to-iu* improves the acceptability of *masaka* only in conditional clauses:
(i) *#Masaka ame-ga huttei-ru to-iu.*
masaka rain-NOM falling-PRES COMP-say
'(Intended) It could be raining.'

This sentence implies that the speaker is almost certain that John will not come, which means that *masaka*'s contribution is passed up to the matrix level.

In summary, *masaka*'s projection property is difficult to describe straightforwardly. The bottom line is that it is not unreasonable to posit that *masaka*'s semantics involves certain kinds of not-at-issueness, given that its contribution projects to the global level in cases such as (9), (37), and (41).

6. Conclusion

We proposed a tentative analysis of *masaka* that accounts for its peculiar properties: i) *masaka* requires a negated epistemic modal to co-occur in the same clause, and ii) *masaka* is licensed in polar questions, but not in *wh*-questions. In our analysis, *masaka* takes a proposition and encodes a strong modalized claim that the proposition is false at the not-at-issue level, while leaving the proposition intact at the at-issue level.

However, three major issues remain unsolved. First, *masaka* is licensed using negated epistemic attitude verbs. To accommodate this case, *masaka*'s modality must be more flexible in referring to the epistemic/doxastic state of agents other than the speaker. Second, the exclamative markers *nante* and *towa* license *masaka*, and the resulting sentence entails that the prejacent is true, which is incompatible with *masaka*'s modality. We suggested that this problem can be solved by assuming that *nante/towa* operates on the temporal information involved in the modal base of *masaka*. Finally, it was demonstrated that *masaka* shows complicated projection patterns.

Appendix: [*nai hazu-da*] $\neq$ [*hazu-nai*]

In Section 3, we analyze the negation *nai* in (5b), repeated here as (42a), as associated with the prejacent *ame-ga huttei-ru* 'It is raining', not with the modal *hazu-da*. Therefore, (42a) is composed as in (42b), resulting in a contradiction between the truth of the prejacent at the at-issue level and the negative modality at the not-at-issue level.

(42) a. #*Masaka ame-ga huttei-nai hazu-da.*
masaka rain-NOM falling-NEG.PRES should-COP
'(Approx.) Possibly, it should not be raining.'

b. $[\![\textit{hazu}]\!]([\![\textit{masaka}]\!]([\![\neg \mathbf{rain}]\!]))$
$= \lambda w.\ \forall w'[w' \in \text{BEST}(f, g, w) \rightarrow \neg \mathbf{rain}(w')] \bullet \exists S[\text{BEST}(f, g, w) \subseteq S \wedge \forall w'[w' \in S \rightarrow \mathbf{rain}(w')]]$.

However, an anonymous reviewer wonders why we have excluded the possibility that the negation *nai* in (42a) is associated with *hazu*. If this is possible, (42a) will have the same interpretation as (3), repeated below as (43), which is a felicitous example:

(43) *Masaka ame-ga huttei-ru hazu-nai.*
masaka rain-NOM falling-PRES should-NEG.PRES
'It should NOT be raining.'

We claim that *nai* in (42a) cannot target the higher modal *hazu* for syntactic reasons; therefore,

(42a) cannot be interpreted on a par with (43).

It is well-known that in Japanese, when a universal quantifier marked with the case particle *-ga* is in the subject position, the clause-mate negation cannot scope over the subject:

(44) *Zen'in-ga kyoositu-ni i-nai.* [$\forall > \neg$ / *$\neg > \forall$]
everyone-NOM classroom-in be-NEG.PRES
'Everyone is not in the classroom.'

Crucially, [*nai hazu-da*] and [*hazu-nai*] exhibit different scopal patterns with respect to their interactions with a universal quantifier:

(45) a. *Zen'in-ga kyoositu-ni i-nai hazu-da.* [$\forall > \neg$ / *$\neg > \forall$]
everyone-NOM classroom-in be-NEG.PRES should-COP
'Everyone should not be in the classroom.'
b. *Zen'in-ga kyoositu-ni i-ru hazu-nai.* [$\forall > \neg$ / $\neg > \forall$]
everyone-NOM classroom-in be-PRES should-NEG.PRES
'Not everyone should be in the classroom'

Given these observations, we claim that *hazu* takes a clause containing its prejacent as its complement as follows:

(46) a. The structure of (45a): [[*Zen'in-ga kyoositu-ni i-nai*] *hazu-da*]
b. The structure of (45b): [[*Zen'in-ga kyoositu-ni i-ru*] *hazu-nai*]

The unavailability of the $\neg > \forall$ reading in (45a) follows straightforwardly from the fact that the universal quantifier in the subject position and the negation *nai* are clause-mates and the latter cannot scope over the former just as in (44). We further claim that the universal quantifier cannot scope over negation in (45b) because of the Complex NP Constraint (CNPC) violation in Japanese. This is empirically supported by the fact that case particles can be attached to the *hazu*-clause, which is one of the traits of nominal argument-hood in Japanese:[16, 17]

(47) *Ame-ga huttei-ru hazu-ga-nai.*
rain-NOM falling-PRES should-NOM-NEG.PRES
'It should not be raining.'

It naturally follows that the negation in (42a) cannot target the higher modal *hazu* because the two items are in different clauses, which leads to the fact that (42a) cannot have the felicitous interpretation that (43) has.[18]

[16]This conjecture is in line with the traditional description of *hazu*, which says that *hazu* is a *keisiki meisi* 'formal noun' that expresses a high probability. This means that the clause preceding *hazu* is some kind of content clause, which blocks extraction.

[17]The availability of the $\forall > \neg$ reading in (45b) can be attributed to the fact that it is a special case of the $\neg > \forall$ reading.

[18]The argument here is further supported by the interaction between negation and existential quantifiers. As with universal quantifiers, *ga*-marked subject existential quantifiers obligatorily has wider scope over the clause-mate negation:

(i) *Dareka-ga kyoositu-ni i-nai.* [$\exists > \neg$ / *$\neg > \exists$]
someone-NOM classroom-in be-NEG.PRES
'Someone is not in the classroom.'

Here, [*nai hazu-da*] and [*hazu-nai*] show different patterns as to scopal interactions with the existential quantifier:

This claim is compatible with the interactions between quantifiers and [*nai*-daroo]. Recall that it licenses *masaka*:

(48) *Masaka ame-ga huttei-nai-daroo.* (=(6))
masaka rain-NOM falling-NEG.PRES-will
'It must NOT be raining.'

The felicity of this example suggests that the negation is associated not with the prejacent but with *daroo*, despite of *nai* being located to the left of *daroo*. This means that, unlike the case of *hazu*, there is no clause boundary between *nai* and *daroo*.

Then, it is predicted that when [*nai-daroo*] co-occurs with a universal quantifier in the subject position, the latter scopes over the former because there is no clause boundary between the two. This is borne out:[19]

(49) *Zen'in-ga kyoositu-ni i-nai-daroo* [$\forall > \neg$ / $*\neg > \forall$]
everyone-NOM classroom-in be-NEG.PRES-will
'Everyone must not be in the classroom.'

In summary, the configuration [*nai hazu-da*] cannot have the same semantics as [*hazu-nai*] because *nai* and *hazu* in [*nai hazu-da*] are contained in different clauses. Meanwhile, *nai* in [*nai-daroo*] can target *daroo* because they are in the same clause.

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(ii) a. *Dareka-ga kyoositu-ni i-nai hazu-da.* [$\exists > \neg$ / $*\neg > \exists$]
someone-NOM classroom-in be-NEG.PRES should-COP
'Someone should not be in the classroom.'
b. *Dareka-ga kyoositu-ni i-ru hazu-nai.* [$\exists > \neg$ / $\neg > \exists$]
someone-NOM classroom-in be-PRES should-NEG.PRES
'No one should be in the classroom'
These patterns can also be explained if we posit the same structures as in (46).

[19]Given f.n. 17, it is also predicted that [*nai-daroo*] scopes under existential quantifiers, which is borne out:
(i) *Dareka-ga kyoositu-ni i-nai-daroo* [$\exists > \neg$ / $*\neg > \exists$]
someone-NOM classroom-in be-NEG.PRES-will
'Someone must not be in the classroom.'

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Projection variation: Is the family of sentences really a family?[1]

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Abstract. Under the 'family of sentences' diagnostic for projection, the projection of content is investigated by embedding the expression that contributes the content in the scope of negation, polar questions, epistemic possibility modals, and conditional antecedents. This paper reports on the results of a set of experiments designed to investigate whether there is variation in the projection of content from under these four types of entailment-canceling operators. The contents investigated are the contents of the complements of 20 English clause-embedding predicates. The results of the experiments suggest (i) that the by-operator variation is small when aggregating over the 20 contents, but (ii) that the effect of operator differs between the clause-embedding predicates. The results of these experiments also extend a result of Degen and Tonhauser 2022, that projection ratings in polar questions do not categorically distinguish factive from non-factive predicates, to cases with negation, the epistemic possibility modal *perhaps*, and conditional antecedents. The observed by-predicate and by-operator variation is not captured by existing theoretical accounts of projection (e.g., Heim 1983, van der Sandt 1992, Abrusán 2011, Schlenker 2021). Our results suggest that an empirically adequate projection analysis must consider interactions between predicates and operators.

Keywords: Projection variation, entailment-canceling operators, (non)factive predicates.

1. Introduction

The 'family of sentences' diagnostic is the standard way of diagnosing whether a content is projective (e.g., Chierchia and McConnell-Ginet 1990). For instance, in (1), the content of the clausal complement of *discover* (that Julian dances salsa) is diagnosed as projective content, if it is typically implied not just by an utterance of (1), but also by utterances of the variants in (2), where (1) is embedded under an entailment-canceling operator, such as negation (2a), a polar question (2b), an epistemic possibility modal (2c), or in a conditional antecedent (2d).

(1) Cole discovered that Julian dances salsa.

(2) a. **Negation:** Cole didn't discover that Julian dances salsa.
b. **Polar Question:** Did Cole discover that Julian dances salsa?
c. **Modal:** Perhaps Cole discovered that Julian dances salsa.
d. **Conditional:** If Cole discovered that Julian dances salsa, Logan will be joyful.

Some research, however, suggests that entailment-canceling operators may affect projection differentially. For instance, Karttunen (1971) proposed distinguishing English factive predicates (e.g., *regret*) from semi-factives (e.g., *discover*). Based on (3), he argued that the content

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of the complement (CC) of true factives consistently projects across the operators in (2), but that of semi-factives does not always project from under polar questions, modals, or conditionals.

(3) Karttunen 1971: (22, 24–26)
   a. John didn't {regret/discover} that he had not told the truth.
   b. Did you {regret/discover} that you had not told the truth?
   c. If I {regret/discover} later that I have not told the truth, I will confess it to everyone.
   d. It is possible that I {regret/discover} later that I have not told the truth.

There have been two experimental investigations of by-operator projection variation. First, Smith and Hall (2014) investigated projection from under negation and conditional antecedents for various types of English projective contents. They found that the expressive content of epithets (e.g., *idiot*) and the CC of *know* was more projective under negation than conditionals. In contrast, the content of appositive relative clauses and the preparatory content of *win* showed the opposite pattern, and the existential presupposition of clefts showed no difference. Second, Sieker and Solstad (2022) compared the projection of the CCs of German factives (*wissen* 'know', *bereuen* 'regret', *enthüllen* 'reveal') and semi-factives (*bemerken* 'notice', *entdecken* 'discover', *herausfinden* 'find out') from under the four operators in (2). Their results suggest that the CCs project more from under negation than from under the other three operators. Contrary to what Karttunen (1971) suggested, a comparison of the factive and semi-factive predicates did not reveal that the CCs of factive predicates project more from under polar questions, modals, or antecedents of conditionals than the CCs of semi-factive predicates.[2]

This paper reports on the results of a set of experiments that were designed to compare projection from under the four entailment-canceling operators in (2) in English. Our experiments extend the empirical scope of prior research on by-operator projection variation by investigating projection for a larger set of contents, namely the contents of the complements of the 20 English clause-embedding predicates in (4), from Degen and Tonhauser (2022).

(4) a. (Semi-)factive predicates: *be annoyed, know, reveal, discover, see*
   b. Non-factive predicates: *acknowledge, admit, announce, confess, confirm, establish, hear, inform, prove, be right, demonstrate, pretend, say, suggest, think*

The five predicates in (4a) have been characterized as factive or semi-factive. Our set of predicates also includes the 15 non-factives in (4b). Including non-factive predicates in investigations of projection is motivated by the empirical investigations in de Marneffe et al. 2019 and Degen and Tonhauser 2022, which suggest that the CCs of non-factives may also project and that projection ratings do not categorically distinguish factive and non-factive predicates.

The results of our investigation suggest that the projection of the CCs of these 20 predicates is affected differently by the four entailment-canceling operators in (2), but not in a way that is consistent with Karttunen's 1971 factive/semi-factive distinction. The results also replicate a result of Degen and Tonhauser 2022, namely that projection from under polar questions does not categorically distinguish factive and non-factive predicates. We also extend this result to projection from under the other three entailment-canceling operators, thereby solidifying their

[2]The factive/semi-factive distinction is also called into question by naturally occurring examples where the CCs of factive predicates do not project from under the four operators (see Beaver 2010, de Marneffe, Manning, and Potts 2012, de Marneffe, Simons, and Tonhauser 2019). For experimental research on the distinction, see Djärv, Zehr, and Schwarz 2018.

claim that "research on projective content has a much broader empirical scope than previously assumed" (p.585), as this scope includes the CCs of both factive and non-factive predicates.

2. Experiments

To assess the effect of entailment-canceling operator and clause-embedding predicate on projection, we collected projection judgments for the CCs of the 20 clause-embedding predicates in four sets of experiments. The predicates were embedded under negation in Exps. 1, under polar questions in Exps. 2, under the epistemic possibility modal *perhaps* in Exps. 3, and in conditional antecedents in Exps. 4. Each set of experiments contained three experiments that differed in the at-issueness measure that was used in a separate block. In this paper, we limit our attention to the projection ratings collected in these twelve experiments.[3]

In all twelve experiments, projection was measured with the 'certain that' diagnostic, which has been used to measure projection with both polar interrogative and declarative sentences (see, e.g., Tonhauser 2016, Stevens, de Marneffe, Speer, and Tonhauser 2017, Tonhauser, Beaver, and Degen 2018, Mahler 2019, Djärv and Bacovcin 2020, Mahler 2020, de Marneffe et al. 2019, Sieker and Solstad 2022).[4] Under this diagnostic, participants are presented with utterances like those in (5), and asked to rate whether the (named) speaker is certain of the CC.

(5) a. Christopher: "Cole didn't discover that Julian dances salsa."
b. Christopher: "Did Cole discover that Julian dances salsa?"
c. Christopher: "Perhaps Cole discovered that Julian dances salsa."
d. Christopher: "If Cole discovered that Julian dances salsa, Logan will be joyful."
Projection question: Is Christopher certain that Julian dances salsa?

We assume, following Tonhauser et al. 2018 and Degen and Tonhauser 2022, that judgments of speaker certainty about the embedded content reflect speaker commitment to that content, that is, projection. If a participant interprets utterances like (5a–d) in a way that the speaker (here, Christopher) is certain of the CC, the CC is assumed to project. If a participant does not take the speaker to be certain of the CC, the CC is taken to not project.

Participants. We recruited 250-300 participants for each of the 12 experiments. Participants for one experiment were recruited on Amazon's Mechanical Turk platform. These participants were required to have U.S. IP addresses and at least 99% of previously approved HITs. Participants for the remaining experiments were recruited on Prolific. These participants were required to reside in the US, to be born in the US, to have English as their first language, and to have an approval rating of at least 99%. See Supplement D (in the repository linked to in footnote 3) for further information about the participants.

Materials. The target sentences consisted of the 400 combinations of the 20 clause-embedding predicates in (4) with 20 embedded clauses (provided in Supplement A). As mentioned

[3]The experiments, data and analysis scripts, as well as the supplements referred to in this paper can be found in the following GitHub repository: `https://github.com/judith-tonhauser/CommitmentBankPlus`.
[4]For other diagnostics of projection see, e.g., Smith and Hall 2011, Xue and Onea 2011, and Tonhauser, Beaver, Roberts, and Simons 2013, and discussion in Tonhauser et al. 2018.

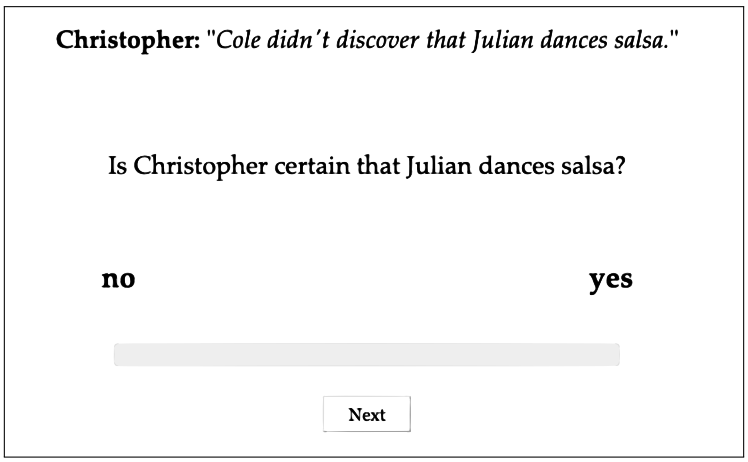

Figure 1: A sample trial from Exps. 1 (negation). In the other experiments, participants were presented with utterances with a different entailment-canceling operator.

above, the predicates were embedded under negation in Exps. 1, under polar questions in Exps. 2, under the epistemic possibility modal *perhaps* in Exps. 3, and in conditional antecedents in Exps. 4, for a total of 400 target stimuli in each of the four sets of experiments. To assess whether participants were attending to the task, each experiment included six control stimuli. For details on the six control stimuli, see Supplement C.

Each participant saw a random set of 26 stimuli: Each set contained one target stimulus for each of the 20 clause-embedding predicates (each with a unique complement clause) and the same six control stimuli.[5] Trial order was randomized.

Procedure. Participants were asked to imagine that they are at a party and that, when walking into the kitchen, they overhear somebody say something to somebody else. On each trial, they read an utterance and gave a response to the 'certain that' question on a slider marked 'no' (coded as 0) at one end and 'yes' (coded as 1) at the other. A sample trial is shown in Figure 1. Following Tonhauser et al. 2018, higher ratings of speaker certainty could reflect one of two things. First, higher certainty ratings could reflect greater speaker commitment towards the CC, and therefore greater projection. This assumes that speaker commitment is interpreted in a gradient way. Second, higher certainty ratings could reflect a higher probability that an interpreter takes the speaker to be committed to the CC. On this interpretation, speaker commitment may be a binary, categorical property and projection variation is a result of uncertainty about speaker commitment. In this paper, we remain agnostic about the underlying interpretation of projection as a gradient property (for discussion, see Grove and White 2023).

At the end of the experiment, participants filled out a short optional demographic survey. To encourage truthful responses, they were told that they would be paid no matter what answers they gave in the survey.

Data exclusion. Data were excluded based on self-declared non-native speaker status and other criteria given in Supplement D. The data from 2,682 participants entered into the analysis.

[5]Each participant saw their set of 26 stimuli twice, once in the projection block and once in the at-issueness block. Block order was randomized. As mentioned above, we focus here on the projection ratings.

3. Results and discussion

We first address by-operator variation (Section 3.1) and then the question of whether there is by-predicate variation in the observed by-operator variation (Section 3.2). Finally, in Section 3.3, we relate our results to those of Degen and Tonhauser 2022, that projection from under polar questions does not categorically distinguish factive and non-factive predicates.

3.1. By-operator variation

Figure 2 shows the mean certainty ratings by entailment-canceling operator, aggregating over the clause-embedding predicates. As shown, there is projection variation by operator: The CCs of the clause-embedding predicates were relatively more projective when embedded in the antecedent of a conditional than in a polar interrogative, where they were relatively more projective than when they were embedded under negation or the epistemic modal *perhaps*.

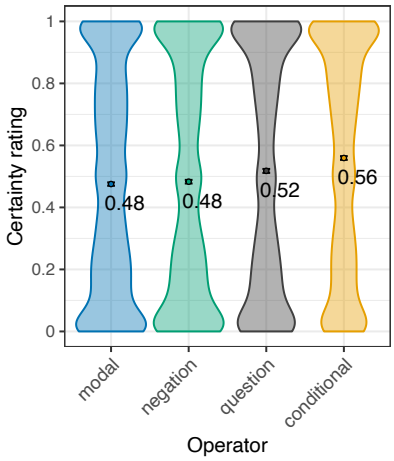

Figure 2: Mean certainty ratings by operator. Error bars indicate 95% bootstrapped confidence intervals. Violin plots indicate the kernel probability density of participants' individual ratings.

These observations are supported by a post-hoc pairwise comparison of the estimated means for each entailment-canceling operator using the `emmeans` package (Lenth 2023) in R (R Core Team 2016). The input to the pairwise comparison was a Bayesian mixed-effects beta regression model that was fit using the `brms` package (Bürkner 2017) with weakly informative priors. The model predicted certainty ratings[6] from a fixed effect of entailment-canceling operator (with treatment coding and 'modal' as the reference level) and included a random by-predicate intercept.[7] The output of the pairwise comparison were 95% highest density intervals (HDIs) of estimated marginal mean differences between each of the operators. We assume that two operators differ in certainty ratings if the HDI of their pairwise comparison does not include 0.

Table 1 provides the output of the pairwise comparison on a logit scale. As shown, the analysis suggests differences between each pair of operators. That is, certainty ratings are higher for

[6]To model the certainty ratings using a beta regression, the ratings were first transformed from the interval [0,1] to the interval (0,1) using the method proposed in Smithson and Verkuilen 2006.
[7]See Supplement E for details on the model.

CCs embedded in conditional antecedents than those embedded under polar questions, certainty ratings for CCs embedded under polar questions are higher than those for CCs embedded under negation, and finally certainty ratings for CCs embedded under negation are higher than those for CCs embedded under the epistemic modal *perhaps*.

contrast	estimate	lower 95% CrI	upper 95% CrI
conditional - negation	0.21	0.18	0.24
conditional - question	0.13	0.10	0.16
modal - conditional	-0.26	-0.29	-0.23
modal - negation	-0.05	-0.08	-0.02
modal - question	-0.14	-0.17	-0.11
negation - question	-0.09	-0.12	-0.06

Table 1: Output of the pairwise comparison of entailment-canceling operators. The 'contrast' column identifies entailment-canceling operators pairs, 'estimate' the estimated marginal mean difference, and 'lower/upper 95% CrI' provide the lower/upper bounds of the HDIs.

These results suggest that certainty ratings for the CCs of the English clause-embedding predicates we investigated vary by entailment-canceling operator. In contrast to Sieker and Solstad 2022 for German, the results of our experiments do not suggest that projection is strongest from under negation. Recall, however, that they only investigated projection of the CCs of (semi-) factive predicates. Since there is by-predicate variation in the effect of entailment-canceling operator on projection (as we show in the next section), this difference between the results of their experiment and ours might be due to the types of predicates investigated. Finally, the differences in mean certainty ratings between the four entailment-canceling operators are very small. This suggests that, when abstracting away from individual predicates and contents, projection from under the four entailment-canceling operators is very similar. In other words, when abstracting away from individual contents, the family of sentences really are a family.

3.2. By-predicate variation in the effect of entailment-canceling operator

Figure 3 shows mean certainty ratings by entailment-canceling operator for the 20 predicates, with predicates ordered by their overall mean certainty rating. As shown, there is by-operator projection variation for each predicate. Further, the effect of operator differs between predicates. For instance, the five (semi-)factive predicates (highlighted in pink) exhibit four different patterns. First, the CC of *be annoyed* projects most from under questions, less from under negation, followed by conditionals, and least from under the modal *perhaps* (Q > N > C > M).[8] Second, the CC of *know* projects most from under questions, less from conditionals and negation, and least from under *perhaps* (Q > {N, C} > M). The CCs of *discover* and *see* exhibit a third pattern: They project most from under questions and conditionals, less from under negation, and least from under *perhaps* ({Q, C} > N > M). Finally, the CC of *reveal* projects most from conditionals, less from questions, and least from under negation and *perhaps* (C >

[8]Under this notation, > indicates a non-zero difference between two adjacent levels of operator, when operators are ordered by mean projection ratings.

Q > {M, N}). Thus, the CCs of none of our (semi-)factive predicts project uniformly from under all four entailment-canceling operators (contrary to what Karttunen 1971 suggested for factive predicates) and the purported semi-factive predicates *discover* and *reveal* do not project more from under negation than the other three entailment-canceling operators.

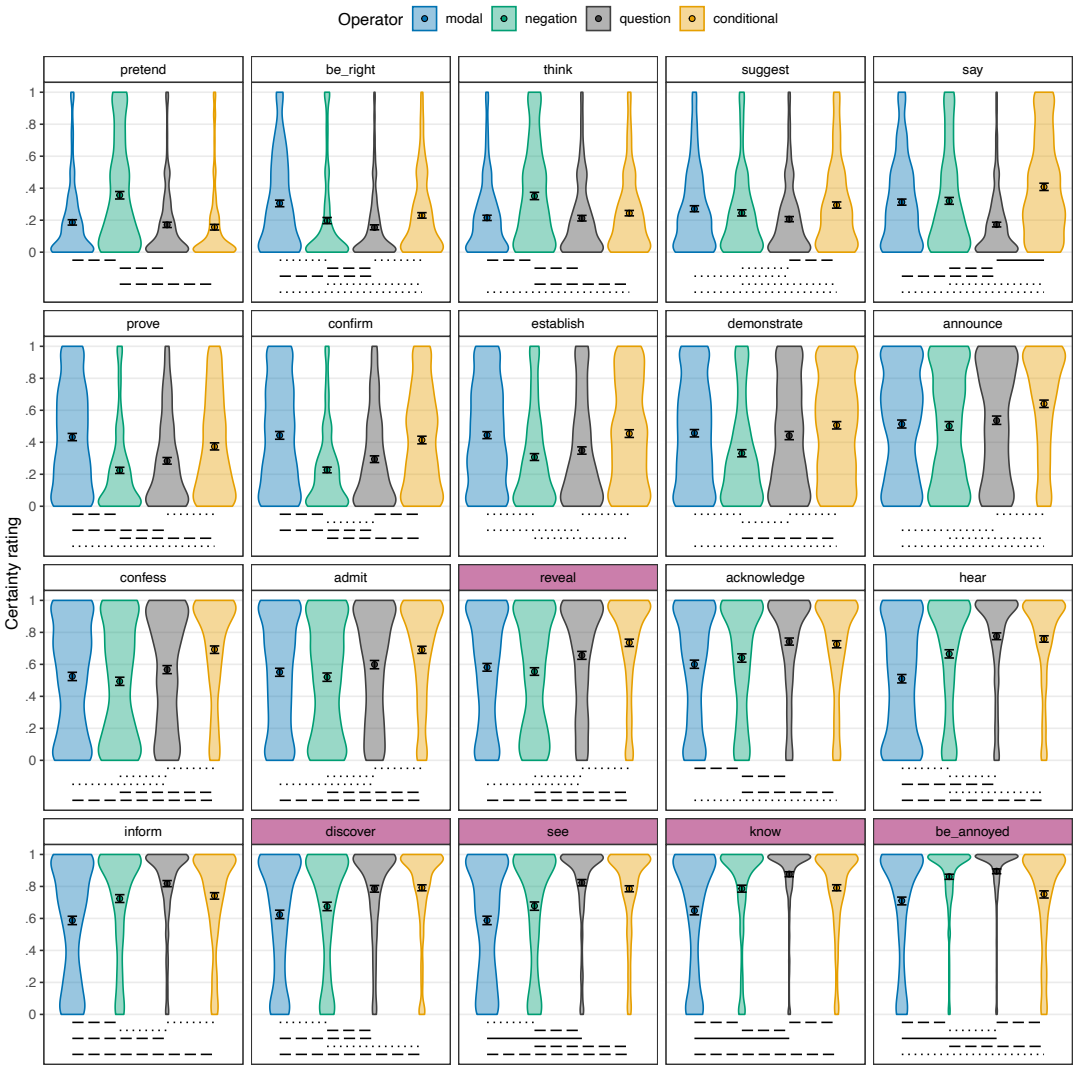

Figure 3: Mean certainty ratings by predicate ((semi-)factive, non-factive) and operator (modal, negation, polar questions, conditional antecedents) with 95% bootstrapped confidence intervals. Violin plots indicate kernel probability density of individual participants' ratings. Predicate facets are ordered by the predicate mean certainty rating (aggregating across operators). Below each facet, a line spanning two operators indicates a non-zero difference according to the pairwise comparison of operators. The line type indicates whether the difference d is ≥ 1 (solid line: —), $0.5 \leq d < 1$ (dashed line: – –), $0 \leq d < 0.5$ (dotted line: . . .).

We also observe by-operator projection variation for non-factive predicates. Some of this variation aligns with that observed for factive predicates: For instance, the CC of *inform* exhibits the same pattern as the CC of *know*, and the CC of *hear* the same pattern as those of *discover* and *see*. Other non-factive predicates exhibit other patterns: The CCs of *admit*, *confess* and *announce* project most from the conditional antecedents than the other three operators.

These observations are supported by post-hoc pairwise comparisons of the estimated means for each entailment-canceling operator within each predicate using the `emmeans` package (Lenth 2023). The input to the pairwise comparisons for each predicate were 20 Bayesian mixed-effects beta regression models that were fit using the `brms` package (Bürkner 2017) with weakly informative priors. The models for each predicate predicted certainty ratings[9] from a fixed effect of entailment-canceling operator (with treatment coding and 'modal' as the reference level) and included a random by-item intercept and a random slope for operator by item.[10] The output of the pairwise comparisons were 95% highest density intervals (HDIs) of estimated marginal mean differences between each of the operators for each predicate. We assume that two operators differ in certainty ratings for a given predicate if the HDI of their pairwise comparison does not include 0. These non-zero differences between two operators are indicated by lines spanning the two operators below each predicate facet in Figure 3.

Our findings align with those of Smith and Hall 2014, who also observed by-expression variation in the effect of operator. However, while they found that the CC of *know* projects more from under negation than the antecedent of a conditional, we did not find a difference here. We hypothesize that this difference is due to the difference in projection diagnostic used. Our results differ, however, from those of Sieker and Solstad 2022. While their work did not find differences in by-operator projection variation between factive and semi-factive predicates, our results suggest four different patterns of by-operator variation for the five (semi-)factive predicates. As Sieker and Solstad 2022 also used the 'certain that' diagnostic for projection, this difference in results is not likely due to the projection diagnostic. Other factors that varied between our experiments are the language under investigation (German vs. English), the clause-embedding predicates investigated, and the CCs that the predicates were paired with. Future research will need to establish which of these factors are implicated in the observed differences.

3.3. Factive vs. non-factive predicates

Lexical approaches to projection assume that factive predicates are ones that presuppose the CC, while the CC of non-factive predicates is not presupposed (e.g., Kiparsky and Kiparsky 1970, Karttunen 1971, Schlenker 2009, Abrusán 2011).[11] Because presuppositions are assumed to typically project from under entailment-canceling operators, this definition predicts that factive predicates are distinguished from non-factives by the projection of their CCs: The CCs of factive predicates are expected to be categorically more projective than those of non-factives. This expectation was investigated in Degen and Tonhauser 2022 based on the 20 clause-embedding predicates in (4) embedded in polar questions. Contrary to expectation, Degen and Tonhauser's 2022 Exps. 1 found that the CCs of the five (semi-)factive predicates varied in projection, that the CCs of the 15 non-factive predicates were projective compared to the non-projective main clause contents, and that the CCs of some non-factives were as projective, or even more projective, than those of some factive predicates. In short, projection of

[9] To model the certainty ratings using a beta regression, the ratings were first transformed from the interval [0,1] to the interval (0,1) using the method proposed in Smithson and Verkuilen 2006.

[10] See Supplement F for further details on the models.

[11] Some of these works additionally assume that the CC of factive predicates is entailed. For details see Degen and Tonhauser 2022.

the CC from under polar questions did not categorically distinguish factive from non-factive predicates. Further support for this result came from analyses of projection ratings in three additional datasets, namely the CommitmentBank (de Marneffe et al. 2019), the VerbVeridicality dataset (Ross and Pavlick 2019), and the MegaVeridicality dataset (White and Rawlins 2018).

The results of the experiments reported on in this paper replicate Degen and Tonhauser's 2022 result. As shown in Figure 4a, there is variation between the five (semi-)factive predicates in the polar question condition, and projection from under polar questions does not categorically distinguish factive from non-factive predicates. Furthermore, our results suggest that this result can be extended to the three other entailment-canceling operators. As shown in Figures 4b-4d, there is variation in the projection of the CCs of the five (semi-)factive predicates from under *perhaps*, negation, and conditional antecedents, and projection ratings in these conditions do not show a categorical difference between factive and non-factive predicates either. These results lend further support to the conclusion of Degen and Tonhauser 2022 that there is, to date, no empirical evidence for a coherent class of factive predicates.

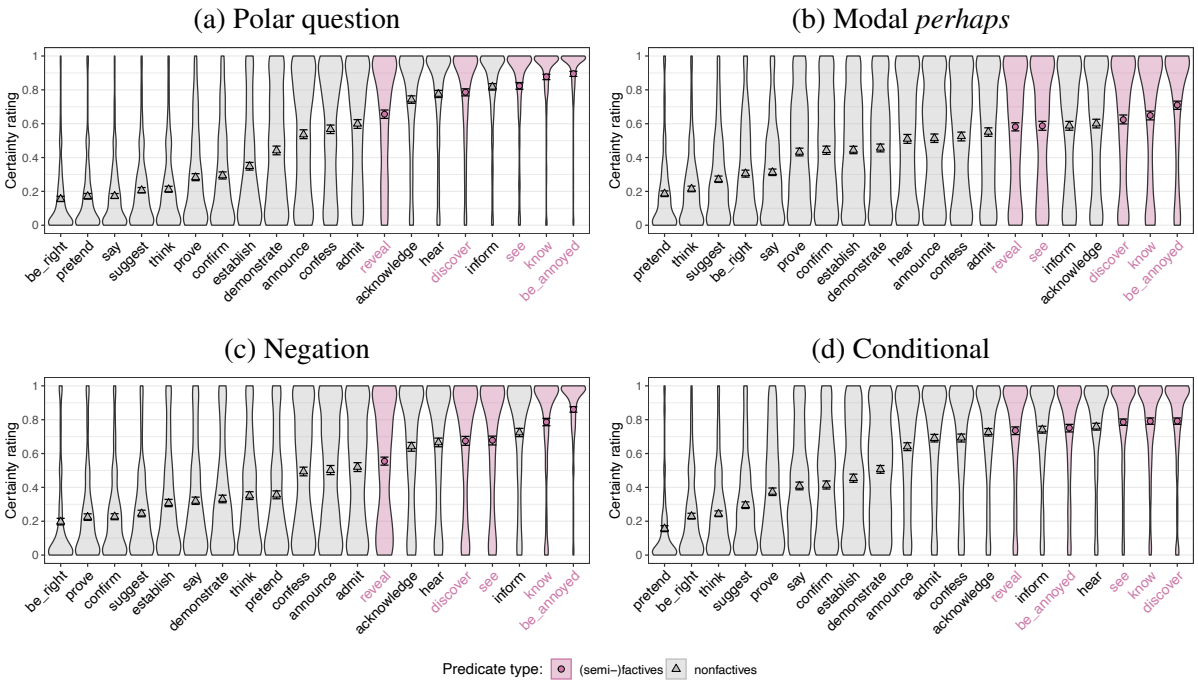

Figure 4: Mean certainty ratings by predicate, with (semi-)factive predicates in pink, for (a) polar questions, (b) the modal *perhaps*, (c) negation, (d) conditional antecedents. Error bars indicate 95% bootstrapped confidence intervals. Violin plots indicate kernel probability densities of the individual participants' ratings.

3.4. Summary

The results of our experiments suggest that there is little by-operator variation when aggregating over clause-embedding predicates, but that the CCs of different clause embedding predicates exhibit by-operator projection variation. Crucially, the effect of operator on projection differs by predicate, but not in ways that align with prior claims about differences between factive and semi-factive predicates (e.g., Karttunen 1971). Finally, the results of our experiments provide

further support for the results of Degen and Tonhauser 2022, who did not find empirical support for a class of factive predicates based on the projection of the CC from under polar questions. Our experiments suggest that projection of the CC from under negation, the antecedent of conditionals and epistemic modals also do not provide empirical support for a natural class of factive predicates. Before discussing the methodological and theoretical implications of these results in Section 5, we provide converging evidence from a different dataset in Section 4.

4. Converging evidence for the by-predicate variation in the effect of operator

We provide converging evidence for the by-predicate variation in the effect of operator based on the MegaVeridicality dataset (White and Rawlins 2018). This dataset contains projection ratings for the CCs of 517 English clause-embedding predicates. As shown in (6) for *know*, the predicates were combined with (what the authors refer to as) "low lexical content". The predicates were embedded under negation as in (6a), in the antecedent of a conditional as in (6b), and under negation in the antecedent of a conditional as in (6c). To assess projection, participants were asked to respond to the question *did that thing happen?*. The response options were 'yes' (indicating projection), 'maybe or maybe not', and 'no' (no projection).

(6) a. Somebody didn't know that a particular thing happened. Did that thing happen?
b. If somebody knows that a particular thing happened, did that thing happen?
c. If somebody didn't know that a particular thing happened, did that thing happen?

To investigate by-predicate projection variation, we recoded the responses as 1 ('yes'), -1 (no), and 0 'maybe or maybe not'). We calculated the mean projection ratings for 25 predicates under the three types of operator combinations shown in (6). We used the 14 non-factive and 5 factive predicates from our experiments that are in MegaVeridicality (*be right* is not included). As Djärv et al. 2018 suggested that the factive/semi-factive distinction can be understood as a difference between cognitive and emotive predicates, we included the emotive (*be disappointed*, *be surprised*) and cognitive (*realize*, *find out*) predicates from their experiments that are in MegaVeridicality. We also added two other predicates suggested by Karttunen as factive (*regret*) and semi-factive (*notice*).

Figure 5 shows mean projection ratings by embedding operator(s) and predicate. As shown, the effect of operator varies by predicate: For many, though not all, predicates, ratings are (at least numerically) lower when embedded under negation, or under negation and in a conditional antecedent, than when embedded in a conditional antecedent. In addition, there is by-predicate variation in the effect of entailment-canceling operator. For instance, the CCs of *acknowledge* and *hear* are more projective (at least numerically) when embedded under negation than when embedded under negation and in a conditional antecedent. The CCs of *demonstrate* and *prove*, on the other hand, exhibit the opposite pattern.[12] These observations suggest that there is by-predicate variation in the effect of entailment-canceling operator even when projection ratings are collected with a different measure and different materials than in our experiments.

[12] As discussed in White and Rawlins 2018: §3.2, the question in (6a) measures projection or, rather, global accommodation, given that the relevant content is not entailed by the common ground. However, since the predicates are embedded in conditional antecedents in stimuli like (6b) and (6c), and the questions that participants respond to in the conditional consequents, (6b) and (6c) might measure local accommodation of the content in the scope of the conditional antecedent. This does not change the point we make in this section, namely that the MegaVeridicality data suggest that there is by-predicate variation in the effect of entailment-canceling operator.

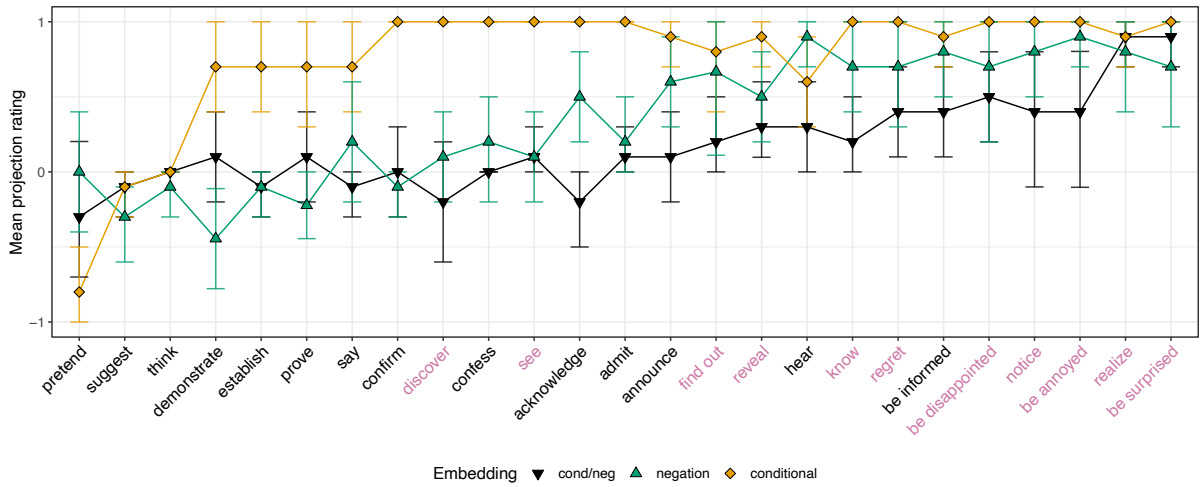

Figure 5: Mean projection ratings by entailment-canceling operator(s) and predicate in the MegaVeridicality dataset. Error bars indicate 95% bootstrapped confidence intervals.

5. General discussion

We now point out methodological implications of our results (Section 5.1), discuss whether contemporary projection analyses can capture the observed variation (Section 5.2), and speculate about lexical differences between the clause-embedding predicates that might predict the by-operator variation observed (Section 5.3).

5.1. Methodological implications

The results of the experiments reported on in Section 2 suggest that there is little by-operator projection variation when aggregating observations for the CCs of the clause-embedding predicates, but that there is by-operator variation that cannot be neglected when we do not aggregate. These results have two methodological implications. First, when initially investigating the projection of a content (or teaching projection to students), the family-of-sentences can indeed be treated as a family, as standard textbooks assume. However, it is advisable to apply the diagnostic with all four operators and attend to possible by-operator projection variation.

A second methodological implication of the results of our experiments is that research on projection should take into account possible by-operator variation when choosing which entailment-canceling operator to use. Further, results about projection variation should be relativized to the entailment-canceling operator under which the expressions and contents were embedded, as they may very well depend on this choice. For instance, two contents that exhibit projection variation when embedded under polar questions might not exhibit such differences with a different entailment-canceling operator, and two contents that do not exhibit projection variation from under negation might exhibit variation when embedded under some other operator.

5.2. Theoretical implications

This section discusses whether contemporary analyses can capture the observed by-predicate projection variation and the interactions between predicate and entailment-canceling operator.

5.2.1. Heim 1983 and van der Sandt 1992

On the analyses in Heim 1983 and van der Sandt 1992, the CCs of factive predicates are lexically specified as presupposed, in contrast to the CCs of non-factive predicates. Presupposed CCs project to the global context, except when that would produce an inconsistency, in which case they are accommodated to the local context of the operator.

These analyses do not predict the observed by-predicate variation, for several reasons. One reason is variation among the factive predicates: For instance, when embedded under polar questions, negation, or *perhaps,* the CC of *be annoyed* is more projective than that of *discover*, which in turn is more projective than that of *reveal*. (In conditional antecedents, the order of *be annoyed* and *discover* is reversed, see Figure 4.) This variation is not predicted because the CCs of factive predicates are invariably specified as presupposed, with no mechanism to predict projection variation between factive predicates. (Recourse to local accommodation is not possible because the stimuli in our experiments were presented in minimal contexts that were not inconsistent with the CCs.) A second reason is that the CCs of some non-factive predicates (e.g., *inform, acknowledge*) are just as projective as those of some factive predicates, or even more projective. Analyses like those in Heim 1983 and van der Sandt 1992 fail to make predictions about the projection of the CCs of non-factive predicates. Thus, as discussed in detail in Degen and Tonhauser 2022, the factive/non-factive distinction is not sufficiently fine-grained to adequately predict the observed by-predicate projection variation.

The analyses in Heim 1983 and van der Sandt 1992 also do not predict differential effects of entailment-canceling operators on projection. This is because negation and conditional antecedents are given a semantics that derives their behavior as presuppositional holes, in the sense of Karttunen 1971. For instance in Heim 1983, presupposition triggers under negation or in conditional antecedents are evaluated relative to a local context that is equal to the global context. Therefore, presuppositions are not expected to project differently from under negation or conditional antecedents. While the analysis does not explicitly address epistemic possibility modals or polar questions, we might expect that they would be treated as presuppositional holes along the same lines, therefore also not predicting any by-operator projection variation, or by-predicate variation in the effect of entailment-canceling operators.

5.2.2. Abrusán 2011 and Simons, Beaver, Roberts, and Tonhauser 2017

Abrusán (2011) and Simons et al. (2017) do not assume that presuppositions are lexically specified. In Abrusán 2011, a lexical entailment of a (possibly embedded) sentence is a presupposition, if it is about a time that is not the event time of the matrix predication and it is not at-issue with respect to the Question Under Discussion (QUD, see Roberts 2012) addressed by

the utterance. For instance, the CC of B's utterance in (7), that Phil's ballet class is canceled, is predicted to be a presupposition (and therefore to project) because it is a lexical entailment of the modal prejacent and not at-issue with respect to A's interrogative utterance.

(7) Adapted from Simons et al. 2017: 188
Context: It's early on Saturday morning. A and B are talking about their son.
A: Why is Phil up already?
B: Perhaps he forgot that his ballet class is canceled today.

In Simons et al. 2017, the CC of a clause-embedding predicate projects if it is entailed by the Current Question of the utterance (where, roughly, the Current Question is the question that is congruent with the utterance).[13] In (7), the Current Question of B's utterance might be the set of propositions {Phil forgot that his ballet class is canceled today, Phil is aware that his ballet class is canceled today}. If so, the Current Question entails that Phil's ballet class is canceled today, and the CC may therefore project under Simons et al.'s 2017 analysis.

Under the analyses in Abrusán 2011 and Simons et al. 2017, CCs that are entailed based on the literal content of an utterance may or may not project, depending on whether they contribute to the main point of the utterance. This opens up the possibility for projection variation among veridical predicates (including those often characterized as factive), representing an improvement compared to the lexical specification of factivity assumed in Heim 1983 and van der Sandt 1992. However, these accounts still do not predict the observed by-predicate variation. First, to make explicit predictions about the observed by-predicate variation, these types of analyses would need to make explicit assumptions about how different predicates contribute to how the question under discussion is chosen. Second, the analyses do not make systematic predictions for non-entailed CCs, and hence they do not predict that the CCs of some non-factive predicates project at least as much or even more than those of some factive predicates.

Both of these analyses set aside the effect of entailment-canceling operators in determining the main point of an utterance. Therefore they do not make predictions about by-operator differences or by-predicate variation in the effect of entailment-canceling operators.

5.2.3. Schlenker 2021

Under the view put forward in Schlenker 2021, the CC of a sentence S like (8a), is presupposed in a context c, if the CC is presupposed by the sentence S' under the entailment-canceling operator, that is (8b), in its local context c'. For the CC to be presupposed in (8b), two conditions must be met: (i) S' contextually entails the CC relative to c'; and (ii) If we consider "a generic agent" who believes the propositions in c' and who has now learned about the truth of S$'$, then the probability that this generic agent already believed the CC is above a contextual threshold α; more colloquially, condition (ii) requires that the generic agent "typically antecedently believes" the CC (p.6) upon interpreting S$'$ in c'. Based on Heim 1983 and Schlenker 2009, the the local context under negation c' is assumed to be identical to the global context c. There-

[13] The Current Question is defined in Simons et al. 2017: 194 as follows: "The Current Question for an utterance is a privileged subset of the focal alternative set of the uttered sentence (given a structural analysis of that sentence, including focus marking)" which meets the conditions that "(i) the proposition expressed is a member of the Current Question and (ii) the Current Question has at least one additional member."

fore, epistemic preconditions relative to c' will also apply to the global context. Applied to (8), Schlenker's 2021 analysis predicts that the CC is presupposed if (i) (8b) contextually entails that Julian dances salsa, and (ii) a generic agent "typically antecedently believes" that Julian dances salsa upon interpreting (8b) in the contexts provided to our participants.

(8) a. Cole doesn't know that Julian dances salsa.
b. Cole knows that Julian dances salsa.

Condition (i) is met under the assumption that the CC of (8b) is an entailment. Schlenker 2021 also assumes the condition (ii) is met: "in many cases, one's knowledge of facts will precede one's knowledge of [Cole's] beliefs about them . . . believing that [Julian dances salsa] is often an epistemic precondition for believing that" Cole knows that Julian dances salsa (p.6). One might, however, challenge this assumption on the basis of the corpus investigation presented in Spenader 2002, which showed that the CCs of the majority of the utterances of sentences with factive verbs (namely 81 out of 109) had to be accommodated (i.e., were not contextually entailed). In other words, utterances of sentences with the factive predicates investigated by Spenader (2002), which included *know*, were "generally used to communicate information the speaker thought was hearer-new" (p.99). This result might therefore suggest that one cannot assume that a generic agent typically antecedently believes the CC of *know*.

Schlenker's 2021 analysis does not incorporate differential effects of entailment-canceling operators on projection. As discussed for Heim 1983 above, the local contexts under negation and in conditional antecedents are both assumed to be the global context (and similarly in Schlenker 2009). Therefore, the analysis does not make predictions about by-operator projection variation or about by-predicate variation in the effect of entailment-canceling operator.

Does the account capture the observed by-predicate variation? The account takes the subjective conditional probabilities associated with expressions and the contextual threshold α as given, and therefore does not offer explicit or systematic predictions about projection ratings for different expressions. We, therefore, assume that it is an open, empirical question which predicates are such that the probability of a generic agent antecedently believing the CC is above the contextual threshold α in the minimal contexts we provided our participants (and, of course, what that threshold might be).

Throughout the discussion, however, Schlenker 2021 appears to assume that there are two classes of predicates: those where the probability is usually above the threshold (including *know, inform*, and *announce*), and those where it is not (including *demonstrate* and *establish*; see p.12 and appendix I). As this division does not fall along the lines of traditionally assumed classes of (non-)factives, an advantage of Schlenker's 2021 analysis over those reviewed in Sections 5.2.1 and 5.2.2 is that it predicts the projection of the CCs of (certain) non-factive predicates (modulo the open questions about condition ii). The analysis correctly predicts that the CCs of *know, inform*, and *announce* are more projective than the CCs of *demonstrate* and *establish*, by virtue of the CCs of the former being usually presupposed, in contrast to the CCs of the latter. It is not clear, however, that the analysis is able to predict the observed variation, because the analysis – even though it does not divide predicates into factive and non-factive ones – nevertheless imposes a binary, categorical distinction between predicates. Crucially, the by-predicate variation reported in Sections 3.2 and 3.3 is not captured by an analysis that does not make more fine-grained distinctions between the meanings of clause-embedding predicates,

as discussed extensively in Degen and Tonhauser 2022. First, there is projection variation between the supposedly presupposed CCs (under all four operators, the CC of *know* is more projective than that of *inform*, which is more projective than that of *announce*). Furthermore, as discussed in Degen and Tonhauser 2022, the CCs of the supposedly nonpresupposed CCs (of *establish* and *demonstrate*) are projective when compared to nonprojective main clause content. In the experiments reported on in Section 2, the mean certainty rating of the CC of *announce*, which is assumed to usually be presupposed, is .55, and that of *demonstrate*, which is not assumed to be presupposed, is .43 (both means are aggregated across entailment-canceling operators). It is not clear that this particular difference in mean certainty rating motivates analyzing the CC of *announce* as presupposed in contrast to that of *demonstrate*.

5.2.4. Interim summary

There is currently no projection analysis on the market that predicts the by-predicate and by-operator variation we observed in the experiments from Section 2. Degen and Tonhauser 2022 suggested that an empirically adequate analysis to capture the observed by-predicate variation requires consideration of "more fine-grained distinctions [between clause-embedding predicates] that are based on the lexical meaning and discourse use of clause-embedding predicates" (p. 585). Further, an account of the observed by-predicate variation in the effects of entailment-canceling operators will need to consider how semantic and pragmatic properties of predicate meanings interact with entailment-canceling operators. We offer some suggestions based on the data from our experiments in the next section.

5.3. Lexical patterns

The results of our experiments suggest that there is by-predicate variation in the effect of entailment-canceling operator. In this section, we suggest that the observed variation may be predictable, at least in part, from lexical semantic and pragmatic properties shared by subsets of the 20 clause-embedding predicates featured in our experiments. Specifically, we observe that the projection of the CCs of the 20 predicates we investigated exhibit (what we call) 'projection patterns', such that the CCs of several predicates exhibit the same or at least a similar by-operator projection variation. The six patterns we identified based on our results are shown in Figure 6, which shows mean certainty ratings for the four operators by projection pattern.

We suggest that these patterns are not accidental, but that the predicates that share a pattern also share lexical semantic and pragmatic meanings. For instance, the non-veridical predicates *pretend* and *think* exhibit the 'Negation high' pattern, shown in panel (a) of Figure 6. These are the only predicates that are most projective under negation compared to all other operators. This generalization might be derivable from the observation that there is an anti-veridical inference for the CC of both *think* and *pretend*. For *think*, this anti-veridical inference can arise from the fact that *think* has a veridical alternative in *know* (e.g., Heim 1991, Chemla 2008). We tentatively hypothesize that this can lead to an inference that the CC is false in many environments, but not under negation. For *pretend*, one might either assume a similar alternative or investigate whether this predicate entails that the speaker assumes that the CC is false.

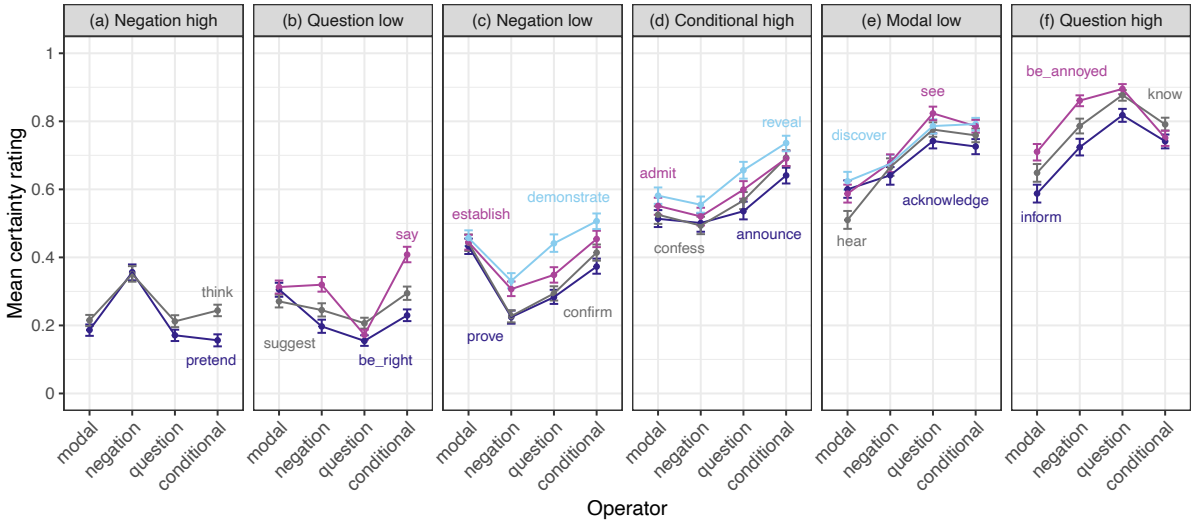

Figure 6: Mean certainty ratings by operator and predicate, by projection pattern. Error bars indicate 95% bootstrapped confidence intervals.

The predicates *suggest, be right*, and *say* ('Question low' pattern, panel (b)) are the only predicates which are least projective in polar questions. We tentatively suggest that these predicates can interact with the pragmatics of polar questions in a way that can lead to an inference of incredulity towards the CC. However, there are also some differences between these predicates. The veridical *be right* is most projective under modals (M > C > N > Q), whereas *say* and *suggest* are most projective in conditional antecedents (C > {M, N} > Q).

The two ∪-shaped patterns in panels (c) and (d) are characterized by relatively low projection ratings with negation and high ratings with conditionals. While there is fine-grained variation with regard to which by-operator differences were statistically supported, (c) and (d) can be distinguished by their ratings for the modal. The the CCs of *admit*, *announce*, *confess* and *reveal* exhibit relatively low projection ratings when embedded under *perhaps* (C > Q > {M, N}). In contrast, the modal ratings for the CCs of *confirm, demonstrate, establish*, and *prove* are relatively high (*confirm*, *prove*: M > C > Q > N; *demonstrate:* C > {M, Q} > N; *establish:* {C, M} > {Q, N}). For an explanation of the high conditional ratings, one might examine how the discourse effect of a conditional interacts with a change-of-state meaning component of these inferential and communicative predicates. A possible explanation for the relatively low negation ratings is that these predicates can be interpreted relative to contextual assumptions that lead to a neg-raising type inference more readily than others (so that, for instance, not announcing *p* amounts to communicating not *p*, or not proving *p* amounts to inferring not *p*).

Finally, the two ∩-shaped patterns in (e) and (f) are characterized by relatively high projection ratings with questions, and low ratings with *perhaps*. The two patterns differ in their ratings for conditionals. The predicates *acknowledge, discover, hear,* and *see*, which are associated with a change of some informational state, show relatively high ratings with conditionals ({Q, C} > N > M). The ratings for conditionals are relatively lower for the predicates *inform*, *know* (Q > {N, C} > M), and *be annoyed* (Q > N > C > M), whose CCs are among the most projective.

Although the patterns we have identified here are tentative and only based on few predicates, we believe that future investigations into shared projection patterns across a wider range of predicates is a fruitful enterprise for future investigations of projection inferences.

6. Conclusion

This paper investigated variation in projection from under the four entailment-canceling operators that have traditionally been used in the family-of-sentences diagnostic for projection, namely negation, polar questions, epistemic modals, and conditional antecedents. The results of our experiments suggest that the projection of the contents of the clausal complements of clause-embedding predicates varies across these operators. As discussed, there is currently no projection analysis on the market that is able to predict the observed by-predicate variation or the by-operator variation. The results of our experiments also extend a result of Degen and Tonhauser 2022, that projection ratings in polar questions do not categorically distinguish factive from non-factive predicates, to cases with negation, the epistemic possibility modal *perhaps*, and conditional antecedents. This results strengthens the conclusion of Degen and Tonhauser 2022 that there is, to date, no empirical evidence for a coherent class of factive predicates.

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Designation modality and the disposition of artifacts[1]

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Abstract. This article is about a modal construction of German that has hardly received any attention in the literature, and I link it to the philosophical notion of the disposition of artifacts. The name that I propose for this kind of modality is designation modality. It is instantiated by the sentence *Dieser Wein ist zur Begleitung des Käses* 'This wine is meant to accompany the cheese.' Being a subtype of goal-oriented modality, it features a theme or instrument oriented semantics specifying the use to which an artifact is put. A modal head underlying the preposition+determiner element *zu*+DET 'to+DET' combines the nominalized VoiceP in its complement with the external argument of the whole structure. To the best of my knowledge, this is the first proposal to trace the philosophical notion of the disposition of artifacts within a clearly delineated structure in natural language.

Keywords: designation modality, goal-oriented modality, disposition of artifacts, syntax-and-semantics.

1. Introduction

This article is about a curious oversight of modality research on German and, more generally, about putting a philosophical concept to use that, to the best of my knowledge, has not been considered in linguistics yet. Consider (1).

(1) *Das Pulver ist zum Lösen schwerer Verschmutzungen in Töpfen.*[2,3]
the powder is to.the solve of.heavy.staining in pots
'The powder is meant to dissolve heavy staining in pots.'

(1) is about a product that was created to fulfill a certain function. (2) is a rather accurate paraphrase.

[1] I would like to thank audiences at *Sinn und Bedeutung 28* and at the *Stuttgart Research Colloquium*, as well as four anonymous referees, for their valuable input. Special thanks go to Ellen Brandner, Ljudmila Geist, Lisa Hofmann, Hans Kamp, Markus Werning and Malte Zimmermann.

[2] Thanks to Klaus von Heusinger for introducing me to this product!

[3] There is another construction of German with the same overall make-up. An example is provided in (i).

(i) *Dieser Film ist zum Weglaufen.*
this movie is to.the run.away
'This movie is so bad that one wants to run away from it.'

Fortunately, it is easy to keep the two constructions apart. Structures as in (i) invariably involve an element of speaker-oriented evaluation. For this reason, (i) may be paraphrased as *Ich finde diesen Film zum Weglaufen* 'I find this movie so bad that I want to run away from it'. This evaluative component is absent from the structure in (1) and, hence, it doesn't allow for 'I find…' paraphrases. Thanks to Daniel Gutzmann and two anonymous reviewers for directing my attention to this *doppelgänger* construction.

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(2) *Mit diesem Pulver kann man schwere Verschmutzungen in Töpfen lösen.*
with this powder can one heavy.staining in pots solve
'One can dissolve heavy staining in pots with this powder.'

(2) features an existential circumstantial modal. Inasmuch as (2) involves modality, (1) does too. The differene between (1) and (2) lies in the fact that (1) explicitly entails that the powder was designed or designated to fulfill the given purpose.[4] No such entailment holds for (2). This sentence could be uttered by someone who just found out by accident that the powder, which was designed to wash clothes, may be used to dissolve heavy stains in pots.

In terms of the morphology involved, (3) is similar to (1). And (3) is modal, too.

(3) *Die schweren Verschmutzungen sind ab-zu-lösen.*
the heavy.stainings are off-to-solve
'The heavy staining is to be dissolved.'

The copula, *zu* and an infinitive interact, just as in (1). (3) has a deontic modal flavor (one must dissolve the staining). This kind of structure has not gone unnoticed in the grammar writing on German, and it is often called the "modal infinitive" (Gelhaus 1977, Bzdęga 1986, Pfeiffer 2002, Hansen 2009). English has similar constructions (*The book is to be read*), but the research on English has, over the past 20 years or so, concentrated on non-finite relative clause structures of this kind (Meier 2003 tackles *to*-infinitives in finite comparative structures, though). There is older work on infinitival clauses as the complement of *be*, though (Jones 1985, Jones 1991). *The wine is to complement the cheese* or *The wine is for complementing the cheese* (Jones 1991: 138, Bhatt 1999: 11) are English translational counterparts of our designation-modal structures. No attempt at a deeper analysis is made by Jones or Bhatt.

Structures as in (1) are extremely common in German, but I have not been able to find a single in-depth treatment of them in the literature. (Bayer & Brandner 2004 discuss dialectal data that sometimes belong within the array of our construction. Hole 2012, 2014 analyzes *zum*-nominalizations in the context of datives that are not subcategorized for. We will return to Hole's analysis in section 6.) This article studies this structure, it devises a name for the kind of modality that it expresses—designation modality—, and it connects this discussion to the philosophical concept of the disposition of artifacts, thereby enriching the inventory of dispositions that are taken from philosophy and inform linguistic analysis.

As is the norm with copula structures, designation modality of the 'be-to' kind has an adnominal counterpart; cf. (4).

(4) *das* [$_{NP}$ *Pulver zum Lösen schwerer Verschmutzungen in Töpfen*]
the powder to.the solve of.heavy.staining in pots
'the powder meant to dissolve heavy staining in pots'

[4] Imagine someone finds out by accident about what the powder can do, even though it wasn't designed for this. This person then comes to use the powder regularly for dissolving heavy stains in pots. Explaining this use to somebody else, the person may well say (1). Hence, designation instead of design is the more appropriate notion in our context.

The analysis that I will propose for the designation-modal structure in (1) carries over to these cases if Predicate Modification (Higginbotham 1985, Heim & Kratzer 1998), or an intensional variant of it (Morzycki 2013), is allowed as a rule of composition.

Before we move on, we should ask ourselves where designation modality has its place in the taxonomy of modal flavors. Frequently assumed modal flavors in the circumstantial domain (Kratzer 1991) are deontic, bouletic and goal-oriented modality, as well as ability. (1) is certainly not deontic, as no obligation or allowance is involved. It is not bouletic, either, as it is not about wishes. (To be sure, artifacts are about wishes in a way, because one designates functions for things because one wishes to put them to some use, but I would argue that this relationship with wishes does not enter into the linguistic construal of (1).) Abilities are about inherent dispositions of living beings, including plants (*Sertab can sing*, *This plant can defend itself against natural enemies*; Bhatt 1999 and much subsequent work). Dispositions of artifacts are not usually called "abilities", simply because we associate abilities with living beings. If that wasn't the case, then designation modality might well be categorized as a subkind of abilities (*This washing machine can hold up to 6 kg of laundry*). Goal-oriented modality, lastly, is about rational agents pursuing a goal and about what they have to do to achieve it (von Fintel & Iatridou 2007). Designation modality is a variant of this. In the end, the detergent powder of (1) exists because rational agents want clean pots. However, use of artifacts with a designated function is just one way to pursue a goal. I conclude, then, that designation modality is a subkind of goal-oriented modality. What is criterial for it is that it centers around artifacts and their intended functions, and not so much around users of these artifacts. As such, designation modality resembles a "passivization" of goal-oriented modality. I will return to this characterization in the context of the implementation of sections 7 and 8.

The plan of the article is as follows. Section 2 identifies some general properties of designation modal structures of the 'be-to' kind. It does so by way of frequent comparison with deontic 'be-to' structures so as to highlight the differences between the two constructions. Section 3 deals with the negation of designation-modal structures, leading to the conclusion that the nominalized infinitive of designation modality must be capable of having a truth-value. Section 4 has as its topic the passive orientation of designation modality, something that will inform the compositional treatment of later sections. In section 5 I adopt and modify Cohen's (2018) taxonomy of dispositions so as to allot designation modality a place in it. As we will see, we need to expand Cohen's classification by one dimension, namely the one distinguishing inherent dispositions from dispositions by designation. Section 6 reviews what authors have said about *zum*-uses in similar contexts like the one we are looking at here. Section 7 presents the overall analysis, while section 8 delves deeper into the NP complement of the *zum*-PP. Section 9 concludes.

2. Two variants of German *ist-zu* 'is-to' constructions

Compare the two modalized sentences in (5).

(5) a. *Der Schlüssel ist mit-zu-nehmen.* (deontic)
the key is with-to-take
'The key is to be taken along.'

b. *Der Schlüssel ist zum Mit-nehmen (gedacht).* (design)
the key is to.the with-taking thought
'The key is meant to be taken along.'

(5a) has a deontic modal flavor. It is an obligation to take the key along. It is construed as a 'be-to' modal construction, a bit as in English (Bhatt 1999), but without the passive morphology (with the complication of a separable verbal particle being involved in its overall construal in the example chosen). (5b) has a designation modality flavor, and it only has this flavor. The key is meant to be taken along. The syntactic construal of (5b) differs from (5a). In (5a), the particle and the infinitive have assembled around the modal particle *zu*. In (5b), the infinitive has been nominalized, and *zu* 'to' appears in its prepositional (and determined) form. Even though that is not the norm, each of the designation cases as in (5b) can be augmented by *gedacht* 'thought, meant', converting the sentence into a stative passive and rendering the PP a complement of *gedacht* 'thought' (the *meant*-construal in the English translation). I will develop a syntactic and semantic analysis of designation modality as in (5b) in sections 7 and 8. Suffice it here to say that the analysis will assume a dedicated designation modality head which denotes a variant of a universal quantifier over worlds (designation-ideal worlds of a specific kind).

Der Schlüssel 'the key' in (5b) corresponds to a theme of events of taking something along. However, instrument involvements occur just the same. Consider (6) for some instrument involvements, and (7) for more theme involvements.

(6) instrument of infinitival event
a. *Der Schlüssel ist zum Aufschließen der Gartentür.*
the key is to.the unlock of.the garden.gate
'The key is for unlocking the garden gate.'
b. *Der Becher ist zum Auffangen des Safts.*
the cup is to.the collect of.the juice
'The cup is for collecting the juice.'
c. *Der Zusatz ist zur Stabilisierung der Schlagsahne.*
the additive is to.the stabilization of.the whipped.cream
'The additive is for stabilizing the whipped cream.'
d. *Diese Einheit ist zum Ausspähen des Gegners.*
this unit is to.the spy.out of.the enemy
'This unit is for spying out the enemy.'

(7) theme of infinitival event
a. *Diese Ecke ist zum Abreißen.*
this corner is to.the tear.off
'This corner is meant to be torn off.'
b. *Die Rinde ist nicht zum Essen.*
the rind is not to.the eat
'The rind is not meant to be eaten.'
c. *Diese Sorte Samen ist zum Überall-Aussähen.*
this variety seeds is to.the everywheere-sow
'This variety of seeds is meant to be sown anywhere.'

Note that animate (group) referents are licit in the instrument cases as in (6d) as long as they form part of a larger design and may be rendered as an instrument PP in active sentences; compare (8a) and (8b).

(8) a. *Diese Einheit späht den Feind aus.*
this unit spies the enemy out
'This unit spies out the enemy.'
b. *Mit dieser Einheit spähen wir den Feind aus.*
with this unit spy we the enemy out
'We spy out the enemy with this unit.'

Hence, I take (8b), and not (8a), to be the structure most direcly associated with the designation modality case of (6d). Note in passing that natural causes don't make for good subjects in designation modality 'be-to' constructions. This is shown by (9).

(9) * *Der Mistral ist zum Trocknen der Wurstwaren.*
the Mistral is to.the drying of.the sausages
int.: 'The Mistral is for drying the sausages.'

Other than theme and instrument involvements of subject referents with designation-modal structures in German, I have found a slightly colloquial or maybe even sloppy use of locatives in this construction. Consider (10).

(10) a. *Kitzbühl ist zum Gesehen-werden.*
Kitzbühl is to.the seen-become
'Kitzbühl is for being seen there (i.e., people go to Kitzbühl to be seen there.)'
b. *Die Nordsee ist zum Ausspannen.*
the North.Sea is to.the relaxing
'The North Sea is for relaxing (there).'

I will return to these locative cases in section 4 and once the final version of my proposal has been presented in section 8, but other than that I will not discuss them in what is to follow. Note that at least (10b) doesn't feature an artifact subject.

In sum, German has two different 'be-to' modal structures, one being deontic, and one being designation-modal. The designation-modal structure features instrument, theme, or locative subjects, where the deontic structure has theme subjects only. Designation Modality involves nominalized infinitives or other event nominalizations, whereas deontic 'be-to' structures have verbal infinitives.

3. Negation and designation vs. deontic modality

In the present section, we will look at designation modality and its interaction with negation. We will keep a close eye on analogous facts from deontic modality of the 'be-to' kind to have a standard of reference.

The negation of deontic structures of this kind is straightforward, as shown in (11).

(11) a. *Der Schlüssel ist nicht mit-zu-nehmen.*
the key is not with-to-take
'The key is not to be taken along.'

b. *... dass der Schlüssel* [*nicht mit-zu-nehmen*] *ist.*
that the key not with-to-take is
'…that the key is not to be taken along.'

c. *Nicht mitzunehmen ist nur der Schlüssel, nicht aber die Karte.*
not with-to-take is only the key not but the card
'Only the key is not to be taken along, not the card, though.'

The negator *nicht* appears in a position following the inflected verb in C^0 and preceding the non-inflected verb form of main clauses (11a). Subordinate clauses, reflecting the basic word order of German, feature the inflected verb form in a clause-final right-headed T^0 position, and *nicht* still precedes the non-inflected verb form and forms a constituent with it to the exclusion of the copula (11b). Proof of this comes from (11c), where the negator and the infinitive have moved to SpecC. This renders negation with deontic modality a standard case of sentential negation with the negator at the edge of, or not far to the left, of VoiceP (Zeijlstra 2004, Bross 2023).[5]

(12) presents two variants of negation for the designation case.

(12) a. *... dass der Schlüssel nicht zum Mit-nehmen ist, sondern…*
that the key not to.the with-take is, but
'… that the key is not meant to be taken along, but…'

b. *… dass der Schlüssel zum Nicht-Mit-nehmen ist.*
that the key to.the not-with-take is
'… that the key is meant to not be taken along/to be left here.'

In (12a), negation takes scope over the modal operator (NOT > MOD), and a certain use of the key is negated as the intended one. In (12b), negation takes scope underneath the modal operator, saying that the intended use of the key is to not be taken along, i.e. to be left in its place. Note the *sondern*-continuation of (12a). It is supposed to hint at the fact that we are dealing with contrastive sentence negation here, most likely with a focus on *Mitnehmen* in this case (Jacobs 1982, 1991, Bross 2023). The continuation could fill in *zum In-Reserve-Halten* 'to keep in reserve'. Contrastive sentence negation is the typical result in German if negation immediately precedes a PP and forms a constituent with it. The special thing about such designation-modal structures is that the PP is, at the same time, the main predicate of the clause. (12b), on the other hand, has properties of canonical clausal negation, albeit with its scope confined to the nominalized *zum*-complement. This can be seen from the fact that its (broad) focus encompasses the negator, as is evidenced by the possible augmentation *zum Nicht-Mitnehmen und In-Reserve-Halten* 'to not be taken along and to be kept in reserve', where *In-Reserve-Halten* is the alternative to *Nicht-Mitnehmen*. The focus clearly encompasses the negation. The fact that the PP-internal negation is a PP-internal variant of standard negation means that the *zum*-PP must be capable of having a truth-value. In sum, where deontic 'be-to' modality has one form

[5] Note that, following Kratzer (2005), I assume VoiceP and vP to be distinct projections. vP is headed by CAUSE predicates, and VoiceP is headed by the agent conjunct of event descriptions.

of negation, designation modality of the 'be-to' kind has two, one contrastive, and one canonical (though PP-internal). The canonical negation negates the designation feature, turning the use expressed by the nominalization into its complement. The contrastive negation scopes above the designation modal and negates that the item at hand has the *zum*-PP-internal use.

Note by way of a side remark that the frequently favored or obligatory phrasal compounding in the *zum*-complement leads to clumsy compounds as soon as more than the infinitive and its particle enter into the compounding structure; cf. (12b). This clumsiness is remedied in cases in which event nominalizations other than the infinitive are chosen or, more importantly, if compounds are avoided and further argumental DPs or PPs are used instead; compare the variants in (13), where (13a) features a nominalized infinitive with two constructional options, and (13b) an *-ung*-nominalization which hardly has the compounding potential.

(13) a. *Der Schlüssel ist zum {Im-Zimmer-}Aufbewahren {im Zimmer}.*
the key is to.the in.the-room-keep in.the room
'The key is meant to be kept in the room.'

b. *Der Schlüssel ist zur Aufbewahrung im Zimmer.*
the key is to.the keeping in.the room
'The key is meant to be kept in the room.'

(14) presents parallel cases of PP-internal negation for the variant of designation modality involving instruments.

(14) a.?* *Die Ladespannungsbegrenzung ist zum Nicht-Überlasten des Akkus.*
the charging.voltage.limit is to.the not-overload of.the battery
'The charging voltage limit is there to not overload the battery.'

b.?* *Das Überlaufventil ist zum Nicht-Überfüllen des Beckens.*
The overflow.valve is to.the not-overfill of.the basin
'The overflow valve is there to keep the basin from getting overfilled.'

I hasten to add that these examples are very unnatural to the point of being almost ungrammatical. Periphrases of negation as in (14′) are much better.

(14′) a. *Die Ladespannungsbegrenzung ist zur Vermeidung der Überlastung des Akkus.*
the charging.voltage.limit is to.the prevention of.the overloading of.the battery
'The charging voltage limit is there to prevent overloading of the battery.'

b. *Das Überlaufventil ist zur Vermeidung eines Überfüllens des Beckens.*
The overflow.valve is to.the prevention of.a overfilling of.the basin
'The overflow valve is there to prevent the overflowing of the basin.'

I am not entirely sure why negation with instrumental designation modality is so bad. The effect may have something to do with the aversion towards phrasal compounding generally found with designation modality, but this cannot explain the whole effect, as the example in (12b) with its instance of theme-oriented designation modality is much better. Negation outside of the *zum*-PP again leads to contrastive negation; cf. (15).

(15) *Der Zusatz ist nicht zum Haltbarmachen der Sahne, sondern zur Stabilisierung.*
the additive is not to.the preservation of.the cream but to.the stabilization
'The additive is not for the preservation of the cream, but for stabilizing it.'

In sum, the canonical negation of designation modality is PP-internal. PP-external negation at the level of the main predicate leads to contrastive negation, as the main predicate has the form of a PP. With deontic modality of the related constructional kind, only outer negation is available, and it behaves like standard negation.

4. The passive orientation of theme designation modality

Upon first sight, deontic modality and designation modality of the theme type don't seem to differ much in terms of their theme orientation if 'be-to' structures are looked at. The parallels can be read off (16). (I am disregarding the designation variant with instrument subjects here, but I will return to it towards the end of the present section.)

(16) a. *Die Ecke ist ab-zu-schneiden.* (deontic)
the corner is off-to-cut
'The corner is to be cut off.'
b. *Die Ecke ist zum Ab-schneiden.* (design)
the corner is to.the off-cut
'The corner is meant to be cut off.'

What corresponds to the theme of the uninflected (16a) or nominalized (16b) verb becomes the subject of the 'be-to' construction of either flavor. However, if one tries to add the agent in a 'by'-phrase as in (17), a difference surfaces.

(17) a. *Die Ecke ist (durch den Benutzer) ab-zu-schneiden.* (deontic)
the corner is by the user off-to-cut
'The corner is to be cut off by the user.'
b. *Die Ecke ist zum (*Durch-den-Benutzer-)Ab-schneiden.* (design)
the corner is to.the by-the-user-off-cut
int.: 'The corner is meant to be cut off (by the user).'
c. *Die Ecke ist zum Abschneiden (*durch den Benutzer).* (design)
the corner is to.the off.cut by the user
int.: 'The corner is meant to be cut off (by the user).'

The deontic structure tolerates the agent in the 'by'-phrase readily (17a), whereas the designation structure doesn't tolerate it. The difference vanishes if *gedacht* 'thought, meant' is added (cf. (5b) above).

(18) a. *Die Ecke ist zum (?Durch-den-Benutzer-)Ab-schneiden gedacht.*
the corner is to.the by-the-user-off-cut thought
int.: 'The corner is meant to be cut off (by the user).'

b. *Die Ecke ist zum Abschneiden* (*durch den Benutzer*) *gedacht*.
the corner is to.the off.cut by the user thought
int.: 'The corner is meant to be cut off (by the user).'

I take this difference between the structures with and without *gedacht* to mean that the construction without *gedacht* is not just an elliptical structure where *gedacht* can always be added. Both are constructions in their own right, where the structure without *gedacht* has slightly more rigid selectional restrictions than the structure with *gedacht*. It is certainly more averse towards integrating 'by'-agents. As said above, I focus on the structure without *gedacht* in this article.

A different picture emerges if the creator or designer is to be integrated in a 'by'-phrase.

(19) *Die Ecke ist durch den Konstrukteur zum Abschneiden* **(gedacht)*.
the corner is by the creator to.the off.cut thought
'The corner is meant by the creator to be cut off.'

If the predicate *gedacht* is used, the creator 'by'-phrase is licensed with designation 'be-to' structures. If it isn't used the creator is not licensed. This is more evidence to the effect that the structures with and without *gedacht* differ, and it shows a complete aversion of the more coalesced designation modal structure towards creator or designator arguments.

(20) features another contrast between deontic and designation modality, and it highlights the stronger passive orientation of designation modality of the theme kind; cf. (20).

(20) a. *Das* {✓*Mitnehmen*/**Mitgenommenwerden*} *des Schlüssels ist eine Pflicht*
the with.take/being.taken.with of.thekey is a duty
des Mieters.
of.the tenant
'Taking along the key is a duty of the tenant.'

b. *Das* {??✓*Mitnehmen*/✓*Mitgenommenwerden*} (*des Schlüssels*) *ist ein Zweck*
the with.take/being.taken.with of.thekey is a purpose
des Schlüssels.
of.the key
'The being-taken-along (of the key) is a purpose of the key.'

(20a), with its deontic content, only allows the active nominalization of the verb. The noun *Pflicht* 'duty' in the predicate nominal restricts the interpretation of the nominalization to the deontic case. (20b), with its designation content, strongly favors the passive nominalization of the verb form. Again the type of modality is restricted, this time to the designation kind, by *Zweck* 'purpose'. What is more, the duty in (20a) is the duty of the agent, whereas the purpose in (20b) is the purpose that the theme referent is intended to be put to. In this sense, deontic modality expressed by way of 'be-to' structures is more agent-oriented, whereas designation modality of the theme type is more theme-oriented.

German doesn't have instrument-to-subject or locative-to-subject raising (i.e., an instrumental or a locative passive; Levin 1993) in finite structures (Kamp & Roßdeutscher 1994). Consider (21) through (23).

(21) a. *This flour bakes wonderful bread.* (Levin 1993)
b. *This place has been dwelled in for thousands of years.*

(22) a. * *Dieses Mehl backt wunderbares Brot.*
int.: 'This flour bakes wonderful bread.'
b. *Mit diesem Mehl kann man wunderbares Brot backen*.
'With this flour, one can bake wonderful bread.'

(23) a. * *Dieser Ort wurde seit Jahrtausenden gesiedelt an.*
int.: 'This place has been dwelled at for thousands of years.'
b. *An diesem Ort wird seit Jahrtausenden gesiedelt.* (impersonal passive)
'At this place, people have settled for thousands of years.'

English has instrument and locational passives as in (21). German, as evinced by (22) and (23), has to resort to instrument and locative topicalizations to arrive at a similar effect. True instrument or loational passive subjects are out.

What we see now is that this restriction doesn't hold generally—it is not present in the VoicePs of *zum*-PPs. This is a welcome result, as it renders two languages more similar that, upon first inspection and judging from what their overt alternations allow, appear to be different in this respect.[6]

Let us now turn to a classification of dispositions and the place that artifacts as occur in designation modal structures have in it.

5. Designation modality as a subkind of dispositions

Dispositions are a notion from philosophy that has received quite a bit of attention in linguistics over the past 20 years (cf., among many others, Lekakou 2004, Mari & Martin 2007, Pitteroff & Lekakou 2019, Pross 2020). Dispositions are about properties of referents that may or must become manifest if the right circumstances are given (Choi and Fara 2021). Flowers (must) blossom if temperature, humidity, light etc. are right, hence flowers have a disposition to blossom. Glass (must) break(s) if it is struck hard, hence it has the disposition of being fragile. The *if*-clauses of the aforementioned examples define the accessibility relations of the kinds of modality that dispositions instantiate (their restrictor), the blossoming and the breaking constitute their nuclear scope, where *may* and *must* correspond to the existential and universal quantifier over worlds that brings the restrictor and the nuclear scope together (Kratzer 1991). Some philosophers would call what I dub "the disposition of artifacts" a subkind of so-called "affordances", relations between animals and their environments that instantiate certain uses of portions of their environments (Chemero 2003). I will model the disposition of artifacts with designation modality as a conditional relationship between designation-ideal worlds and the way things are put to use in them in section 7.

Cohen (2018) proposes what he dubs the "square of disposition", thereby alluding to Aristotle's square of opposition (the four main kinds of quantifiers such as 'each', 'no', 'some' and 'not

[6] I will leave for future studies the elucidation of the emergence of this restriction in German.

all', which are related to each other by inner or outer negation). Table 1 renders Cohen's classification of dispositions (Cohen 2018: 16). It is a cross-classification of the features [±Causer] and [existential] vs. [universal] quantification over worlds.

	+Causer	**–Causer**
Existential	capability: *can*	passivility: *-able*
Universal	active disposition: *-er*	passive disposition: middles

Table 1: The square of disposition (Cohen 2018)

(24) provides one or several examples each.

(24) a. capability
Sertab can/knows how to dance.
Hammers are good for driving nails into something.
b. active disposition
Sertab is a dancer.
c. passivility
washable, *fragile*
d. passive disposition
The bread cuts easily.

"Capabilities" as in (24a) are the cover term for dispositions that characterize agents, instruments or causers like natural forces (summarized as [+Causer] in Table 1). Capabilities have existential force, which means that they may, but need not materialize if the right circumstances are given. If Sertab knows how to dance, then she still needn't be dancing if the circumstances are right. Active dispositions are dispositions that define a [+Causer] participant by way of ascribing a certain defining property to the referent.[7] Passivility (a term coined by Cohen; (24c)) is the kind of disposition that themes or patients have underneath the causal operator, a disposition that needn't materialize. Washable clothes don't need to be washed, and a recyclable bottle needn't be recycled. The passive disposition of (24d) characterizes properties that materialize each time one acts upon a theme or patient. If the bread cuts easily, then it always cuts easily under normal circumstances.

Cohen's terminology for the square of dispositions is not entirely fortunate, I think. [–CAUSER] is not the best cover term for what essentially boils down to themes. Agents, natural forces and instruments may be subsumed under the cover term [+CAUSER], but since we gave up [–CAUSER] a moment ago, we can just as well choose something else. I propose "(theta-roles) above CAUSE/v" instead of "[+CAUSER]" and "Themes" instead of

[7] Cohen's (2018) argumentation concerning the existential or universal force of dispositions is a bit blurry at times. For instance, Cohen (2018: 14) states explicitly that the disposition of *-er*-nominals sometimes has to be manifested (*saver of lives*), and sometimes needn't (*lifesaver*). On the following page, he goes on state that „…*-er*-nominals […] express active universal dispositions." He arrives at that conclusion mainly by discussing the phrase *beautiful dancer*, to which he ascribes the interpretation 'someone x such that if x dances… x does so beautifully (borrowed from von Fintel & Heim 1999). Note that the universal force ties together cases of dancing and doing so beautifully here, but doesn't say anything about the universal manifestation of dancing in a referent.

"[–CAUSER]". I'm a little wary of Cohen's argumentation concerning existential and universal quantification (cf. fn. 7). This may be a matter to come back to later; at the present point, I will give up the existential/universal dimension in the classification. Instead I will introduce a new dimension that we need for the central topic of this article. The distinction between inherent dispositions and dispositions by designation. That flowers blossom given the right circumstances is an inherent disposition. That one best opens a beer can by lifting the ring on its top is due to a disposition of the beer can by designation or design. This gives us the updated square of disposition in Table 2.

	above CAUSE/v	**Themes**
inherent disposition	***Sertab*** *can dance.* *Sertab is a* ***dancer****.*	***Flowers*** *blossom.* ***Glass*** *is fragile.*
disposition by designation or design	***This unit*** *is for spying out the enemy.* ***Hammers*** *are good for driving nails into things.*	***The corner of this packaging*** *is meant to be cut off.* ***This fabric*** *is washable.*
	German 'be-to'+nominalization	

Table 2: A new square of disposition

What unites the 'inherent disposition' row as a category is that no designator's intention came up with these dispositions. Moving on to the designation row, the left cell assembles dispositions of entities involved in causing events. Designers of special organizational structures may devise a certain unit to spy out the enemy. Hammers are designed to be instrumental in driving nails into things. The right cell of the 'disposition by designation or design' row assembles dispositions that themes have as a result of a designator's or designer's intention. This is completely clear in the packaging case. It holds for the washability case if the washability is the result of a designer's intention, but not if the fabric is washable just so. Now, the neat thing about the 'disposition by designation' row is that all the dispositions here may be expressed by German 'be-to'+nominalization constructions as discussed in this contribution. This establishes this row of Table 2 as a natural class. This should come as no surprise, as the functional dispositions of artifacts constitute a standard type of dispositions in philosophy (cf. the overview in Preston 2020). I introduce them to linguistics here.

Here's a last amendment to my proposal for a new version of the square of dispositions. For it to be of use for my description of designation modality, I need the distinction between artifact dispositions that are primary and others that are secondary. If a clothes designer designs a winter sweater keeping an eye on washability, it is possible to say (25a), but not (25b).[8]

(25) a. *Dieser Pullover ist zum Warmhalten im Winter.*
this sweater is to.the warm.keep in.the winter
'This sweater is meant to keep you warm in winter.'

[8] This characterization can be maintained even in view of the acceptability of (25b) in a context in which there are two piles of clothes, one meant to go to dry-cleaning, ad the other one to the washing machine. In this case, the *ad-hoc* designation of the second pile is for the clothes to go into the washing machine.

b. # *Dieser Pullover ist zum Waschen.*
this sweater is to.the wash
'This sweaterer is made for washing.'

The primary function of the particular sweater in question is to keep you warm in winter. It is not a primary function of any pullover to be washable, even though its washability may well be among the design intentions of its designer. Only the sweater's primary function(s) can be encoded by the German 'be-to' construction, but not its secondary function(s), this is what the contrast in (25) leads me to conclude. (Preston's 2020 proper functions in her take on artifacts correspond to my primary funtions, whereas her system functions align with my secondary functions.)

6. The market on *zum*

Zum is the contracted form of the dative-governing preposition *zu* 'to' and the masculine or neuter dative singular form of the definite article *dem*. Hence its literal meaning is 'to the'. Depending on the gender of the nominalization found in its NP complement in designation modality structures, one also finds the corresponding feminine form *zur*.

I am aware of two analyses of intensional *zum*-PPs in contexts other than designation modality. One is about structures as in (26) (Meier 2003), and the other one about structures as in (27) (Hole 2012, 2014).

(26) 'too/enough'-comparatives
Sertab ist alt genug zum Autofahren.
Sertab is old enough to.the car.drive
'Sertab is old enough to drive a car.'

(27) Datives that are not subcategorized-for
a. *Paul strickt Sertab einen Pullover zum Anziehen im Winter.*
Paul knits Sertab.DAT a sweater to.the wear in winter
'Paul is knitting Sertab a sweater to wear in winter.'
b. *Der Pullover ist Paul zu kratzig zum Anziehen.*
the sweater is Paul.DAT too scratchy to.the wear
'Paul finds the sweater too scratchy to wear.'

Meier's work on structures as in (26) is really on English. But as the set of infinitival clauses (like *to drive a car*) in the comparative structures under scrutiny naturally translate as *zum*-PPs in German, I take her analysis to carry over to German. Details left aside, Meier (2003: 87) assigns the denotation in (28) to *to drive a car* of and, by my transfer to German, to *zum Autofahren*.

(28) $[\![\textit{zum Autofahren}]\!]^{w^*}$ = λw. given what the law provides in the evaluation world w*, Sertab can drive a car in w

This is a predicate of worlds, and embedded in it we furthermore find 'can', a clearly intensional operator (Meier 2003: 83 assumes a standard existential analysis for *can*). Sertab appears in the denotation of (28), because *Sertab* binds a PRO at the left edge of the *zum*-PP of (26).

Hole's (2012, 2014) analysis of *zum*-PPs as in (27) is partly derivative of his observation that German datives which are not sucategorized-for must bind a variable in their local domain. In the *zum*-cases as in (27) he makes out this variable at the left edge of the *zum*-PPs, and its value is the "owner" of a purpose predicate (the one who pursues a goal). His proposal is not fully worked out and also problematic in its details, but the λ-term in (29) appears to do justice to his analytical intention.[9]

(29) $[\![$*zum Anziehen im Winter* (27a)$]\!]^{w^*}$ = λx.λe.e can fulfill Sertab's purpose$_{w^*}$ of wearing x in winter

The important thing about this denotation is that it contains the predicate 'purpose', again a clearly intensional notion. On top of that it has an existential modal, thereby displaying a parallel to Meier's *zum*-phrases. Generalizing over Meier's and Hole's analyses, *zum*-PPs serve to tie certain intensional additions to the truth-conditions of sentences, and these intensional additions are anchored in one or several of the local clauses' arguments (i.e., these arguments bind an argument of the intensional predicate at hand).

In sum, Meier (2003) resorts to rather unspecific possibilities in *zum*-PPs with *zu* 'too' and *genug* 'enough'. Hole (2014) assumes the more specific possible pursuit of goals in the denotations of *zum*-PPs co-occurring with datives that are not subcategorized for. We characterized designation modality as a subkind of goal-oriented modality earlier, so I'll side with Hole's (2014) general intuition involving purposiveness in *zum*.

7. The syntax-and-semantics of designation modality in German (first take: variable-free style)

In this section, I will develop a first (variable-free; Jacobson 1999) take on the syntax-and semantics of designation modality of the 'be-to' type.[10] It probably gets most of the semantics right, but, as we will see in section 8, it needs to be worked out in its details within the NP complement.

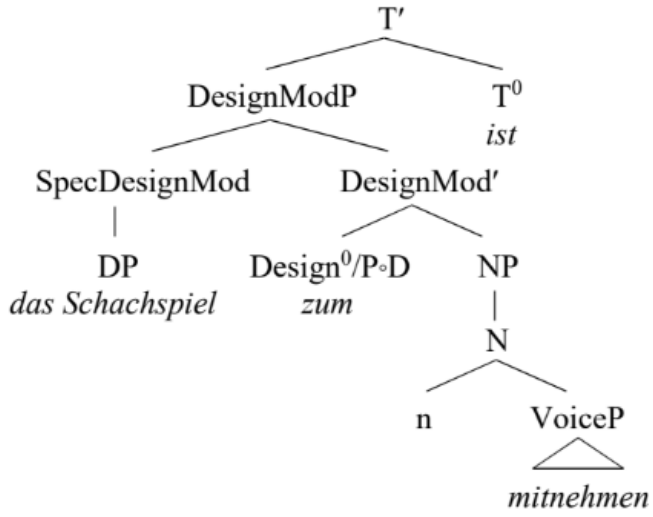
Consider (30).

(30) a. … *dass das Schachspiel zum Mitnehmen ist.*
that the chess.set to.the take.along is
'…that the chess set is meant to be taken along.'

[9] Hole (2015: 180) assumes *zum*-PPs as in (27) to be predicates of events and fails to model the reference to the pullover in the *zum*-PPs. I present a reconstruction of his analytical intentions here.

[10] Note that "variable-free" in the sense of Jacobson (1999) means 'interpretation without indices or assignments' in the input, not 'interpretation without λ-bound variables'.

b.



Zum is the designation modality head. It amalgamates the preposition *zu* 'to' with the determiner, and it selects an NP complement and a DP in its specifier. The DP eventually moves up to SpecT. *Mitnehmen* in the complement of *zum* must at least be a VoiceP, because it can be negated (cf. section 3). Little *n* nominalizes the VoiceP. Probably this overall syntax is uncontroversial, with different treatments conceivable for the P–D head or the nominalization trigger. A very interesting alternative to the P–D analysis comes from Postma (2014). Investigating Brazilian Pomeranian (West-Germanic), he proposes that *taum* 'for.to' in that language, with identical function with German *zum*, is really an amalgam of the non-finite complementizer *um* and the T-level infinitival marker. However, German clearly has a dative-marked nominalization here (where the dative is required by *zu* 'to'), rendering the *zu* + *um* analysis rather unlikely.

With our purpose-oriented modeling goal from the previous section in mind, one could propose something as in (31) as the denotation of *zum Mitnehmen*.

(31) $[\![\textit{zum Mitnehmen}]\!]^{w^*} = \lambda x.\forall e[e \text{ instantiates x's designated purpose}_{w^*} \rightarrow \exists y[y \text{ takes x along}(e)]]$

With the chess set filled in, we would arrive at the preliminary denotation in (32) for the complete DesignModP.

(32) $[\![\text{DesignModP of (30b)}]\!]^{w^*} = \forall e[e \text{ instantiates the chess set's designated purpose}_{w^*} \rightarrow \exists y[y \text{ takes x along}(e)]]$

This makes for an intuitively good denotation, I would say. However, in what sense is it modal? I would like to propose that we can break the instantiation of purposes down as in (33).[11]

(33) $[\![\text{DesignModP of (30b)}]\!]^{w^*}$ = ∀e∀w[w is designation-ideal$_{w^*}$ with respect to the chess set & e has the chess set as a part in w → ∃y[y takes the chess set along(e)(w)]]

In (33), the instantiation of a purpose has been restated as something that must hold in all designation-ideal worlds as defined in the evaluation world w*. The antecedent of the implication in the truth-conditions thus has the standard format of making reference to an ordering source (Kratzer 1991). This may now be teased apart in the standard way so as to have *zum* denote the quantifiers with their restrictions, and the NP – the consequent, with the subject DP being filled in last; cf. (34).

(34) a. $[\![\textit{zum}]\!]^{w^*}$ =
λf$_{\langle s,\langle e,\langle s,t\rangle\rangle\rangle}$.λx.∀e∀w[w is designation-ideal$_{w^*}$ with respect to x & e has x as a part in w → f(w)(x)(e)]]
b. $[\![\textit{Mitnehmen}]\!]^{w}$ =
λw.λz.λe.∃u[u takes z along(e)(w)]

This will do the trick. However, the type of $[\![\textit{Mitnehmen}]\!]$ in (34b) is unusual. It has the look of an intensional passivized verbal entry with its agent variable existentially bound and the theme argument still unsaturated. In the next section, I will shed some light on this situation and render it compatible with standard syntax assumptions.

8. Decomposing the NP complement

Recall the denotation that we assumed for *Mitnehmen* 'taking along'. I repeat it in (35).

(35) $[\![\textit{Mitnehmen}]\!]^{w}$ = λw.λz.λe.∃u[u takes z along(e)(w)]

Undoing intensionalization, we arrive at (36).

(36) $[\![\textit{Mitnehmen}]\!]$ = λz.λe.∃u[u takes z along(e)]

That is the denotation of a passivized VoiceP, with the theme argument still unsaturated. A syntax that gives us this is provided in (37).

(37) [PRO$_i$ [$_{\text{VoicePPASS}}$ …t$_i$ …]]

The PRO object has moved to the periphery of the passivized VoiceP. There it functions as a λ-abstractor (Landau 2015), yielding a function of type ⟨e,⟨s,t⟩⟩, as needed. Instrument-oriented nominalizations may be treated analogously such that PRO originates as an instrumental DP

[11] To maintain perspicuity, I refrain from introducing counterparts in the main text. If necessary, one may replace *the chess set* in (33) by *the counterpart of the chess set in w*, or "C(chess set)(w)."

and moves up just like the PRO in (37). I take this architecture to properly reflect the passive-like properties of the nominalizations found in designation-modal structures.

There remains the question of negation within the nominalization, as in (38) (=(12b)).

(38) … *dass der Schlüssel zum Nicht-Mit-nehmen ist*.
that the key to.the not-with-take is
'… that the key is meant to not be taken along/to be left here.'

This negation cannot be modeled in the most standard way, namely as a negated existential quantifier binding the event variable (Acquaviva 1997, Giannakidou 1999, Zeijlstra 2004). The reason for this is that the event variable needs to stay available for composition higher up, namely to get bound by the universal quantifier in the denotation of *zum* (cf. (34a)). For this reason I assume a rather old-fashioned operator that maps the denotation of the VoiceP to its complement.

Higher negation, typically resulting in contrastive sentence negation, is easily introduced by way of negating the existential quantifier in the consequent of (33), repeated here as (39).

(39) $[\![\text{DesignModP of (30b)}]\!]^{w^*}$ = $\forall e \forall w$[w is designation-ideal$_{w^*}$ with respect to the chess set & e has the chess set as a part in w $\rightarrow$ $\exists y$[y takes the chess set along(e)(w)]]

This concludes my proposal for designation-modal 'be-to' structures in German.

9. Conclusion

In the present article, I focused on a modal construction of German which had virtually gone unnoticed before. I came to characterize this construction as a theme or instrument-centered "passivized" version of goal-oriented modality. Specifically, this type of modality is not so much about agents pursuing goals, but about instruments and themes being used according to their designated purposes. I proposed an implementation with a universal quantifier over worlds which ties together designation-ideal worlds with the way things are put to use in them. Lastly, I identified the disposition of artifacts, maybe a subkind of affordances, as the philosophical counterpart of this kind of modality, thereby bringing together discussions from philosophy and linguistics.

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On the relation between expressive meaning and information structure: Exploring focus-marking with emoji[1]

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Abstract. Written digital communication (e.g. text messages, email) lacks prosody, but innovations like emoji have emerged to enrich this communicative channel. In speech, prosody can indicate information structure, e.g. contrastive or new-information focus. In this paper I investigate the relation between focus and emoji, and propose that (i) one class of emoji (e.g. sparkles, pointing hands, what I call 'plain focus emoji') act as semantically flexible focus-signalers, and (ii) another class (e.g. angry-face, heart-eyes-face, what I call 'affective focus emoji') can signal focus while also resembling linguistic expressives (e.g. *yay*, *damn*) in conveying information about speakers' attitudes, in a way that I show to be scopally dissociable from their focus-related behavior.

Keywords: emoji, expressives, focus, digital communication, information structure

1. Introduction

Because digital communication (e.g. texts, social media) lacks many features of face-to-face communication, including facial expressions, gestures and prosody (e.g. Gawne & McCulloch, 2019; Pasternak & Tieu, 2022), innovations such as emoji have emerged to enrich this communication channel (Bai et al., 2019). In spoken communication, prosody can signal not only emotional content (e.g. Banse & Scherer, 1996; Cowie & Cornelius, 2003; Liscombe et al., 2003; Scherer, 2003; Wagner, 2016) but also information-structural meaning at the semantics/pragmatics interface, e.g. whether information is focused (new) or given. However, despite a lot of work spoken languages, to the best of my knowledge there is little systematic work on whether compensatory emoji mechanisms have emerged in digital communication for marking different focus types, or for marking information-structural focus at all.

In this paper, I explore the relation between emoji and the information-structural notion of focus by focusing on emoji that 'encircle' words (ex.1-2), and claim that we need to distinguish two sub-classes of focus-signaling emoji. Using Twitter data, I argue that one class of word-encircling emoji – what I call *plain focus emoji*, e.g. ✨and 👉 – consists of semantically and pragmatically flexible focus indicators, as exemplified in (1). Here, the emoji encircle the name 'Trump,' which – as the context indicates – is contrastively focused.

(1) *'Plain' focus emoji*
No she wasn't but 👉 TRUMP👈 was

Furthermore, I propose that we need to distinguish this class of plain focus emoji from another class, what I call *affective focus emoji*, e.g. 😍😡. These emoji act as focus indicators and also

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resemble expressives (e.g. *damn, yay*) in conveying information about affective attitudes in a way that (as I show in Section 5 of this paper) can be dissociated from their focus-related behavior. An example of affective focus emoji is provided in (2). Here, the 'angry face' emoji encircle the name 'Trump' in one sentence and the heart-eyes emoji encircle the name 'Biden' in the next sentence. Clearly, Trump and Biden are being contrasted with each other, and in addition to indicating contrastive focus, the emoji also signal the author's attitude towards the referents of the focused elements.[2] (All examples are from Twitter unless otherwise indicated.)

(2) *Affective focus emoji*
I know, right?? With Trump, it was, well, you know, 😡TRUMP😡 doing a totally illegal thing. Now it's 😍Biden😍 doing a totally very legal thing

The aim of this paper is largely empirical, as it seeks to explore the behavior of these kinds of word-encircling emoji, in particular in relation to focus types, with the goal of providing a foundation for future work.

1.1. Emoji as an object of study

In recent years, there has been an explosion of interest in emoji (e.g. see Bai et al., 2019 for a recent overview). Researchers have explored the nature of the relation between emoji and gestures (e.g. Gawne & McCulloch, 2019), the differences between face and non-face emoji (e.g. Maier, 2023), emoji and comic-type pictorial sequences (e.g. Cohn et al., 2019) as well as many other issues. Researchers have used various methods to explore emoji, including experimental approaches (e.g. Weissman & Tanner, 2018; Scheffler et al., 2021; Kaiser & Grosz, 2021; Weissman et al., 2023). Emoji are obviously a human-created artifact, which grew out from the 'emoticons' of the 1980s. Picture-type emoji similar to present-day emoji have been used for over ten years, as Apple added its first emoji keyboard in 2011 and Android in 2013. Emoji are an immensely popular aspect of digital communication: by some estimates, over 10 billion emoji were sent every day in 2020. This suggests that emoji fulfill an important communicative need and are shaped by how humans' minds work. Thus, although emoji are in some sense an artificial creation, the way that humans use them in communication – especially in conjunction with language – can offer new insights into human language as well.

The structure of this paper is as follows. Section 2 provides a brief overview of focus, especially the distinction between new-information vs. contrastive focus. In Sections 3 and 4, I introduce and provide evidence for the existence of two kinds of focus-sensitive emoji. First, in Section 3 I show that what I call *plain focus emoji* (in particular 👉 and ✨) can occur with multiple focus types, and thus I analyze them as underspecified 'focus indicators.' In Section 4 I provide evidence that what I call *affective focus emoji* (e.g. 😍😡🤢🤩) have a dual function, in that they indicate focus as well as affect. Crucially, I also show that with affective focus emoji, the scope of focus marking and the scope of the affective attitude is dissociable. The question of how to capture this dissociation raises intriguing theoretical challenges, and I sketch out informal steps

[2] It is also interesting to note that encircling emoji of both types can occur in addition to use of all capitals (e.g. here on TRUMP, see also ex.(1), (10d), (10e), (12b), (12d) for additional examples). This suggests that the information being expressed by these emoji goes beyond – or is not redundant in the presence of – whatever is being signaled by capitalizating all letters of a word.

towards an analysis that distinguishes expressive meaning vs. truth-conditional meaning in Section 5, building on non-emoji work by Gutzmann (2013; 2019, see also Potts 2005).

Before continuing, a few words about the scope of this investigation are in order. This paper focuses on configurations where the same emoji occurs immediately before and after the word or constituent of interest. I describe this as a situation where the emoji *encircle* the word/constituent. This work does not look at configurations where there is an emoji between every word (e.g. that 😍 look 😍 like 😍 this 😍, see Grosz et al. 2022 on beat emoji), or occurrences of only a single emoji.[3] We focus on the encircling uses because those are the ones whose distribution appears to show parallels to focus marking (e.g. pitch accents that signal new information focus or contrastive focus).

2. Focus and focus-marking in spoken and written language

Researchers at the semantics/pragmatics interface have, over the decades, argued for different kinds of information-structural divisions (e.g. *topic-comment*, Gundel 1974; Reinhart, 1982; *topic-focus*, Sgall & Hajicova, 1977/78; *focus-presupposition*, Chomsky, 1971; Jackendoff, 1972; *theme-rheme*, e.g. Halliday, 1967; *open proposition-focus*, Ward, 1985; see Vallduví, 1990 on a tripartite division). However, broadly speaking, all of these approaches distinguish between new vs. given information (see e.g. Krifka, 2008 for discussion), and build on the intuition that a part of each utterance connects to something the listener already knows, and another part provides new information. *Focus* refers to the part of an utterance that contributes new information, which is what this paper centers on. Many researchers agree that focus can be divided into (at least) two categories: *new-information focus* and *contrastive focus* (e.g. Chafe, 1976; Rochemont, 1986; Kiss, 1998; but see Rooth, 1992 for a different view).

New-information focus involves the introduction of new, non-presupposed information into the discourse, as in the answer to wh-questions (ex.3). It is widely agreed that the new-information focus is the part of the sentence that corresponds to the answer to the wh-question. This is illustrated in (3) for different parts of a sentence. Elements that are contrastively focused, on the other hand, have contextual or situational alternatives, e.g. elements that have already been mentioned in prior discourse (e.g. Kiss, 1998; Zimmermann & Onea, 2011, i.a.). This is illustrated in (4). While some researchers distinguish between contrastive focus (4d) and (explicitly) corrective focus (4a-c) (e.g. Dik, 1997), in the present paper we follow many others in grouping them together (see e.g. Zimmermann & Onea, 2011 for discussion), and will use the label 'contrastive focus' for both.

(3) *New information focus*
- a. Who likes coffee? [Sam] likes coffee.
- b. What does Sam like? Sam likes [coffee].
- c. How does Sam feel about coffee? Sam [likes] coffee.
- d. Tell me something about Sam. Sam [likes coffee].

[3] For recent research on emoji in clause final and clause-medial positions, see e.g. Paggio & Tse (2022), Grosz (2022), Grosz et al. (2023a; 2023b) and Tang et al., (2023).

(4) *Contrastive/corrective focus*
   a. I heard Sam likes coffee. No, [Alex] likes coffee.
   b. I heard Sam likes tea. No, Sam likes [coffee].
   c. I heard Sam dislikes coffee. No, Sam [likes] coffee.
   d. I heard that Sam likes tea. Good to know! [Alex] likes [coffee].

2.1. Linguistic means of encoding focus

Both new-information and contrastive focus can be encoded through a variety of linguistic devices, including prosodic, morphological and syntactic means. On the prosodic side, research suggests new-information focus and contrastive focus are realized differently in many languages (e.g. in pitch accent terms, H* vs. L+H* in English, see Pierrehumbert 1980 and many others), though differences many not involve a simple one-to-one mapping between focus types and pitch accent types (e.g. Watson et al., 2008 on English). Crucially, this kind of prosodic information is missing in the written domain, although visual cues such as *italics* and CAPITALS can be used (see e.g. Lukl, 2020, but also Norton, 2018). As will become clear, the naturally-occurring data that I present in this paper suggests that some emoji, such as the pointing hands in (5), can be used in a compensatory way as focus indicators in a modality that lacks prosodic cues. In (5a), the verb 'hate' is focused, and in (5b), the pronoun 'me' is in contrastive focus, evoking a contrast to 'you.'

(5)
   a. I 👉hate👈 being sick
   b. I forgot you're not adult like 👉me👈

Unless otherwise stated, all examples cited in this paper from Twitter (now renamed 'X') and available through Twitter's public search function. I omit usernames, Twitter handles and URLs, in light of recommendations from Tatman (2018).

It is worth noting these kinds of focus-indicating emoji are not required when an element is focused: focused elements can occur without focus emoji. In this regard these emoji pattern like italics and capitalization: based on contextual cues, we can construe a written text as having focused elements without emoji, italics or capitalization. In light of their optionality, I suggest that these emoji best viewed as disambiguating indicators of focus, in a written modality without prosodic cues.

3. Plain focus emoji

Now, let us take a closer look at the evidence that specific kinds of emoji have emerged as a focus-marking tool. This section considers the first of the two focus emoji types that I propose, namely *(plain) focus emoji*. I suggest that this class contains at least two emoji, namely the ✨ sparkles ✨and the 👉pointing hands👈.[4] In the rest of this section I investigate whether these emoji occur with different focus types and other related phenomena. This section also

[4] There may be other emoji with similar functions; I do not intend to claim that these two are the only plain focus emoji that exist. Furthermore, emoji use changes rapidly, so new options are probably already emerging.

provides a crucial backdrop for Section 4, where we turn to a second type of focus emoji – what I call *affective focus emoji* – that makes unique use of the affordances of digital communication, namely the fact that many emoji also express affective, emotion-related content (e.g. 😍🤢❤️).

3.1. New-information focus

As shown in (6a-c), both ✨ and 👉 occur with new-information focus. The critical word in each of these examples, encircled by the emoji, is new information that is being introduced to the discourse for the first time.

(6)

a. the first thing i think of in the morning is ✨ice cream ✨
b. Same! First haircut I've managed to get since last January and I am ✨excited✨
c. I have a new addiction 👉👉👉coffee 👈👈👈

It's worth acknowledging that these examples, like the others in this paper, are quite heterogenous. For example, the focused word in (6c) is essentially a free-standing constituent that is not an argument of the verb 'have' (and would presumably be preceded by a colon : in standard language). The varied nature of the example is due to my use of naturally-occurring examples from Twitter: In a corpus, especially one as informal as Twitter, it is often not feasible to find the minimal question-answer pairs used in theoretical work.

3.2. Contrastive focus

In addition to new-information focus, examples like those in (7) show that both ✨ and 👉 can also occur with contrastive focus:

(7)

a. I don't even wanna buy a car no more, I wanna buy a ✨house ✨
b. Not risking getting covid, but risking being ✨tired✨
c. the mirror didn't even mention you✨ it said 👉me👈
d. Every time Trump points a finger, there are three pointing back at 👉him👈

A variety of parts of speech can be focused in this way. In (7a), the noun 'house' is in focus and contrasts with 'car', while in (7b), the adjective 'tired' is in contrastive focus. Examples of pronouns in contrastive focus are in (7c,d). In (7c), the alternative to 'me' is explicitly mentioned in prior discourse ('you'), whereas in (7d), the existence of alternatives to 'him' can be inferred from the first clause even though the oblique object is omitted ('points a finger *at someone*').

3.3. Verum focus

In addition to new-information focus and contrastive focus, both ✨ and 👉 can also be used to indicate so-called verum focus, as shown in (8). Descriptively speaking, verum focus emphasizes the truth of the proposition and in English is typically indicated by a H*L pitch accent on the auxiliary verb (e.g. Peter *did* write a book, e.g. Höhle 1992, but see Gutzmann et al., 2020 for a crosslinguistic view). In (8a) and (8b), we see examples of the sparkles and the pointing hand respectively being used for verum focus, to emphasize the truth of the relevant proposition.

(8)

a. [context: someone said Republicans did not regroup]
They ✨did✨ regroup to figure out how to bring back the voters they lost: voters who want to trust elections

b. [note: '45' refers to the 45th president of the U.S., Donald Trump]
As usual Faux News leaves out a very salient point: 45 👉did👈 ask Comey to drop the Russia investigation during a subsequent mtg. Typical.

A fascinating question that I leave for future work has to do with whether the phenomenon standardly known by the name 'verum focus' actually involves a focus accent that focuses a covert verum predicate (as originally argued by Höhle 1992) or whether it is independent of focus *per se* and instead realizes a lexical verum operator that relates the predicate to the current Question Under Discussion (QUD), as argued by Gutzmann et al. (2020) on the basis of crosslinguistic evidence. Their claims raise important questions about whether what I am calling plain focus emoji can also be used in contexts that do not involve information-structural focus: it could be the case that plain focus emoji are not only underspecified for focus type – occurring with both new-information focus and contrastive focus – but are even more underspecified, such that their use extends beyond focus contexts. I leave this question for future work.

3.4. Further data from 'even' and 'only'

If the placement of ✨ and 👉 in encircling contexts is motivated by focus, we should be able to detect effects of their placement on the interpretation of focus-sensitive operators such as *even* and *only*. *Even* and *only* associate with the focused element and have truth-conditional consequences (e.g. Jackendoff 1972). Consider (9), with exhaustive *only*. Example (9a), with focus on 'look' and (9b), with focus on 'my' are interpreted differently: For (9a) to be true, the person only looked in the speaker's direction, and did nothing else (e.g. did not move towards the speaker). For (9b) to be true, the person only looked at the speaker and did not look at anyone else.

(9)

a. They only [looked]$_F$ in my direction.
b. They only looked in [my]$_F$ direction.

Thus, if ✨and 👉 are focus indicators, they are predicted to occur on the element that *even* or *only* associates with. Indeed, as can be seen in (10a,b) for *even* and (10c,d,e) for *only*, this is the case. In (10a,b) *even* associates with the emoji-encircled, focused verb. In (10c,d,e), *only* associates with emoji-encircled, focused pronouns and the numeral 'one.'

(10)

a. It seems like they didn't even ✨try✨
b. Conversations before coffee…like don't even ✨look✨ in my direction 😂
c. THEYRE surprisingly comfy! Chose them bc amazon reviews agreed they were easy to walk in even for infrequent heel wearers like 👉 me👈
d. Just a reminder to many that you ONLY need 👉ONE👈senator to contest the electoral college results on January 6th & Josh Hawley has ALREADY committed to doing so
e. What if I ONLY want 👉YOU👈
f. don't even look in ✨ my ✨ direction [constructed example, adjusted from 10b]

Furthermore, the constructed example in (10f) shows that the focus association pattern shifts if the emoji are moved to encircle another word: if the emoji encircle 'my' (10f) rather than 'look' (10b), the interpretation changes in exactly the way we predict if the emoji are signaling which constituent is in focus: in (10b), *even* associates with 'look,' indicating that 'look' is on the lower end of a likelihood scale: One should not look at the speaker, and not do anything higher on the scale either. In (10f), *even* associates with 'my,' now putting 'my' on the lower end of the scale, such that one should not look at the speaker's direction and not in the direction of anyone ranked higher on the relevant scale either. In sum, the interpretation of the focus-sensitive elements *even* and *only* provides further evidence that the sparkle emoji and pointing hand emoji, when used to encircle words, act a focus indicators.

3.5. Focus and/or prosodic prominence?

A consequence of focusing on emoji encircling single words is that one starts to wonder whether the sparkles emoji ✨ and the pointing hand emoji 👉 encircle words that are in focus, or whether they simply encircle the most stressed, most prosodically/accentually prominent word in a sentence (see e.g. Ladd & Arvaniti, 2023 for a recent review of the notion of prosodic prominence and phrasal accents). One might wonder, is the distribution of these emoji sensitive to an information-structural notion or to an acoustic/phonetic dimension? In many cases, these two things coincide. However, looking at multi-word expressions (11a,b) and VP-level focus (11d,e) suggests that the distribution of plain focus emoji is not simply reducible to words' accentual prominence and can indeed be driven by the information-structural notion of focus.

(11)

a. Bro I swear my Halloween costume this year is ✨on fleek✨
b. I'm feeling ✨on point✨ today
c. anxiety on ✨fleek ✨
d. I'm so jelly of girls that have a good relationship with their moms because my mom simply ✨ hates me ✨
e. my kids got these and I ✨hate them✨

Examples (11a,b) use the multi-word expressions 'on fleek' and 'on point' (roughly paraphraseable as meaning something similar to *awesome, perfect, flawless*). If emoji simply encircle the acoustically/accentually most prominent *word*, we would not expect them to be able to encircle the entire prepositional phrase. However, the entire prepositional phrase is in new-information focus in both of these examples, so from a focus-based point of view, the emoji positioning in (11a,b) is entirely expected. Nevertheless, the existence of examples such as (11c) shows that the emoji can also encircle just the word 'fleek,' not the entire prepositional phrase. While examples like (11a,b) provide evidence against a pure prominence-based approach, (11c) points to the existence of potential variation and individual differences in how plain focus emoji are used. This is a worthwhile direction to investigate further.

More evidence for the emoji positioning being sensitive to focus, rather than accentual prominence, comes from examples like (11d,e). Here, the entire VP ('hates me' or 'hate them') is in focus, and encircled by the plain focus emoji. If emoji positioning were driven only by an individual word's prosodic prominence, this pattern is not straightforwardly predicted. However, I emphasize that these are only initial observations, and more systematic, large-scale investigation is needed in future work.

3.6. Summary: plain focus emoji

The examples presented in Section 3 provide evidence that the sparkles emoji ✨ and the pointing hand emoji 👉 can occur with different kinds of focus, including new-information focus, contrastive focus and verum focus, and that they attract focus-sensitive operators (*even/only*). This suggests that these emoji are flexible in terms of the kinds of focus that they occur with. What does this tell us about the 'meaning' of plain focus emoji? I suggest that this points to focus emoji being semantically and pragmatically *underspecified* for focus type. It's not the case, for example, that one emoji is associated with new-information focus and the other with contrastive focus (at least we have uncovered no evidence for this). In this regard, they differ from pitch accents in many languages; for example, in English H* is typically associated with new information focus and L+H* with contrastive focus. Thus, if my approach is on the right track, plain focus emoji are more underspecified that many other focus-signaling devices in human language.

4. Affective focus emoji

In addition to ✨ and 👉, we also find affective emoji (e.g. 😡🤢❤️😍) in encircling configurations where they surround focused elements. (These emoji are also used in other ways.) Crucially, these kinds of emoji carry meaning that is not present with ✨ and 👉, as they express positive or negative emotional/affective content. In this section, I argue that this extra meaning dimension is a crucial distinguishing property between the plain focus emoji discussed in Section 3, and the affective focus emoji discussed here in Section 4.

Face emoji, by definition, resemble human facial expressions, something which has also been addressed in prior research (e.g. Weissman & Tanner, 2018). We build on observations by Grosz et al. (2023a,b) that affective face emoji (e.g. 😍😡) resemble linguistic expressives such

as *damn* and *f*ing,* which Gutzmann (2013) defines as linguistic elements "that express some emotional and evaluative attitude with a high degree of affectedness" (Gutzmann 2013:4, see also Gutzmann 2019, Potts 2005, and many others).

In this section, I first explore the use of affective focus emoji with new-information and contrastive focus. I then provide evidence that these kinds of emoji have a dual function: they function as focus indicators and also convey information about the author's opinion (like linguistic expressives). Thus, they carry meaning not present with plain focus emoji (✨and 👉). In the following section, I identify a dissociation between the focus- and affect-related interpretations of these emoji, by showing that the scope of the focus does not always match the scope of the affective attitude.

4.1. New-information focus and contrastive focus

As illustrated in (12), affective focus emoji can encircle new information (12a) as well as contrastively-focused information (12b-d). The examples in (12b-d) are contrastive contexts where the author has a positive attitude towards one and a negative attitude towards the other referent. Thus, by indicating the author's attitude, affective focus emoji can provide details about the nature of the contrast between the two focus alternatives. As a whole, these examples show language users employing emoji for the dual purpose of (i) indicating which element is in focus and (ii) what the author's attitude is towards that element.

(12)

a. I wanna buy so many things for myself but cant cause im 😡broke😡
b. I know, right?? With Trump, it was, well, you know, 😡TRUMP😡 doing a totally illegal thing. Now it's 😍Biden😍 doing a totally very legal thing
c. U ever see someone's body and ur like wow why do they look like 😍that😍 and I look like 🤮this🤮
d. How come han and leia look like ✨THAT✨ but then ben looks like 🤢…that…🤢

Before continuing, a brief digression about the sparkle emoji ✨ is in order. Although some regard the sparkle emoji as positively valenced (and that may well be its function in (12d)), it is currently widely used in seemingly negative contexts as well, as exemplified in (13a,b). In fact, in many contexts it is judged, at least by some people, to be sarcastic. The risk of the addressee interpreting the sparkle emoji sarcastically may what motivated the author to include the clarification clause in (13c), where 'no cap' means 'I'm sincere, I'm not lying.' For now, I will make the simplifying assumption that for many users the sparkle emoji has become bleached of positive connotations, and thus I group it with plain focus emoji. However, a closer look at changes over time, as well as potential differences between generations of emoji users, is a valuable direction for future work.

(13)

a. I am ✨sad✨
b. it was just ✨boring✨
c. Gurl, that is ✨ART✨. (No cap, that's actually amazing<3)

5. Expressives and use-conditioned meaning

The data presented in Section 4 shows that affective focus emoji act both as focus indicators and as signals about the author's attitude. In this section, I discuss examples showing a surprising dissociation, namely examples where the focus marking and the affective attitude do not target the same element. Before turning to the relevant examples, I first review relevant non-emoji work on linguistic expressives that will provide us with useful tools to analyze the behavior of the affective focus emoji.

In his work on expressive adjectives like *damn*, to express the author's attitude, Gutzmann (2013, 2019) uses fraction-like representations to distinguish truth-conditional meaning (shown in the denominator) from expressive (use-conditioned) meaning (in the numerator), which I have slightly adapted below (see also Potts 2005). Although discussion of expressives has mostly focused on examples like (14a) where the attitude can target a particular entity (e.g. the dog), Gutzmann points out that in cases like (14b), the most plausible reading is one where the expressive applies to the full propositional content of the sentence.

In both (14a) and (14b), the expressive adjective, here *damn*, syntactically modifies the noun. In (14a), this adjective can be interpreted as expressive the speaker's attitude towards the dog, i.e., that the speaker has a negative attitude towards the dog.

Crucially, in the right context, this adjective can also be interpreted as semantically targeting the propositional context of the sentence, not just the noun's referent. Thus, (14a) can be interpreted as the speaking having a negative attitude about the dog barking again, not necessarily about the dog *per se*. This reading is perhaps more easily available with (14b).[5] Here, although the adjective *damn* modifies the noun bottle, the speaker's negative attitude most plausibly targets the event of the bottle spilling, not the bottle itself. For example, someone could utter this after spilling their favorite bottle of wine. This is striking, as it shows that we can have a mismatch between the syntactic position of the adjective and its semantic interpretation, what Gutzmann (2019) calls non-local interpretations.

(14)

a. I hear your damn dog barking again =

   <u>I have a negative attitude towards the dog</u>
   I hear your dog barking again

b. I've spilled that damn bottle again =

   <u>I have a negative attitude towards this event</u>
   I've spilled the bottle again

[5] Another example is 'The damn dog ate the cake' (from Gutzmann 2019:87), which can express the speaker being angry about the situation as a whole, not the dog *per se*.

5.1. Affective focus emoji: When focus marking and the affective attitude target the same element

In the case of affective focus emoji, we find examples akin to both (14a) and (14b). In this section, I first consider a situation where the attitude expressed by the emoji targets a particular entity, which is the referent of the words encircled by the emoji. In this case, the 'target' of the focus marking and the 'target' of the author's attitude coincide, and are encircled by the affective focus emoji.

Consider (15). Here, the author's disgust is specifically targeted at the specific thing the person ate and that thing is also what's encircled by the emoji and in focus. The affective meaning can be represented along the lines of what we saw in (14a). This is depicted in (15), adapting Gutzmann's fraction format with the affective (use-conditioned) content as the 'numerator' on top and the truth-conditional meaning as the 'denominator.' Note that here, the affective meaning simply targets the (referent of the) DP *that*. The examples in (12) are of this same type: the affective emoji encircle the focused word and convey the author's attitude about the referent of that word.

(15) you ate 🤢that🤢 =

I have a negative attitude towards what you ate
you ate that

It's worth noting that the above representation does not capture the positional constraints we have observed, i.e. that the emoji occur at the left and right edges of the focused element. As we will see in the next section, this is a desirable property because at least in certain contexts, we need to be able to dissociate the focus-related content and the affective content of affective focus emoji.

5.2. Affective focus emoji: When focus marking and the affective attitude do not target the same element

In addition to the cases in Section 5.1 where the affective meaning of the emoji is specifically linked to the referent of the particular word that is in focus and is encircled by the emoji, we will now see cases where the emoji encircle the focused word but, strikingly, the affective meaning of the emoji is not restricted to that particular word and instead takes scope over a larger part of the utterance. Consider the examples in (16).

(16)

a. I woke up to #valentinesday2021 being not the usual coupledom but LOVE FOR THE WORLD in 2021 and I am ❤️here❤️ for that!
b. He's literally just..standing 😍there😍
c. I love when hes just ❤️there❤️

In (16a), the author's positive feelings are not about the referent of the word *here*. Rather, in this context 'I'm here for that' is an idiom, and *here* does not refer to a specific location. Instead, we can infer that the heart indicates that the author feels happy about the proposition

that Valentine's Day in 2021 is about love for the world. In (16b,c), the author's positive feelings are not about the location *per se* but rather about the entire situation where a particular person is present in that location. Thus, we see a mismatch in what the focus marking is targeting (a particular word) and what the affective attitude applies to (a larger constituent).

Similar patterns occur with negative affective focus emoji, as shown in (17).

(17)

a. Need a holiday right 😡now😡
b. Need 😡coffee😡

In (17a), *now* is in focus and encircled by the emoji, but author's anger is directed at the broader situation about her life being such that she needs a holiday. Similarly, in (17b), *coffee* is in focus and encircled by the emoji, but author's anger is not directed towards the referent of the noun *coffee*. Rather, the angry emotion takes scope over the entire utterance: the author is angry about the fact that she needs coffee (or angry at the situation of being without coffee). Thus, although the affective information is conveyed by the emoji encircling the focused word, the scope of this affective information is *not* limited to that word.

These kinds of examples show that the affective scope of the emoji does not have to match its 'focal scope.' Although the emoji encircle the focused word, their affective contribution can take wider scope. In this regard, they are very much like the 'damn bottle' example (14b) (from Gutzmann 2013). We can represent the truth-conditional meaning and affective (use-conditioned) meaning for (17b) as illustrated in (18).

Crucially, here, the emoji has scope over the entire proposition (similar to *damn* in (14b)). Thus, to capture the contribution of affective focus emoji, their affective meaning needs to be able to (potentially) project beyond the specific word that is focus-marked. While this mismatch may at first glance seem surprising, examples like (14b) show that this phenomenon has a linguistic precedent.

(18) Need 😡coffee😡=

<u>I have a negative attitude towards my needing-coffee situation</u>
I need coffee

5.3. Digression: Could the difference in scope be due to focus projection?

A possible concern is whether what the kinds of examples discussed in Section 5.2 could simply be analyzed as a case of focus projection (see e.g. Selkirk, 1984; 1995), eliminating the need to claim that the affective meaning of the emoji can scope over a larger constituent. However, examples like (19) suggest that this is unlikely to be the case. In (19), the author's positive attitude is not about the determiner *that* but about the entire noun phrase or even the entire clause: the author feels happy because she received good news. Thus, here we again see that affective meaning conveyed by the emoji applies not only to the encircled word but to a larger part of the utterance. Crucially, under typical analyses of focus projection**,** focus is not

expected to project out of *that*, which suggests these effects cannot be attributed to focus projection.

(19) When you get 😍😍THAT😍😍 notification

6. Discussion

This paper is an initial exploration where I argue for the existence of two kinds of focus-indicating emoji that are used to encircle words: (a) plain focus emoji such as the ✨sparkles✨ and the 👉pointing hands👈 and (b) affective focus emoji (e.g. 😡🤢❤️😍). Based on naturally-occurring examples from Twitter, I show that both focus emoji types are (i) semantically flexible, in the sense that they can occur with multiple focus types, unlike spoken language where different focus types often differ in prosodical realization, and (ii) positionally constrained, as they typically occur to the immediate left and right of focused element. Thus, they can provide a useful signal of focus in a domain lacking prosody.

Furthermore, I argue that these two emoji types differ in the information conveyed: While *plain focus emoji* function as focus indicators, *affective focus emoji* have a dual function: they act as focus indicators and also provide information about author's affective attitude (disgust, happiness etc). Crucially, I show that there can be a dissociation between the content that is targeted by focus and the content that is targeted by the affective attitudes expressed by affective focus emoji. While this lack of isomorphism may at first seem unexpected, I propose that there exists a linguistic precedent for this, in the domain of expressive adjectives (see Gutzmann, 2013; 2019), that provides us with tools to better explain these patterns.

Of course, many issues still remain open. In addition to the open questions I identified throughout this paper, there are also are other kinds of focus-related contexts where ✨and 👉 occur that merit a closer look. For example, in some contexts these emoji appear to resemble to contrastive-focus reduplication (e.g. Ghomeishi et al. 2004 on expressions like *salad-salad)*. Topics such as second-occurrence focus should also be explored in the domain of emoji. Furthermore, sentences that contain *both* focus emoji and expressive adjectives like *damn* need investigation. Hopefully this paper can provide a foundation for future work on these topics.

(20)

a. Not a salad but a ✨salad✨ [accompanied by picture of a fancy salad]

b. I meant [say] to pasta ✨salad✨[self-correction after tweeting about 'lemon basil pasta']

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Problem solving with Japanese *beki*[1]

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Abstract. Expressions of prioritizing modality vary within and across languages in the criteria they can encode (rules, goals, or desires) and the directive or expressive speech acts they can perform. Crucial parameters include source of evaluation, endorsement, modal strength, and counterfactuality implicatures. Japanese *beki* is a prioritizing modal which, unlike the better studied Indo-European modals, lacks epistemic readings and interacts with tense transparently, allowing us to isolate modal and temporal effects of past marking.

Keywords: prioritizing modality, counterfactuality, decision problem

1. Introduction

Expressions of prioritizing modality vary within and across languages in the criteria they can encode (rules, goals, or desires) and the directive or expressive speech acts they can perform. Crucial parameters include source of evaluation, endorsement, modal strength, and counterfactuality implicatures (von Fintel and Iatridou 2008; Rubinstein 2012; Silk 2022). Japanese *beki* is a prioritizing modal which, unlike the better studied Indo-European modals (von Fintel and Iatridou 2008; Portner 2009; Rubinstein 2012; Silk 2022: i.a.), lacks epistemic readings and interacts with tense transparently, allowing us to isolate modal and temporal effects of past marking. In this paper we are especially interested in the observation that *beki*-sentences with Past tense generally (with few exceptions, discussed below) have counterfactual interpretations, stating that something should have happened but did not. We explain this behavior in terms of a complex interplay between the modal at-issue meaning of *beki* and certain presuppositions that are triggered by *beki*.

In Section 2 we lay out the basic facts about *beki* and its interaction with tense. We present our analysis of *beki* as a practical modal with special at-issue and non-at-issue profiles in Section 3. Section 4 discusses how our analysis predicts the strong tendency for Past-tense *beki*-sentences to receive counterfactual readings, as well as the limited range of cases in which this counterfactual inference is avoided. Section 5 concludes.

2. Data

2.1. Basic properties

Japanese *beki* is a so-called 'formal noun' (*keisiki meisi* – Yamada 1908; Matsushita 1928; a.o.). It takes a Non-Past-tensed clause as its complement to form a combination which behaves

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outwardly like a noun phrase. In its most typical use, *p-beki* is followed by a tensed form of the copula *da* to form a clause:

(1) *John-wa asita zyugyoo-ni ik-u* ***beki da***.
John-TOP tomorrow class-DAT go-NPST BEKI COP.NPST
'John should go to class tomorrow (in **my** opinion).'

In the descriptive literature, *beki* has been treated as a modal expression concerned with decision-making or moral/value judgment (Moriyama 1997; Takanashi 2010; a.o.). Building on this basic intuition, we assume furthermore that the semantics of *beki* involves **subjective evaluation**: the core meaning of *p-beki* is that the course of events or state of affairs described by *p* is optimal or appropriate by the moral standards or preferences of some perspective holder, which is by default identified with the speaker. Criteria of this kind are typically associated with weak necessity modals, which state about a course of events that it is optimal but not strictly necessary (von Fintel and Iatridou 2008; Sæbø 2009; Rubinstein 2012, 2021; a.o.).

The subjective nature of *beki* can be demonstrated by a number of diagnostics. For instance, as (2) shows, the speaker of *beki* must be able to give grounds for their evaluation (cf. Willer and Kennedy 2020 for a similar requirement imposed by expressions of morality in English): a follow-up that indicates a lack of this ability leads to infelicity. This contrasts with the behavior of *-nakereba naranai*, another prioritizing necessity modal which roughly corresponds to English '*have to*', as shown in (3) (see Kaufmann and Tamura 2020 for a survey of modal expressions in Japanese written in English).

(2) a. *Boku-to kekkonsu-ru nara, kimi-ga myoozi-o kaer-u* ***beki da***.
I-with marry-NPST if you-NOM name-ACC change-NPST BEKI COP.NPST
'If you marry me, you should change your last name.'
b. ??... *naze sore-ga hituyoo ka-wa wakar-ana-i ga.*
why that-NOM necessary Q-TOP know-NEG-NPST though
'... though I have no idea why that's needed.'

(3) a. *Boku-to kekkonsu-ru nara, kimi-ga myoozi-o kae-****nakereba narana-i***.
I-with marry-NPST if you-NOM name-ACC change-must-NPST
'If you marry me, you have to change your last name.'
b. ... *naze sore-ga hituyoo ka-wa wakar-ana-i ga.*
why that-NOM necessary Q-TOP know-NEG-NPST though
'... though I have no idea why that's needed.'

As with weak necessity modals in other languages, *beki* cannot be used to describe the content of laws, as shown in (4) from Takanashi (2010: p.95) (see von Fintel and Iatridou 2008 for corresponding observations about English *should*). Unlike *-nakereba naranai*, the use of *beki* implies that the speaker assumes that getting a license is not required by law but thinks it is desirable at least from his point of view.

(4) *Kuruma-o untensu-ru-ni-wa, menkyo-o* {#*tor-u* ***beki da*** / *tor-****anakereba narana-i***}.
car-ACC drive-NPST-DAT-TOP license-ACC get-NPST BEKI COP.NPST
get-must-NPST
'In order to drive a car, you {#should / must} get a license.'

Beki also contrasts with imperatives in a way that further highlights its core meaning described above. Imperatives do not necessarily commit the speaker to a personal preference about whether *p* comes about, as they can be used to give speaker-disinterested advice (5B) or express concessions (6b) (Kaufmann 2012). *Beki*, however, cannot be used for either purpose. (5B') sounds as if the speaker is giving her own view (based on her own personal standards) on what is the best way to get to the station, which is not what the hearer asked for. The *beki*-statement thus feels irrelevant and uncooperative in this exchange. (6b) sounds as if the speaker actually prefers the hearer going to the party, while the signal of concession *moo ii* (lit. 'already enough') and the derogatory expressive *kuso* (lit. 'shit') suggest otherwise.

(5) A: *Sono eki-e-wa doo yat-tara ik-e-mas-u ka?*
that station-to-TOP how do-COND go-be.able-POL-NPST Q
'How can I get to that station?'
B: *Aa, hachiban-no basu-ni not-**te** **kudasai**.*
well number.eight-GEN bus-DAT take-GRND please
'Well, please take the No.8 bus.'
B': ?*Aa, hachiban-no basu-ni nor-u **beki des-u** ne.*
well number.eight-GEN bus-DAT take-NPST BEKI COP.POL-NPST SFP
'Well, you should take the No.8 bus.'

(6) a. *Moo ii, sono kuso mitaina paatii-ni it-te-**koi** yo!*
already good that shit like party-DAT go-GRND-come.IMP SFP
'Alright then, go to that damn party!'
b. #*Moo ii, sono kuso mitaina paatii-ni it-te-kur-u **beki** **da** yo!*
already good that shit like party-DAT go-GRND-come-NPST BEKI COP.NPST SFP
lit. 'Alright then, you should go to that damn party.'

Note finally that, in line with what has been observed for other perspective sensitive elements, who counts as the source of the assessment underlying a use of *beki* can shift in specific grammatical environments.[2] In an information-seeking question like (7), the source of evaluation shifts from speaker to addressee, a phenomenon known as 'interrogative flip' (Faller 2002).

(7) *John-wa asita zyugyoo-ni ik-u **beki des-u** ka?*
John-TOP tomorrow class-DAT go-NPST BEKI COP.POL-NPST Q
'Should John go to class tomorrow (in **your** opinion)?'

The perspective can be shifted to the attitude holder of an attitude predicate, as in (8). A shift to a third person can also be effected by hearsay evidentials, in which case the source may optionally be made explicit by *-ni yoreba* ('according to'), see (9).

(8) *Mary-wa [John-ga asita zyugyoo-ni ik-u **beki da** to] omotteiru.*
Mary-TOP John-NOM tomorrow class-DAT go-NPST BEKI COP.NPST C think
'Mary thinks that John should go to class tomorrow (in **her** opinion).'

[2]Other phenomena instantiating this pattern are discussed in Speas and Tenny (2003), Zu (2018), and Stegovec (2019), a.o.

(9) *(Gakkatyo-ni yoreba,) kyooin-ga sore-o su-ru **beki da** sooda.*
dean-DAT according professor-NOM it do-NPST BEKI COP.NPST HEARSAY
'A professor should do it (according to **the dean's** opinion).'

2.2. Interaction with past

While the prejacent of *beki* has to have Non-Past tense, the copula *da* that follows *beki* can combine with the Past morpheme *-ta*. Sentences of the form '*p-beki dat-ta*' typically give rise to a counterfactuality inference: they do not merely state that *p* was necessary in the past, but also imply that *p* did not happen. Past-tensed *beki* is typically used to express regret about, or criticize, a wrong choice made out of ignorance, inertia or ill-will. As was observed in Takanashi (2010: pp.159-160), (10) cannot be continued with a follow-up that implies the truth of *p* with the same ease with which (11) ('*-nakereba narana-katta*') can be continued with the same follow-up.[3]

(10) *Kinoo-wa haisya-ni ik-u **beki dat-ta**. ...*
yesterday-TOP dentist-DAT go-NPST BEKI COP-PAST
'Yesterday I should have gone to the dentist. . . .'
a. ??. . . *Sorede, zikan-o tukut-te, it-ta.*
so time-ACC make-GRND go-PAST
'. . . So, I made time and went.'
b. . . . *Sikasi, zikan-ga naku-te ik-e-na-katta.*
but time-NOM be.not-GRND go-able-NEG-PAST
'. . . But I couldn't because I didn't have time.'

(11) *Kinoo-wa haisya-ni ik-**anakereba narana-katta**. . . .*
yesterday-TOP dentist-DAT go-must-PAST
lit. 'Yesterday I had to go to the dentist. . . .'
a. . . . *Sorede, zikan-o tukut-te, it-ta.*
so time-ACC make-GRND go-PAST
b. . . . *Sikasi, zikan-ga naku-te ik-e-na-katta.*
but time-NOM be.not-GRND go-able-NEG-PAST

To underscore these points, we observe that Past-tensed *p-beki dat-ta* cannot be used when the speaker is uncertain whether the prejacent *p* took place, as shown in (12): the sentence implies wrongly that John did not go to the class and the speaker knows it.

(12) **Context (Uncertainty)**: John hesitated whether to attend the class yesterday. Today I heard from another student in that class that the professor held a helpful review session for the exam. I don't know if John went in the end. I happen to see John and say:
??*Kimi-wa kinoo-no zyugyoo-ni ik-u **beki dat-ta** (kedo,*
you-TOP yesterday-GEN class-DAT go-NPST BEKI COP-PAST but
zyugyoo-ni-wa it-ta?).
class-DAT-TOP go-PAST
'You should have gone to the class yesterday. (Did you go to class?)'

[3]Note that, unlike English '*had to*', Past-tensed '*-nakrereba narana-katta*' does not give rise to the actuality inference (i.e., the inference that *p* happened), as suggested by its compatibility with the follow-up in (b).

As we noted, '*p-beki dat-ta*' is typically used to imply that a wrong decision was made: in such cases the counterfactuality of *p* results as the failure to made the right decision. However, one can also imagine cases in which the right decision was made but failed to be carried out because of external obstacles. In such cases '*p-beki dat-ta*' cannot be used, as (13) shows. Thus even if the prejacent is false, '*p-beki dat-ta*' is infelicitous as long as the agent made the right decision.

(13) **Context (Prevention)**: John hesitated whether to attend the class yesterday. In the end, he decided to attend, but got stuck in the elevator until after the class. His decision itself was the right one, as the professor held a helpful review session for the exam in the class. I know all this. I happen to see John and say:

#Kimi-wa kinoo-no zyugyoo-ni ik-u ***beki dat-ta*** *yo.*
you-TOP yesterday-GEN class-DAT go-NPST BEKI COP-PAST SFP
'You should have gone to the class yesterday.'

In addition to the basic properties described in Section 2.1, a successful analysis of *beki* also has to explain its intricate interaction with Past tense. In the next section, we will outline such an analysis. In Section 4, we will discuss how our analysis explains the data presented in this section, with special focus on when and why the counterfactuality inference does or does not arise.

3. Analyzing *beki* as a practical modal

We assume a standard model with a set of possible worlds W and times T (for simplicity, the latter are temporal instants). Contexts c are Kaplanian (1989) quadruples $\langle SP, AD, w, t\rangle$, where SP_c is the speaker, AD_c the addressee, w_c and t_c the utterance world and time, respectively. Interpretation proceeds with respect to a context and an index of evaluation, where the index is a triple $\langle w, t, \pi\rangle$ consisting of a world w, a time t, and a perspective center π (Lasersohn 2005; Stephenson 2007). In the unembedded case, the world and time component of the index of evaluation are identified with w_c and t_c, respectively. Intensional operators quantifying over worlds and/or times shift the world and time of the index as usual. By default, π is identified with SP_c in matrix declaratives but it shifts to AD_c in matrix interrogatives, to the referent of the matrix subject in attitude reports, and to the information source under hearsay evidentials.

We propose that *beki* denotes a Kratzer-style necessity modal (Kratzer, 1981, 1991, 2012), whose modal base represents relevant facts and whose ordering source encodes π's moral principles or subjective preferences. We propose (14) as its at-issue meaning:

(14) '*p beki*' is true at c and $\langle w, t, \pi\rangle$ iff for all w' that are (i) compatible with the relevant facts at $\langle w, t\rangle$ and (ii) optimal according to π's moral principles or subjective preferences at $\langle w, t\rangle$, there is a t' such that $t < t'$ and p is true at $\langle w', t', \pi\rangle$.

This definition captures the observations from Section 2.1. The modal flavor (moral principles or subjective preferences) ensures that *beki* cannot describe the contents of laws or convey instructions, concessions, or the like. The dependence on the perspectival center π explains the default anchoring to the speaker and the shifts depending on linguistic context. Finally, given standard assumptions about introspection regarding one's moral principles or preferences, speakers (more generally, the perspectival center) have to be able to give grounds for the evaluations expressed with *beki*.

We propose furthermore that *beki* has the non-at-issue content in (15):

(15) At a context c and an index $\langle w,t,\pi\rangle$, p *beki* presupposes that
  a. there is a salient **decision problem** Δ such that p answers Δ; and
  b. Δ is **not nailed** in c; and
  c. p is **not settled** at $\langle w,t\rangle$.

The presuppositions are intended to capture the inherently practical character of *beki*; the crucial concepts are understood as follows. A **decision problem** Δ induces a partition on a salient set of indices. The cells of this partition represent possible courses of events choosable for the relevant agent (see Cariani et al. 2013). Thus the formal representation of decision problems is similar to that of questions (e.g., Groenendijk and Stokhof 1984), as shown in Figure 1.

$\Delta \approx$ 'Does John go to the class?'

Yes
No

$\Delta \approx$ 'Where does John go?'

Class	Cafe
Party	Home

Figure 1: Illustration of decision problems

A decision problem Δ is **nailed** at world w and time t iff Δ has been decided correctly at w and t according to the relevant criteria. Thus there are several possible reasons for which Δ may **not** be **nailed** at $\langle w,t\rangle$: (i) no decision has been made; (ii) a decision has been made, but it was a wrong decision by the criteria underlying the interpretation of *beki*; (iii) the speaker does not know what the relevant criteria amount to. Notice that, since we assume that the speaker has introspective access to their own criteria, (iii) will typically arise only when the perspectival center is shifted away from the speaker.

A proposition p is **settled** at $\langle w,t\rangle$ iff its truth value is constant across all ***historical alternatives*** of w at t. The set of historical alternatives of w at t consists of worlds that share the same history with w at least up until t.[4] A proposition p is **not settled** at w and t iff its truth value is not constant across the historical alternatives of w at t. Historical alternatives may disagree about the truth value of propositions about the future. Propositions about future actions are generally neither settled true nor settled false, but propositions about past actions always are either. We assume that *beki* is interpreted with respect to a ***metaphysical modal base***, that is, the domain of quantification at w and t is given by the set of historical alternatives of w at t (compare 'compatible with the relevant facts' in (14)).

Note that in the non-at-issue meaning component of *beki*, the requirement that the prejacent is not nailed is anchored to the utterance context, whereas the requirement that the prejacent is not

[4]This notion of "settledness" deviates from the one typically found in the literature, according to which p is settled at $\langle w,t\rangle$ iff p is true at all historical alternatives of w at t (Thomason 1984; Condoravdi 2002). The present notion, according to which the truth value of p must be constant (but may be false) across w's historical alternatives at t, was called "presumed settled" in Kaufmann (2002) and "presumed decided" in Kaufmann (2005). We avoid those latter terms here because of a danger of confusion with notions related to the decision problem.

settled is anchored to the index of evaluation. Consequently, we expect intensional operators to affect where (or when) settledness is evaluated, but not where (or when) nailedness is evaluated.

Our proposal analyzes (1), repeated in (16), as follows. As (16) is a matrix sentence with Non-Past on the copula, we assume that it constitutes a case in which the index of evaluation $\langle w,t\rangle$ is identical to $\langle w_c,t_c\rangle$. The sentence presupposes that there is a salient decision problem Δ that partitions the modal base into two cells, containig worlds at which John goes to class (in the future) and worlds at which he does not, respectively. Given that John has yet to make this choice and thus neither option is excluded at t_c, non-nailedness and non-settledness are satisfied automatically. With all these presuppositions met, the speaker asserts that for all indices that are compatible with the relevant facts and optimal according to her subjective criteria, there is a future index that is *tomorrow* (from the perspective of t_c) and at which John goes to class.

(16) *John-wa asita zyugyoo-ni ik-u* ***beki da.***
John-TOP tomorrow class-DAT go-NPST BEKI COP.NPST
'John should go to class tomorrow (in **my** opinion).'

4. Enter Past

4.1. Interaction with Past explained

Past shifts the temporal coordinate of the index of evaluation $\langle w,t\rangle$ to an earlier time t'. The at-issue and non-at-issue meanings of '*p beki dat-ta*' are then as follows.

(17) '*p beki dat-ta*' is true at c iff for some $t' < t_c$, all w' that are (i) compatible with the relevant facts at $\langle w_c,t'\rangle$ and (ii) optimal according to π's moral principles or subjective preferences at $\langle w_c,t_c\rangle$, there is a t'' such that $t' < t''$ and p is true at $\langle w',t'',\pi\rangle$.[5]

(18) At a context c and an index $\langle w,t',\pi\rangle$, '*p beki dat-ta*' presupposes that
a. there is a salient decision problem Δ such that p answers Δ;
b. Δ is not nailed at $\langle w_c,t_c\rangle$; and
c. p is not settled at $\langle w,t'\rangle$.

Notice that the at-issue meaning in (17) is evaluated with respect to the relevant facts at the past time t', as is the non-settledness presupposition in (18c). In particular, even if p is settled at the utterance time, it can be unsettled at the earlier t' (by definition, the set of historical alternatives monotonically shrinks towards the future, Thomason 1984). Intuitively, Past-tensed *beki*-sentences involve a 're-deliberation' of the decision problem Δ relative to a past time at which p was not yet settled: they are true iff p was the right action relative to Δ at the past state of affairs according to π's subjective criteria.

These definitions gloss over two important issues in the interest of readability. We briefly state here what those issues are and how our formal analysis could be augmented to deal with them.

[5]We assume an interpretation of Past tense under which $t' < t_c$ is existentially quantified over. Alternatively, we could assume a referential analysis under which Past introduces a free temporal variable (e.g., Heim 1994). This difference is not important for our immediate concerns in this paper.

First, our analysis sets aside ***hindsight effects***, where events in the future of the past decision point affect what counts as the optimal decision. Arregui (2010) observes hindsight effects for *should have* and considers them reason to abandon an analysis in terms of temporal backshift. Hindsight effects surface also in the interpretation of counterfactual conditionals. For these, Kaufmann (2005) proposes an analysis in terms of causal independencies which reconciles a backshift analysis with the possibility that events in the future of the past branching point are relevant for the truth of the counterfactual sentence (see also Kaufmann 2013). We assume that our analysis of *beki* can be enriched along these lines to deal with hindsight effects.

Second, and related to the point about hindsight effects, while (17) states that criteria relevant for the evaluation are the perspectival center's preferences at the index of the utterance context $\langle w_c, t_c \rangle$, we refrain from saying exactly *why* it is this context, and not the past $\langle w_c, t' \rangle$, that anchors the preferences. Notice first that it seems descriptively correct that the preferences at utterance time are at work in many cases (we discuss more linguistic examples below). Suppose the speaker liked Californian wines until recently and used to order them in restaurants. But her taste has changed; now she prefers French wines. She can then felicitously say '*I should have ordered French wine (at that fancy restaurant last fall)*'. Clearly this is only true relative to her new preferences, not the ones at the time of the order.[6]

Now recall that Past-tensed *beki*-sentences typically imply that the prejacent p did not happen, as shown in (19) (repeated from (10)).

(19) *Kinoo-wa haisya-ni ik-u* ***beki dat-ta***. ...
yesterday-TOP dentist-DAT go-NPST BEKI COP-PAST
'Yesterday I should have gone to the dentist. ...'
a. ??... *Sorede, zikan-o tukut-te, it-ta.*
so time-ACC make-GRND go-PAST
'...So, I made time and went.'
b. ... *Sikasi, zikan-ga naku-te ik-e-na-katta.*
but time-NOM be.not-GRND go-able-NEG-PAST
'...But I couldn't because I didn't have time.'

The counterfactuality of (19) is derived under our analysis as follows. The speaker re-deliberates the salient decision problem Δ (i.e., whether to go the dentist) that she faced in the past. The past tense and the adverbial *kinoo* 'yesterday' shift the index of evaluation to a moment in the past. Absent further modification, the frame-setting adverbial is likely to locate in the past also the event described by the prejacent; that is, the sentence is typically understood as being about a visit to the dentist to be taken within yesterday. (This is often but not always the intended reading. See below for examples involving past deliberation about future actions.) The prejacent proposition ('I go to the dentist yesterday') is therefore settled at w_c and t_c. That is, the speaker has made a decision. However, (19) presupposes that Δ is not nailed at $\langle w_c, t_c \rangle$; given that a decision has been made and that the speaker has to know her own subjective preferences, the only possible reason is that she made the wrong decision, which, as inferred from the assertive content, is that she did not go to the dentist; hence the counterfactuality of p.

[6]That said, we could conceivably derive this effect even if our semantic definition were to anchor the relevant preferences to the past index $\langle w_c, t' \rangle$, provided that we treat those preferences as among the worldly facts that are subject to hindsight. This route was explored with regard to a different but related set of facts, Japanese past desire reports, by Mizuno and Kaufmann (2022). In this paper we remain non-committal as to the exact mechanism by which current preferences enter the reassessment of past decisions.

Our analysis also correctly predicts that (20) (repeated from (12)) is infelicitous.

(20) **Context (Uncertainty)**: John hesitated whether to attend the class yesterday. Today I heard from another student in that class that the professor held a helpful review session for the exam. I don't know if John went in the end. I happen to see John and say:

??*Kimi-wa kinoo-no zyugyoo-ni ik-u* ***beki dat-ta*** *(kedo,*
you-TOP yesterday-GEN class-DAT go-NPST BEKI COP-PAST but
zyugyoo-ni-wa it-ta?).
class-DAT-TOP go-PAST
'You should have gone to the class yesterday. (Did you go to class?)'

(20) presupposes that Δ (i.e., whether John attends the class) is not nailed at the utterance time. The use of Past and the past indexical imply that *p* is settled at the utterance time, so John has made a certain decision. Given this, and given that the speaker knows her own subjective criteria, the only possibility is that she believes that a wrong action was taken, which, as inferred from the assertive content, is that John did not attend the class. This, however, contradicts her uncertainty regarding which action was actually made, hence the infelicity of the sentence.

Finally, our analysis can also explain why (21) (repeated from (13)) is infelicitous.

(21) **Context (Prevention)**: John hesitated whether to attend the class yesterday. In the end, he decided to attend, but got stuck in the elevator until after the class. His decision itself was a right one, as the professor held a helpful review session for the exam in the class. I know all this. I happen to see John and say:

#*Kimi-wa kinoo-no zyugyoo-ni ik-u* ***beki dat-ta*** *yo.*
you-TOP yesterday-GEN class-DAT go-NPST BEKI COP-PAST SFP
'You should have gone to the class yesterday.'

The reason for the infelicity is simply that Δ here is *nailed*, that is, John's decision to attend the class was optimal according to the speaker's subjective criteria: he should have taken another route to avoid the obstacles, but that would engage one in a separate decision problem, different from the one that the *beki*-statement here is addressing.[7]

4.2. When counterfactuality is obviated

4.2.1. Uncertainty about what's optimal

Takanashi (2010: pp.162–163) notes that in her corpus research of Japanese novels and newspaper articles, 859 out of 862 examples of the '*p beki dat-ta*' form were judged to imply the counterfactuality of the prejacent. One of the three exceptions involves an idiomatic expression '*tokuhitu su beki dat-ta*' ('was noteworthy'), which can be excluded as a non-genuine case. The other two actually involve the same sentential forms '*koo nar-u beki dat-ta no da*' (≈'should have been like this'). (22) illustrates one of them. (22a) is the translation of the preceding text.

[7]For instance, we could think of this as a local problem of 'how do I get to class', in the (hypothetical) context of 'If I want to get to class'. See Kaufmann and Kaufmann (2021) for the interaction between contextually salient decision problems and the felicity of conditionals with imperative consequents.

(22) a. ['Looking back now, it doesn't seem to me particularly surprising that I feel that things like this had been expected to occur from long ago. . . . ']
b. . . . *Koo nar-u* ***beki dat-ta no da.***
like this become-NPST BEKI COP-PAST FIN COP.NPST
'Things should have become like this.'

The preceding text suggests that the prejacent of (22b) (i.e., 'things become like this') did come out true. The other case of this kind Takanashi provides likewise involves a preceding text that suggests that the prejacent is true (see Takanashi 2010: p.162).

What we think to be characteristic of the case at hand is its particular utterance discourse: with the truth of the prejacent p taken for granted, what is at-issue is whether p was actually the right decision according to the relevant criteria. To support this idea, it is worth noting that (22b) sounds more natural if phonological prominence is placed on *beki* itself, suggesting that 'should' or 'should not' is the focus of the discourse.

Our analysis of *beki*, as stated, does not immediately account for the felicity of (22b), but it can be amended to do so. In the interest of brevity, we give only an informal outline of the required modification.

The main point to note is that (22b) is most naturally used in a context in which the question whether the course of action that led to the truth of the prejacent was in fact the best one, or can still be considered the best one, is being reconsidered, perhaps in light of new information. The speaker suspends her belief that that course of action was in fact the best one, for the sake of argument. We see a parallel between this kind of reasoning about *beki*-sentences and so-called Anderson conditionals (Anderson, 1951). A version of the classic Anderson sentence is given in (23a). The X-marking on these sentences makes intuitive sense if we assume, with Stalnaker (1975), that it signals the suspension of an assumption that is taken for granted. Here, that assumption concerns the symptoms that the patient shows. In virtue of this reasoning, (23a) conveys that the antecedent would be a good *explanation* for the truth of the consequent.[8] But while this intuition is clear enough, formal analyses of X-marking typically do not account for it, except for the generic statement that some assumptions are suspended. It is not our goal here to improve over this situation; we only want to point out the parallelism between Anderson conditionals and *beki datta* sentences like (22b), which can be brought out with the paraphrase in (23b). In view of this similarity, we assume that a successful account of the former will be adaptable, *mutatis mutandis*, to an account of the latter.

(23) a. If the patient had taken arsenic, she would have shown the symptoms that she is in fact showing.
b. If the decision problem had been nailed, the course of action would have been taken that was in fact taken.

As a side remark, we note that Takanashi actually speculates that *beki* in (23b) may not represent prioritizing necessity but rather concern 'schedules' or 'destinies'. This latter possibility of meaning is reminiscent of the 'normality' reading of English *should* highlighted in the previous literature (see e.g., Yalcin 2016). Takanashi also observes that some cases of Non-Past

[8] See Gärdenfors (1988) for a belief-dynamic account of explanation that crucially involves the retraction of the explanans.

beki appearing in the relative clause likewise seem to obtain such readings. In this paper we would like to leave open whether *beki* may productively obtain the putative nomality reading, though we think that the prioritizing flavor is equally conceivable for *beki* in (23b).

In addition to Takanashi's data, we observe that the counterfactuality of *p* can be easily obviated in interrogatives. (24) was collected from the web, which was posted on an online history forum as a prompt to get the discussion started.[9]

(24) *Rui.16-see-wa syokeesare-ru* ***beki des-ita*** *ka? Iken-o kudasai!!*
LouisXVI-TOP be.executed-NPST BEKI COP.POL-PAST Q opinion-ACC please
'Should Louis XVI have been executed? Please give your opinion!!'

As the speaker should know that Louis XVI was executed, we can assume that the truth of the prejacent *p* is taken for granted in the utterance context. As above, what is at-issue is whether *p* was right or wrong. Here the relevant perspective is shifted from the speaker to the addressee, due to the use of an interrogative. Because the speaker does not know the subjective criteria of the addressee, it cannot be taken for granted that Δ has been correctly resolved from the perspective of the addressee, hence satisfaction of the non-nailedness presupposition.

In a similar vein, the counterfactual inference does not arise when '*p beki dat-ta*' appears within an embedded interrogative, as shown in (25). Here the speaker makes it explicit that it is open whether Δ has been correctly resolved according to her criteria. The felicity of the sentence is predicted as above.

(25) [*Rui.16-see-ga syokeesare-ru* ***beki dat-ta*** *kadouka*], *watasi-ni-wa*
LouisXVI-NOM be.executed-NPST BEKI COP-PAST whether I-DAT-TOP
wakar-ana-i.
know-NEG-NPST
'I don't know if Louis XVI should have been executed.'

4.2.2. Frame-setting adverbials

In (19), we have seen an example where the frame-setting adverbial *kinoo* 'yesterday' shifts back both the index of evaluation and the event time of the prejacent. With sufficient contextual support, it is possible for a frame-setting adverbial to shift only the index of evaluation (and hence the modal perspective, in the sense of Condoravdi 2002), without shifting the event time of the prejacent predicate into the past.

(26) **Context (New information 1):** The speaker has offers from multiple PhD programs, including MIT. She has yet to make up her mind. MIT looked like the best option until yesterday, but today she found out that her desired adviser is leaving there.
Kinoo made-wa, watashi-wa MIT-ni ik-u beki dat-ta. (Demo
yesterday until-TOP I-TOP MIT-DAT go-NPST BEKI COP-PAST but
ima-wa tiga-u.)
now-TOP be.not.true-NPST
'Until yesterday, I should have gone to MIT. But now, that's not the case anymore.'

[9] `https://www.clearnotebooks.com/ja/questions/443838`, last accessed on January 25, 2024.

Importantly, this example does not give rise to a counterfactual inference, i.e. it does not imply that the speaker will go to MIT. This is possible thanks to the mismatch between the (past) modal perspective and (future) choice of action: the sentence says that until yesterday, going to MIT was optimal, though Δ is not yet decided at $\langle w_c, t_c \rangle$; hence, no counterfactuality inference is generated.[10]

Note that the same sentence is felicitous even when a choice was previously made, as in (27). Again, this example does not give rise to a counterfactuality inference.

(27) **Context (New information 2):** The speaker has offers from multiple PhD programs, including MIT. She accepted MIT's offer yesterday, because her desired advisor is a faculty member there. Today, she finds out that the professor is leaving MIT next year. Unfortunately, the offer she accepted cannot be withdrawn.

Kinoo made-wa, watashi-wa MIT-ni ik-u beki dat-ta. (Demo
yesterday until-TOP I-TOP MIT-DAT go-NPST BEKI COP-PAST but
ima-wa tiga-u.)
now-TOP be.not.true-NPST
'Until yesterday, I should have gone to MIT. But now, that's not the case anymore.'

Without spelling out a full account, we speculate that this example requires us to allow for the possibility that a decision problem that was previously nailed becomes not nailed at a later time. Intuitively, in (27), the speaker thought that the decision problem 'Do I go to MIT?' was nailed when she accepted the offer, but now she knows that it is not, due to the new information that the professor is leaving.

5. Conclusion and further research

We have developed an analysis for the Japanese modal expression *beki*, which serves to single out specific courses of events as optimal in light of subjective assessments. Similar functions are performed by weak necessity modals like English *ought* or *should* (on their non-epistemic uses). It has been observed that a number of typologically unrelated languages derive weak necessity modals by placing special morphological marking on strong necessity modals (which translate to English as *have to* or *must*). Specifically, von Fintel and Iatridou (2023) note that the marking found is the (e)X(tra)-marking characteristic of the consequents of conditionals about remote or possibly counterfactual states of affairs. They assume that this marking is crucially involved in the weakening of the modals' quantificational force. In light of the fact that X-marking is expressed as Past tense in languages like English, it is sometimes analyzed as involving a backshift (Past-as-Past), deriving counterfactuality effects in a way similar to what we have assumed for *p-beki dat-ta*.

However, while in Japanese some counterfactual conditionals are marked with Past tense, the distribution of this marking and its semantic semantic contribution differ from the English

[10]One complication of (26) (as well as (27) below) is that hindsight effects seem to be absent: to say truthfully that going to MIT was optimal until yesterday would require us to ignore the fact that my desired advisor is leaving, which was learned only at a later time. We do not have an account of why this is the case, but note that the absence of hindsight effects may result from the frame-setting adverbial *kinoo made-wa* 'until yesterday'.

case. The X-marking on English weak modals is the same as that in English 'Simple Past subjunctives' (Ippolito, 2013), but the Japanese counterparts of English 'SP subjunctives' are not X-marked (they are not distinguished from indicatives). Instead, Japanese Past-marked conditionals correspond to English 'Past Perfect subjunctives'. The latter are distinguished in English by an additional Perfect morpheme (*would have V-ed* as opposed to *would V* – see Ippolito 2013); the closest analogs among weak modals are also Perfect-marked (*should have V-ed*, *ought to have V-ed*). Thus it seems that the Past marking in Japanese counterfactuals corresponds to the Perfect in English 'PP subjunctives', not the Past in English 'SP subjunctives'. Its semantic contribution is a shift back in time (Mizuno and Kaufmann 2019, 2022; Mizuno 2023).[11] Our analysis of *beki dat-ta* as involving a backshift to revisit a past decision problem thus assimilates *beki dat-ta* to English 'PP subjunctives' as well as its closest English translation *should have*. This leaves open whether Non-Past *beki da* is a true indicative form or the equivalent of English SP-X-marking (for recall that the latter is not marked on Japanese conditionals).

Recently, Ferreira (2023) described a Portuguese lexical expression of weak necessity (*dever*) which, just like strong necessity modals, can be (SP-style) X-marked to express suspension of presuppositions to make room for an unlikely or counterfactual prejacent. Similar to *dever*, Japanese *beki* is associated lexically with weak necessity (but restricted to the prioritizing modality, unlike *dever*). In our analysis, the backshift expressed by *beki dat-ta* is then a form of X-marking, however not the one associated with the formation of weak necessity modals per se, but as expressing a kind of backshift as associated with PP-style X-marked conditionals. In this paper, we have aimed to account for the presence and absence of counterfactual inferences in terms of the speaker's assessment of a (past) decision problem as "not nailed", hence in need of re-deliberation. A first informal investigation of English *should have* suggests that the expression behaves similarly to *beki dat-ta* in terms of when an inference to the counterfactuality of the prejacent can be avoided. More crosslinguistic research will be needed to fully determine the connection between different types of necessity modals, different types of X-marking, and the contextual factors responsible for the presence or absence of counterfactual inferences.

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[11] Ogihara (2014) has provided a Past-as-Modal analysis of the Past in Japanese counterfactuals, but this leaves unexplained why it cannot appear in the Japanese counterparts of genuinely counterfactual English 'SP subjunctives'.

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A framework for performative and assertive updates[1]

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Abstract. This article develops a framework for the representation of performative speech acts, in particular declarations (including explicit performatives) and assertions. It is a dynamic framework that treats these speech acts as updates of a common ground, modelled as a context set. It distinguishes between two kinds of updates: Informative updates restrict the indices of the context set by adding information, whereas performative updates change the indices, thus creating new facts. The article discusses the notion of index change in detail and presents an analysis of declarations as performative updates with a proposition concerning social facts. Assertions are specialized performative updates with a truth commitment by the speaker with implicated intention to bring about a corresponding informative update. It also discusses the various tense and aspect forms that are used to express declarations. Finally, it argues that locutionary acts can be modelled as performative updates as well and proposes a treatment of the performative marker *hereby*.

Keywords: speech acts, performatives, assertions, declarations, context change

1. Introduction

In 1930, the slavicist Erwin Koschmieder discovered that there are declarative sentences which are not used to *describe* an action but rather to *act*. Observing that in such sentences the words coincide with the action, he termed this "Koinzidenzfall". This predates the distinction between constative and performative speech acts made by the philosopher of language John Austin in the 1950's that resulted in his famous essay "How to do things with words" (1962).[2]

Constative and performative use of language was difficult to tease apart because many sentences can be used for either purpose, cf. (1). Furthermore, whenever a declarative clause in its performative use was felicitously uttered, the assertive clause can be uttered felicitously as well because its proposition became true by the performative utterance.

(1) A: *The meeting is adjourned.*
   a. Constative (assertive, reportative): A reports that the meeting is adjourned.
   b. Performative: A adjournes the meeting.

But there are well-known differences that help to distinguish between these sentences. Koschmieder observed that performative sentences cannot answer questions. If B asks, *What happened?* (1) only has a constative reading. Koschmieder and Austin pointed out that in action sentences, the self-referential adverbs *hiermit* / *hereby* identify the performative use as in (2a,b). Koschmieder also noticed that the adverb *soeben* 'right now' disallows the performative use, even though it also expresses a temporal coincidence between the utterance and the

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[2] Cf. Keck & Stubbs (1984) for discussing Koschmieder's contribution relative to Austin's.

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described event. Correspondingly, Austin noticed that progressive tense disfavors the performative interpretation; this effect seems even stronger with the adverb *right now*:

(2) a. A: *I hereby adjourn the meeting.*
b. A: *Ich vertage hiermit die Versammlung.*
c. *I am adjourning the meeting* (*right now*).
d. *Ich vertage soeben die Versammlung.*

Another observation by Koschmieder and Austin is that performatives tend to have first person subjects. This applies to action sentences like (2), where replacement by second and third person subjects blocks a performative interpretation, cf. (3a). However, action performatives can occur in passive sentences like (3b), and in statives like (1) and (3c).

(3) a. A: *She* (*#hereby*) *adjournes the meeting.*
b. A: *Die Versammlung wird* (*hiermit*) *vertagt.*
c. A: *Die Versammlung ist* (*hiermit*) *vertagt.*

Stative expressions were not mentioned prominently in early work on performative utterances, where the discussion centered on examples like (2) or *I promise to come to your party* that contain a verb, like *adjourn* or *promise*, that denotes the very act that is performed; hence the term "explicit performatives". Searle (1976) introduced the distinction between "representatives" (assertions) and "declarations" (performatives). Declarations, if performed felicitously, adapt the world to the words and thus guarantee that the words also correspond to the world. Recanati (1987) and Searle (1989) argued that explicit performatives are a subcase of the larger class of declarations, a view that I will follow here.

Furthermore, Austin (1961) remarks that performative utterances cannot be true or false. He also observes that performative declaratives do not contain modal verbs like *could* or *might* – in fact, they do not allow for epistemic or evidential modification in general, and their strength cannot be modified. Hence, (4a,b) only have a constative reading.

(4) a. A: *The meeting is probably / presumably / certainly adjourned.*
b. A: *The meeting is really / indeed adjourned.*

As performatives cannot be true or false, one cannot lie with them (Marsili 2021). For an utterance to be a lie requires that the speaker commits to, or vouches for, the truth of a proposition, which is the defining feature of assertions (cf. Shapiro 2020). Austin observed that performatives can be uttered in mischievous or deceiving ways, but this is different from lying:

(5) Impostor to A: *You are arrested.*
A to impostor: *#You are a liar. / You aren't even a police agent!*

Performatives are put in force whenever they are correctly produced. For example, if a police officer in regular circumstances tells *A*, *You are arrested*, then A is in the legal status of being arrested. Even if the police officer later finds out that A was the wrong person and revokes this act, in the time in-between it holds that A is arrested.

The distinction between descriptive and performative use of language is of great importance in philosophy of language but it is treated rather marginally in linguistic semantics. The beginning of a semantic account that takes performatives seriously is Szabolcsi (1982). I engaged with this article in Krifka (2014), and in the current article I will offer several refinements.

In Section 2, I will characterize Szabolcsi's approach and her notion of functional index change. In Section 3 I will argue for a relational form of this notion. In section 4 I will integrate relational index change into a simple form of dynamic semantics for which we can define both the well-known "informative" update and the novel "performative" update. Section 5 will present an interpretation of assertions and declarations which assumes that this distinction is reflected in the syntax, and it will also point out that assertions have a performative component. Section 6 will discuss the temporal, modal and aspectual forms of performatives in a range of languages. In the Section 7, I will argue that the utterance of expressions themselves, and hence their locutionary aspect, can be addressed in the framework developed here as well. The final Section 8 deals with the performative marker *hereby*.

2. The proposal of Szabolcsi (1982)

Szabolcsi's short paper was written in the framework of Montague (1973), who proposes that declarative clauses denote propositions φ, functions from world-time indices into truth values, type ⟨s, t⟩. This captures the use of language as describing how the world is like. Performative speech acts do not describe the world but change it, and Szabolcsi interprets them as "transition from one state of affairs to another", hence of type ⟨s, s⟩ (cf. also Sbisà 2002 for speech acts as context changers). She proposes that performative meanings based on a proposition φ are functions that change an index i to i′ with i ≤ i′ (that is, i′ is equal or later than i), where i′ is identical to i with the (possible) difference that φ is true at i′. While Szabolcsi writes i[φ] for this index i′, we will use the notation i+φ, and call it "functional index change":[3]

(6) Functional index change (Szabolcsi):
i+φ = ιi′[i≤i′ ∧ i′ is identical to i with the possible exception that φ(i′)]

Now, given some index i, some expressions that involve a proposition φ are interpreted descriptively, as φ(i), whereas others are interpreted performatively, as i+φ. But what determines the type of interpretation? Why is *I congratulated you* interpreted descriptively, and *I congratulate you* rather performatively? Szabolcsi proposes that this is regulated by the system of syntactic categories[4]: descriptive sentences are of category *t* and interpreted by functions from indices to truth values, type ⟨s, t⟩, whereas performative sentences are of a different syntactic category $\bar{t}$ and interpreted as functions from indices to indices, type ⟨s, s⟩. As sentences are projected from verbal predicates, this leads to a doubling of syntactic categories. For example, the verbal

[3] Lascarides & Asher (2003) define an action that makes a proposition true as a function from worlds to worlds; however, they do not give any restriction except that the proposition should hold at the output world. A similar index change is proposed in Hunter et al. (2018), rule 21.

[4] Montague (1973) uses t for both the syntactic category of sentences and the semantic type of truth values. In order to avoid confusion, I use italics for syntactic types here. Note, also, that Szabolcsi names indices as world-time pairs ⟨i, j⟩, whereas in the current text, letters i, i′ etc. stand for indices encompassing possible worlds and times.

predicate *congratulate* has two distinct syntactic categories, (*t*/*e*)/*T* for the informative use, and ($\bar{t}$/*e*)/*T* for the performative use. Szabolcsi considers $\bar{t}$ as a subcategory of *t*, hence every syntactic rule involving *t* also applies to $\bar{t}$. For interpretation, she proposes a meaning postulate scheme that states that whenever α is a meaningful expression with a meaning of type ⟨s, t⟩, then α is also a meaningful expression of type ⟨s, s⟩. The two interpretations are linked via the rule mentioned above: If φ is a meaning of type ⟨s, t⟩, a function from indices i to truth values λi.φ(i), then the corresponding meaning of type ⟨s, s⟩ is λi.i+φ, a function from indices to minimally different indices where φ is true.

It is only at the final step in the derivation of sentences that informative and performative expressions are treated in distinct ways. In addition to Montague's syntactic rule S17, which introduces tense and negation for informative meanings, Szabolcsi proposes a rule S17′ for performative meanings.[5] It is interpreted by a translation rule T4′ that effectively results in the meaning λi.i+φ, where φ is whatever the informative update rule for present perfect sentences would have given us. For example, for the performative form *I congratulate you*, we get the interpretation λi.i['speaker has congratulated addressee'(i)], where 'speaker has congratulated addressee' is interpreted as H('speaker congratulates addressee'), which is λi.∃i′<i[speaker congratulates addressee at i′]. This function maps indices i to truth iff there is a preceding index i′ at which the speaker congratulates the addressee. This means that the performative interpretation of *I congratulate you* is the function λi.i+λi′.∃i″<i′[speaker congratulates addressee at i″], a function that maps indices i to the index i‴ that is identical to i except that i≤i‴ and ∃i″<i‴[speaker congratulates addressee at i″].

There is an interesting consequence of this treatment, not pointed out by Szabolcsi. It is reasonable to assume that i″ = i, that is, the congratulation happens at the very index i, the one at which the performative sentence is interpreted. If i″ would be situated before i, that is, if i″ < i, then the congratulation would have already been performed at the index i, and the performative update would not lead to any change. But performative utterances typically involve a change, otherwise they would be superfluous. Equating i″ with i is a welcome consequence, as it means that whenever the sentence *I congratulate you* is interpreted at index i, the proposition 'the speaker congratulates the addressee', understood as a perfective sentence, is also true at i. This motivates Koschmieder's notion of "coincidence": the utterance of the sentence, i.e. the interpretation at an index, coincides with the change it brings about.

In the following two sections, we will refine Szabolci's notion of index change and propose another way of treating descriptive and performative expressions within a dynamic framework.

3. The notion of index change

Szabolcsi requires that there is, for an index i, a *unique* index i′ with i≤i′ such that i′ differs from i *minimally* insofar as φ is true at i′. It turns out that this notion of functional index change is difficult to satisfy and has to be amended. One problem with definition (6) is that it excludes

[5] Szabolcsi's rule S17′ states that the verb should appear in its "appropriate present perfect form" – this should be "appropriate simple present form". Montague (1973) did not provide for simple present tense or for first and second person, hence the vague term "appropriate", as performative sentences in the form discussed by Szabolcsi have a first person subject.

independent changes that happen at the same time. Imagine that the speaker s utters to the addressee a at the index i, *I congratulate you.* Szabolcsi models this as the functional update with i+'s has congratulated a', the index i′ with i≤i′ that is most similar to i except that at i′, the effect of the congratulation of a by s has taken effect. The similarity condition will force i′ to be temporally as close to i as possible – otherwise, other events would have happened in-between, and i and i′ would be more different. But we do not want to exclude that other, unrelated changes happen at precisely the same moment, changes that went unnoticed by the participants or that are part of their joint attention. For example, we would not like to exclude that at the time s says *I congratulate you*, a sneezes.

To discuss how the problem of independent changes can be avoided, let us assume a framework of branching time (Thomason 1984). We assume a transitive relation < on the set of indices I with the condition of backwards linearity, i.e. it holds for all i, i′, i″∈I that if i′ < i and i″ < i, then either i′ = i″ or i′ < i″ or i″ < i′. This entails that for each index i, the past is fixed, and the future is open. We now define functional index change as follows:

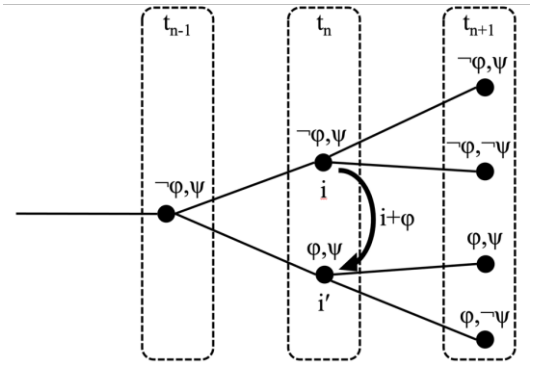
(7) Functional index change with respect to a temporal order <:
i+φ is the unique index i′ such that
a. for all i″: i″<i ↔ i″<i′
b. φ(i′) = 1
c. i and i′ do not differ in any other relevant proposition except φ

(7)(a) guarantees that i and i′ have the same history, (b) states that the proposition φ is true for the changed index i′, and (c) ensures that i and i′ differ in no other respect. Notice that in case φ(i) = 1, i and i′ are identical, following (c). In the crucial case where φ(i) = 0 and φ(i′) = 1, the indices i and i′ are not ordered by <; rather, a branch has occurred with φ(i) = 0 and φ(i′) = 1. But i and i′ are cotemporaneous, i ~ i′, a notion defined recursively as in (8).

(8) Cotemporaneity across branches:
a. For all i, i′ ∈ I: If ∀i″[i″ < i ↔ i″ < i′], then i ~ i′
b. For all i, i′ ∈ I: If ∀i″<i∃i‴<i′[i″ ~ i‴], then i ~ i′
c. For all other i, i′ ∈ I: ¬[i ~ i′]

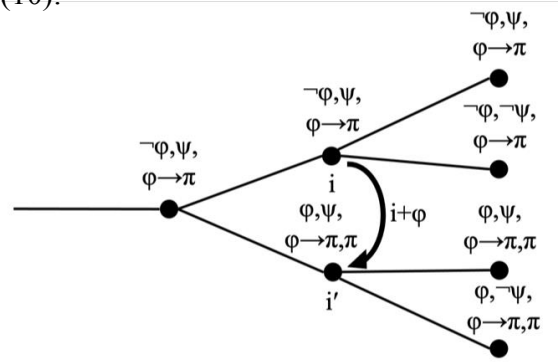
This creates equivalence classes of indices that are cotemporaneous, {{i∈I | i ~ i′} | i′∈I}. These equivalence classes, or "times" t, are ordered; we have t < t′ iff ∀i∈t∀i′∈t′[i < i′]. Under certain conditions the order for times is linear (cf. Di Maio & Zanardo 1992 for "synchronized histories"), namely if I has a unique root and all indices have at least two successors. To illustrate, (9) shows seven indices, represented by dots, and the successive times t_{n-1}, t_n and t_{n+1} they belong to. The diagram highlights four propositions φ, ¬φ, ψ and ¬ψ that obtain at these indices. Notice that the indicated functional index change i+φ is momentaneous as it does not take time; we have i ~ i′, and i, i′ ∈ t_n.

(9) Functional index change:
i+φ = i′ in a discrete model



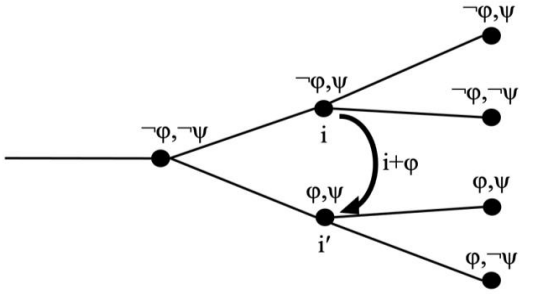
We now turn to the condition (7c): What does "any other relevant proposition except φ" mean? First, there are propositions π that follow from φ. These propositions may be entailed by φ logically, such as in case π is [φ ∨ φ′], or it might be that it has been established in the current history that whenever φ is true, π is true as well. This situation does not have to bother us. Assume that there is an index i″ with i″ < i such that for all i‴ with i″ ≤ i‴ it holds that φ(i‴) → π(i‴). The functional index change i + φ will result in an index i′ for which not only φ is true but π is true as well, as illustrated in (10):

(10) Functional index change
with dependent index change:
i+φ = i′,
where φ → π is established
throughout the current histories



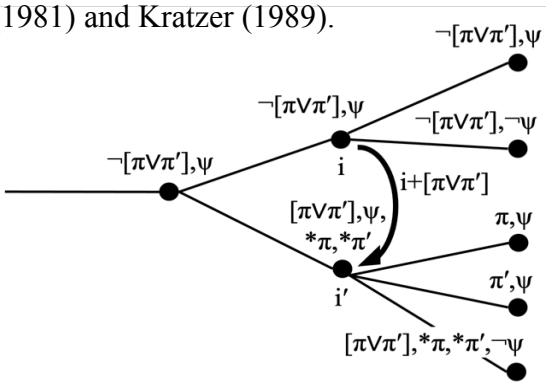
But it also might happen that with the change from i to i + φ, there is another, coincidental change. Assume that at the indices before i, both φ and ψ are false, and that ψ happens to become true at index i. The index change i′ = i+φ will keep ψ as true, as illustrated in (11). Compared to the predecessor of i′, both φ and ψ have become true, but only the first change was triggered by the performative update i+φ, the second change is independent of it.

(11) Functional index change
with independent index change
i+φ = i′,
with cotemporaneous change
from ¬ψ to ψ.



Another case to consider are situations in which there are multiple ways to make a proposition φ true. For concreteness, take φ = λi[π(i) ∨ π′(i)], for which we write [π ∨ π′]. Then the change i′ = i+φ requires that φ(i′) = [π ∨ π′](i′) = 1, but leaves it open whether π or π′ is true at i′. If we want to retain the idea that index changes are functions, i.e. right-unique relations, then we would have to allow that propositions can be undetermined at particular indices (as e.g. situations in the sense of Barwise & Perry (1981) and Kratzer (1989).

(12) Functional index change
with a proposition [π ∨ π′],
where * denotes indeterminacy,
with further change to π and π′.



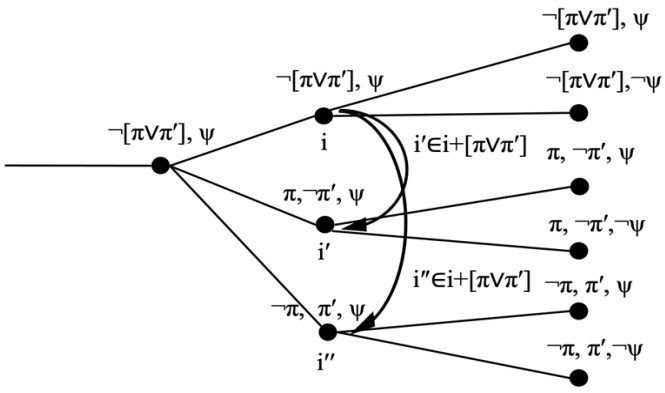
The notation *π for indeterminacy suggests an approach with a three-valued logic. However, such logics generally exclude that a disjunction is true but both disjuncts are undefined. It is rather the indeterminacy of quantum logic, to model that it is known that a particle is in one state or another, without knowing in which state it is (cf. Aerts et al. 2000)

Another option for dealing with the problem of multiple ways of satisfying a proposition is to retain classical indices that determine the truth value of all propositions, and assume that index change is a relational, not a functional notion (Krifka 2014). To illustrate, we can define i+[φ] as the *set* of indices i′ that are minimally different from i, as follows:

(13) Relational index change:
i′ ∈ i+[φ] iff
a. for all i″, i″<i ↔ i″<i′
b. φ(i′) = 1
c. i and i′ do not differ in any other relevant proposition but φ.

Example (14) illustrates relational index change, as the i can be changed in two equally minimal ways to make [π∨π′] true.

(14) Relational index change:
i+[π ∨ π′],
where π, π′ are mutually exclusive



The choice between functional index change and relational index change is reminiscent of two prominent treatments of counterfactual conditionals. For the semantics of *if φ were the case then ψ would be the* case, interpreted at index i, Stalnaker (1968) proposes access to the unique index i′ that is as similar to i except that φ holds, whereas Lewis (1973) argues that this index is not unique, and allows for a set of such indices. I consider relational index change the more plausible option and use this notion for the remainder of the paper.

4. Informative and performative updates

Szabolcsi (1982) is an example of a dynamic theory of meaning, but only for performative expressions, as they are functions from input indices to output indices. Dynamic theories have been developed several years earlier by Stalnaker (1978) for descriptive expressions. The central assumption of such models is that conversation consists of the update of the common ground by the interlocutors, where "common ground" is understood as the beliefs about the actual world and current time that the interlocutors assume to be shared (Stalnaker 2002).

Stalnaker (1978) works with a simple model of common ground, so-called "context sets", which we understand as sets of world-time indices. A context set c can be updated by the information present in the proposition φ as follows, which we call "informative update"; the set c is restricted to those indices for which φ is true as well. Notice that the indices in c are not changed; c is just reduced to those indices for which φ is true.

(15) Informative update:
c + inform(φ) = {i | i∈c ∧ φ(i) = true} = {i∈c | φ(i)}

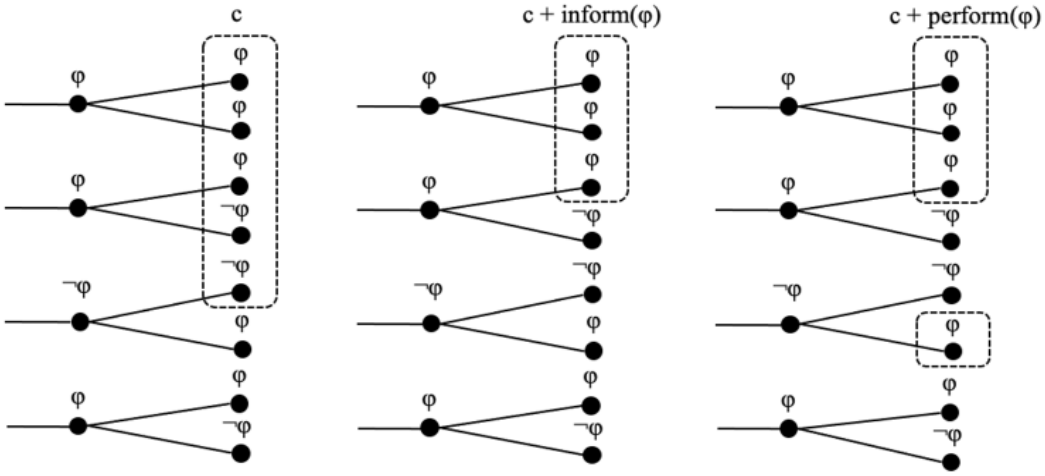
Participants of a face-to-face conversation assume that they share their notion of current time, hence we have for all c, ∀i,i′[i∈c ∧ i′∈c → i ~ i′].

We now define an update of a context set that is based on relational index change as defined in Section 3; we call this "performative update":

(16) Performative update, based on relational index change:
c + perform(φ) = {i′ | ∃i∈c[i′ ∈ i+[φ]]}

While informative update reduces a context set c, performative update changes the indices in c. We always have c + inform(φ) ⊆ c, but this relation typically does not hold for performative update, and often we will even have [c + perform(φ)] ∩ c = Ø. In a branching time model, informative and performative update of a context set can be illustrated as in (17).

(17) Informative and performative update of a context set c



As we see, performative update can introduce new indices into a context set that were not in it before. For typical cases of performative updates c + perform(φ), the proposition φ is not true at the indices of the input context set c, i.e. we have c + inform(φ) = Ø.

Informative and performative updates have one thing in common: They change the context set. This is motivated when we want to use them to model assertions and declarations, as both are communicative acts that are supposed to leave their mark on the common ground. However, declarations seem to have a wider effect than just on common ground of a conversation. If a

manager declares in a meeting to give a pay raise to an employee, this has lasting effects beyond the conversation in the meeting. This might necessitate a distinction between the world in which the communication happens on the one hand, and the context set that represents the shared assumptions about this world on the other (cf. Buch 2023 for a proposal).

5. The syntactic realization of declarations and assertions

We now turn to the interpretation of declarative sentences and consider what causes their interpretation as assertions or declarations. Recall that Szabolcsi (1982) stipulated different syntactic categories and semantic types for all subexpressions. This is not necessary.

Let us start with declarations and assume that they are based on a TP that denotes a proposition to which an operator • is applied that turns this into a performative update of a context set. This is an illocutionary operator in the sense of Searle (1969). Syntactically, it results in what we call here an "Act Phrase", ActP, where • forms the head of this ActP (cf. also Krifka 2014), cf. (18). This is a function that takes input assignments c and turns them into output assignments, where every index i in c is changed minimally so that the TP proposition becomes true.

(18) $[\![[_{\text{ActP}} \bullet\ [_{\text{TP}}$ *the meeting is adjourned*$]]]\!]$
$= [\![\bullet]\!]([\![_{\text{TP}}$ *the meeting is adjourned*$]\!])$
$= \lambda p \lambda c[c + \text{perform}(p)](\lambda i[\text{the meeting is adjourned at } i])$
$= \lambda c[c + \text{perform}(\lambda i[\text{the meeting is adjourned at } i])]$
$= \lambda c\{i' \mid \exists i \in c[i' \in i + [\lambda i[\text{the meeting is adjourned at } i]]]\}$

Declarations come with preconditions. Searle (1989) pointed out that performatives like *I hereby fry this egg* would not work, as the egg won't be cooked by just declaring so. What we can change with our utterances are the social facts (cf. Searle 2010 for the fundamental role of declarations to build up our societies). But even for those changes, the speaker must have the prerequisite entitlements for the change to occur. We can model such felicity conditions by a presupposition, as already suggested by Szabolcsi (1982). In (19), s refers to the speaker.

(19) $[\![\bullet]\!]^s = \lambda p \lambda c$. s is entitled in c to enact the update of c to perform(p) [c + perform(p)]

Explicit performatives are analyzed as a special case of declarations that name the speech act that is performed. We assume here that they refer to events (cf. also Eckardt 2012).

(20) $[\![[_{\text{ActP}} \bullet\ [_{\text{TP}}$ *I declare the meeting to be adjourned*$]]]\!]^s$
$= [\![\bullet]\!]^s([\![[_{\text{TP}}$ *I declare the meeting to be adjourned*$]]\!]^s)$
$= \lambda c[c + \text{perform}(\lambda i \exists e[e \text{ at } i \wedge e$: s declares the meeting to be adjourned$])]$

This changes the indices i of c minimally to i′ so that for all indices in the output context set there is an event e that is at (= ends at) i′, where e is a declaration that the meeting is adjourned, and s is the agent of e. As before, s must be entitled to perform this change, and if s is entitled, then the existence of this event will bring it about that the meeting is adjourned. This means that the proposition λi[the meeting is adjourned at i] will hold in the output of (20) as well.

Let us now turn to assertions. One straightforward way to model assertions is to assume another illocutionary operator, ∘, that triggers an informative update:

(21) $[\![\circ]\!]^s = \lambda p \lambda c[c + \text{inform}(p)]$

However, there are good reasons to assume that assertions do not change the common ground by brute force, as suggested by (21). Rather, this change only happens if the addressee agrees or at least does not object to it (cf. Farkas & Bruce 2010, Lauer 2013, Krifka 2015, 2022). I model this by assuming that the basic meaning of an assertion is to introduce a commitment of the speaker to the truth of the proposition, and that, with this support, the speaker wants that the addressee accepts the proposition to the common ground (cf. Geurts 2019, Shapiro 2020 for the commitment view of assertions). I express this by "$s \vdash_{i,e} \varphi$", which stands for "s commits him/herself by the event e that occurs at i to the proposition φ". I assume that the commitment operator is introduced by its own projection, the ComP ("commitment phrase"):

(22) $[\![[_{\text{ActP}} \bullet [_{\text{ComP}} \vdash [_{\text{TP}}$ *the meeting is adjourned*$]]]]\!]^s$
$= [\![\bullet]\!]^s ([\![\vdash]\!]^s ([\![[_{\text{TP}}$ *the meeting is adjourned*$]]\!]^s))$
$= \lambda c[c + \text{perform}(\lambda i \exists e[s \vdash_{i,e} \lambda i[\text{the meeting is adjourned at i}]])]$

This is a performative update in which s changes the indices i of the context set so that they support there being an event e at i in which the speaker s vouches for the truth of the proposition that the meeting is adjourned. This is a performative update: s changes the social world from a state where s did not have this commitment to one in which s has. This captures the performative aspect of constatives, which was noted already by Austin (1962) noticed. The presupposition (19) is satisfied, as persons are generally entitled to make truth commitments.

The social commitment to the truth of a proposition undergone by the speaker is the reason why other participants put the proposition into the common ground. In general, this uptake is the intention of the speaker that asserts a proposition; it is the primary perlocutionary effect intended by the speaker. It can be modelled by informative update ∘. Krifka (2015) argues that this informative uptake is a conversational implicature, as it can be cancelled, and can be derived as a plausible goal of a speaker that undergoes a commitment. Krifka (2022) models it as a disjunction between the informative update of the proposition and, alternatively, an action of the addressee that expresses disagreement with this, in which case the informative update does not happen. The table model of Farkas & Bruce (2010) provides another mechanism to capture the negotiation aspects that lead to the uptake of an asserted proposition.

The commitment operator ⊢ and a syntactic projection of a ComP can explain the presence of expressions that strengthen or weaken the commitment of speakers, as a way to shield their reputation in case the proposition turns out false. This is illustrated in (23) with *really*, which I assume expresses that the commitment event e is strong.

(23) $[\![[_{\text{ActP}} \bullet [_{\text{ComP}}$ *really* $[_{\text{ComP}} \vdash [_{\text{TP}}$ *the meeting is adjourned*$]]]]\!]^s$
$= \lambda c[c + \text{perform}(\lambda i \exists e[\text{strong}(e) \wedge s \vdash_{i,e} \lambda i[\text{the meeting is adjourned at i}]])]$

Assertions also allow for epistemic and evidential modification. Following Krifka (2023), assertions with subjective epistemic modifiers can be analyzed as commitments to a positive

epistemic attitude of the speaker towards the TP proposition. This gives sufficient support for the TP proposition to be accepted to the common ground. At the same time, it shields the reputation of the speaker in case the core TP proposition turns out to be false. We assume here a separate projection, the JP ("judge phrase").

(24) $[\![[_{\text{ActP}} \bullet [_{\text{ComP}} \vdash [_{\text{JP}}$ *certainly* $[_{\text{JP}}$ J– $[_{\text{TP}}$ *the meeting is adjourned*$]]]]]\!]^{s}$
$= \lambda c[c + \text{perform}(\lambda i \exists e[s \vdash_{i,e} \lambda i[s \text{ is certain in i that } \lambda i'\text{the meeting is adjourned at i'}]]])]$

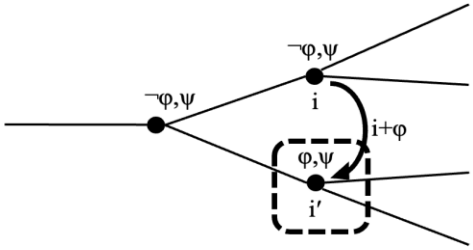
It should be highlighted that the proposal developed here assumes different syntactic structures for assertions and declarations which lead to interpretation differences via rules of the syntax-semantics mapping. This is contrary to assumptions that they can have the same meaning but can find distinct pragmatic uses. One point in favor of the current analysis is that even though declarations are often string-identical to assertions, only assertions can host commitment strengtheners and subjective epistemic and evidential operators as they have the appropriate syntactic projections to do so, and of course the concomitant pragmatic interpretations.[6]

6. The temporal and aspectual representations of declarations

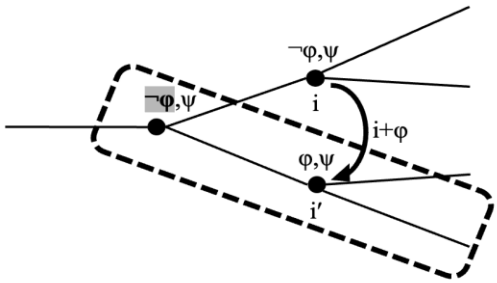
As mentioned in Section 2, Szabolcsi (1982) modelled the performative use of *I congratulate you* by minimal change to an index at which the proposition 'I have congratulated you' is true. This is curious, as the English sentence *I have congratulated you* cannot be used as an explicit performative. As Austin (1962) showed, it is the simple present tense that is typical for explicit performatives in English. However, Koschmieder (1930) pointed out that in Slavic languages, such sentences can be expressed not only by the imperfective but also by the present perfective, which typically has a future meaning in assertions. Here I will survey the various tense and aspect forms, mostly following the overview of De Wit et al. (2018) and Fortuin (2019).

The use of a simple present (in contrast to a present progressive) as in English is frequent in languages. Avoidance of the progressive form can be explained under the standard assumption that progressives signal ongoing activities. That is, progressive clauses hold at an index i if the core clause is true at an interval that includes i as a non-initial point. But the notion of a minimal index change leads to a change only if the clause was not true before the index i:

(25) a. Simple present tense



b. Present progressive impossible



De Wit et al. (2018) summarize their findings by stating that languages use that aspectual form

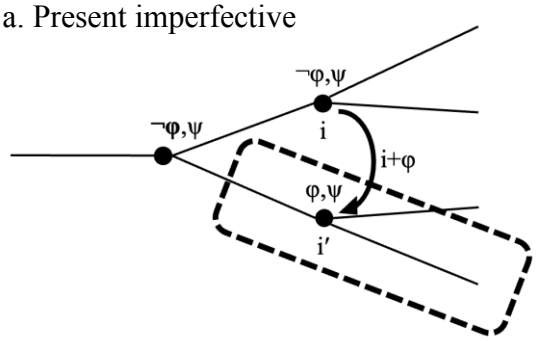
[6] H.-M. Gärtner (pers. communication) points out that *I am really warning you!* can be understood as a performative. Such cases, which refer to the locutionary act, could be analyzed as assertions in which the speaker commits to a proposition that implies a performative.

that can express eventualities that are fully and immediately recognizable at an instance of a given situation type at the time of speaking. This should apply to the expression of states and habits because they show the subinterval property (if such clauses are true at an interval, they are also true at the parts of that interval). According to them, this should rule out progressives.

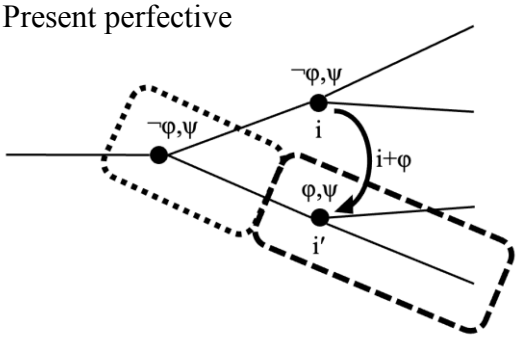
However, Fortuin (2019) points out that there are languages that allow for progressives. One example is Mongolian for explicit performatives; however, it appears that the progressive of episodic verbs has a futurate meaning that does not imply that the event in question is ongoing. English also allows for the progressive with some verbs, as in *I am warning you!* or *I am dedicating this performance to my spouse.* De Wit et al. (2018) suggest that progressives make the speech act more prominent, perhaps by indicating that the involved action is more complex. They might also refer to the locutionary part, which is temporally extended; see Section 7.

The situation in Slavic languages is varied, and it sometimes depends on the lexical nature of the verbs. In general, the imperfective present is used, which is also the simplest verb form in Slavic. Also, while the imperfective is compatible with a clause that is true over an extended interval but is compatible with an initial evaluation index. Hence, it can be used to express explicit performatives, cf. (26a). As for the use of the perfective present, this is possible if perfective expresses that at the index of evaluation the clause has become true already. The use of the perfective then presupposes indices before at which the clause was not true yet, and the index of change is the first one for which this is the case, cf. (26b).

(26) a. Present imperfective



b. Present perfective



In non-performative utterances, the presence perfective typically has a future meaning. A plausible reason is that it would be very rare to report on an event that is completed precisely at the index of utterance. Typically, the completion is already in the past, in which case the past tense perfective can be used. The systematic exception to this rule are precisely explicit performatives, which, as we have argued, become true exactly at the moment of utterance.

Fortuin (2019) also identified a number of other languages, mostly of the Afro-Asiatic and Niger-Congo family, that express explicit performatives in the present perfect. The motivation for this form is similar to the perfective above: At the index of interpretation of a perfect clause, the end-state of a phase change has been reached, and the index of explicit performatives is the first such index at which the perfect clause is true. This motivation also underlies the use of perfect participles in German performances such as *Versprochen!* 'Promised!), also in urgent commands, such as *Stillgestanden!* 'stand still!' (Ørsnes 2020).

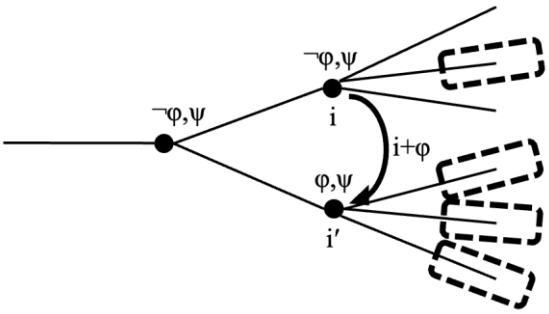
There are languages that can use a past tense form to express performatives. This appears in inscriptions of ancient languages of the Levante and in Old Russian (Dekker 2018) and could plausibly be explained by reference to a preceding oral act. However, it also occurs in the spoken language, e.g. in modern Persian:

(27) *Hamintowr raha šodi*
hereby free become.2SG.PST
'You are hereby free', lit. 'You became hereby free' (Perry 2007: 999)

Perry (2007) describes this use as expressing "irrevocable intent", and the realis flavor past tense might contribute to the sense of irrevocability. Still, it does not fit into the model of perfectives presented here. This also holds for the use of the aorist in Ancient Greek; Bary (2012) explains this as a marker of punctual or complete events that may apply to the index of evaluation, as there is no present aorist in the language. The occurrence of past tense forms corresponds to Szabolcsi's use of the H operator in the analysis of performatives.

There are languages that can use future-related verb forms to express performatives; Fortuin (2019) mentions Tibetan and Bulgarian. This is compatible with the model of performatives developed here: A future clause is true at an index i if all continuations of i (or all normal continuations) are such that the clause will become true at them. Performative update then can be seen as a minimal change from an index where this is not the case to an index where it is:

(28) Future performative



Fortuin (2019) discusses rare cases of English future performatives as the following example:

(29) *I will promise you this, that if we have not gotten our troops out by the time I am president, it is the first thing I will do.*

This can be analyzed as a double performative. Notice that future clauses with first person subjects can be understood in general as performatives. The sentence *I will come to your party* can not only be understood as a prediction about the future developments but also a performative, where s changes the index so that in all accessible future developments, s will come to the party, as in (28). Hence (29) can be analyzed as a promise to give a promise, which is pragmatically equivalent to a simple promise.

I would like to add two more data point to the discussion of the morphological forms. One concerns explicit performatives. There are many languages that differentiate between two modal forms, "realis" and "irrealis", for example Oceanic languages (cf. von Prince et al. 2022). The basic distinction is between a form that is applied for events and states that are "real" because they hold at the actual world and current time or some time before that, and

another form for events and states that are not real, for example because they hold in the future or at an non-actual development. One interesting question is which form explicit performatives take in such languages. On the one hand, when uttered felicitously, they make the world adhere to the words, hence we would predict a realis form. On the other, their proposition is not real yet at the very moment of utterance, hence we would predict an irrealis form. I investigated this issue for the language Daakie (Ambrym, Vanuatu). Daakie has a realis – irrealis distinction; in fact, it has three irrealis forms, one of which denotes counterfactuality and is restricted to dependent clauses (Krifka 2016). The two forms that are of concern here are the simple irrealis, which is used in root clauses for expressing commands and promises, and a combination of a prefix *a-* with that irrealis form, forming a future that is used for predictions. The following examples illustrate the simple irrealis (glossed PT for "potentialis") as a command, and contrasts it with the future:

(30) *Mwe kie ka, Andri, ngyak ko-**p** van*
RE say C.IR Andri 2SG 2SG-**PT** go
'He said, Andri, you go!' (Andri5.032)

RE: Realis, C.IR: Irrealis complementizer
PT: Potentialis

(31) *ngale **a-**ko-**p** mee soaa lan bogon*
then FUT-2SG-PT come come.out at point
'Then you will come out at the (agreed) point' (Aiben2.048)

Interestingly, speakers use the irrealis in explicit performatives. This form can be elicited but also occurs in actual conversations as in (32), which was uttered by a high-ranking visitor, as part of a public speech, when he handed over a tent to congregation of chiefs and church elders.

(32) *na-**p** sengane man tiri kingyee nge*
1SG-POT give CL2-3SG something DEM.PL FOC
'I hereby give these all these things' (Obed1.040)

CL2: possessive classifier
FOC: focus

The other data point concerns declarations excluding explicit performatives, that is, declarations that do not name the action itself. German has a morphological form that is known as a reportative evidential, the "Konjunktiv I" (cf. Sæbø & Fabricius-Hansen 2003). This form has another use to mark declarations (so-called "Heischesatz", cf. Jäger 1970).

(33) a. *Es **werde** Licht!* 'Let there be light!'
b. *Dein Wunsch **sei** dir gewährt.* 'Your wish is granted.'
c. *Es **sei** n eine Primzahl.* 'Let n be a prime number.'

The two functions of "Konjunktiv I" have in common that they exclude assertions by the speaker. In the reportative use, the committer must be distinct from the speaker; as "Heischesatz", the sentence is not an assertion but a declaration.

7. Locutionary acts as index changers

The speech acts we looked at so far where illocutionary acts. They create new facts in the world, even with assertions, which create truth commitments. However, in order to perform such acts, the speaker must also produce a linguistic sign, which Austin (1962) called the

"locutionary" act. Uttering a sentence clearly also changes the world in the common ground, and we should be able to model this as a performative update as well.[7] Locutionary acts are typically temporally extended, hence cannot become true at instances. In this, they differ from illocutionary acts like declaring (20) or committing to the truth of a proposition (22). In the terminology of Vendler (1957), illocutionary acts are achievements, whereas locutionary acts are accomplishments.

To integrate locutionary acts into our framework we have to refer to the wording used by the speaker. Let us assume a predicate SAY that takes a linguistic representation as an argument, together with the speaker, the addressee, an interval, and an event that happens at that interval. (34) is a non-performative example, for illustration. I use j, j′ etc. for intervals, totally ordered sets of indices; that is, for all intervals j it holds that $\forall i,i' \in j[i<i' \vee i'<i \vee i=i']$. We have that $j<j'$ iff $\forall i,i'|i \in j \wedge i' \in j' \rightarrow i<i']$.

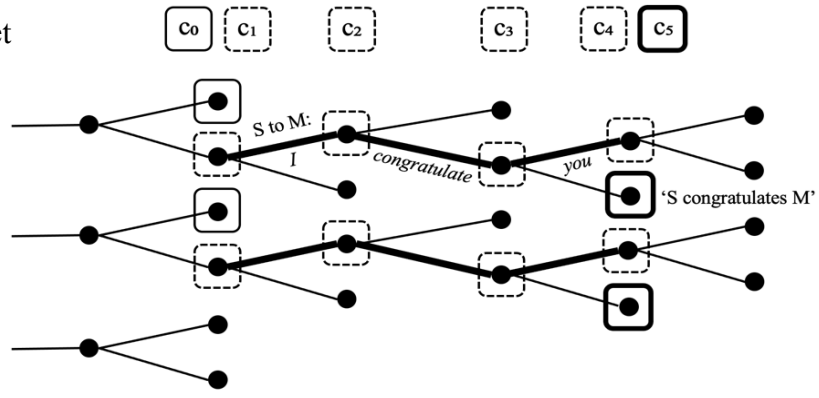
(34) $[\![[_{TP}$ *Sue said "I congratulate you" to Max* $]]\!]^{s,a}$
$= \lambda i \exists e \exists j[j < i \wedge SAY(j)(e)([I\ congratulate\ you])(max)(sue)]$

Locutionary acts can be represented by performative updates as in (35). This changes the indices i of the input context c first to indices i′ that are minimally different from i insofar they are the initial point of an interval j at which there is an event e, where Sue says to Max, *I congratulate you*. The output indices i‴ are the final points of these intervals:

(35) Sue says to Max: $[_{ActP} \bullet [_{TP}$ *I congratulate you*$]]$ where
$= \lambda c\{i''' \mid \exists i \in c \exists i'[i' \in i+[\lambda i'' \exists e \exists j[i'' = ini(j) \wedge i''' = fin(j)$ $i = ini(j)$ iff $i \in j \wedge \neg \exists i'<i[i' \in j]$
$\wedge SAY(j)(e)([I\ congratulate\ you])(m)(s)]]]\}$ $i = fin(j)$ iff $i \in j \wedge \neg \exists i'>i[i' \in j]$

The performative update with the locutionary act, which consists in producing a linguistic expression, is followed by the performative update with the illocutionary act, which consists of interpreting this expression. This is illustrated in (36).

(36) Update of a context set with a locutionary act and illocutionary act



The input context set c_0 represents the information that is mutually shared at the point where Sue makes this utterance. When Sue starts to pronounce the first word, she initiates a change of the indices in c_0, with the resulting context set c_1. The pronunciation of the first word *I* leads

[7] See Buch (2023) for an architecture that distinguishes between the situation at which a conversation takes place and the content of what has been communicated so far.

to the context set c_2, the pronunciation of the second word *congratulate* to c_3 and the pronunciation of the third word *you* to c_4. The indicated changes may include other events during the uttering of this sentence. After the locutionary act is completed, the illocutionary effect arises: The indices of the context set c_4 are updated with the proposition 'Sue congratulates Max', as a result of the utterance of the sentence. This results in the context set c_5.

In general, locutionary acts are based on a linguistic form α performed by a speaker s directed to an addressee a. Let us use double angled brackets $\langle\!\langle ... \rangle\!\rangle$ for the phonological interpretation of a linguistic form as in (37). The speech act can be modeled by dynamic conjunction, or function composition, of a locutionary act with an illocutionary act as in (38).

(37) $\langle\!\langle \alpha \rangle\!\rangle^{s,a} = \lambda c\ \{i''' \mid \exists i \in c \exists i'[\ i' \in i + [\lambda i'' \exists e \exists j[\ i'' = ini(j) \wedge i''' = fin(j) \wedge SAY(j)(e)(\alpha)(a)(s)]]\}$

(38) $\langle\!\langle \alpha \rangle\!\rangle^{s,a}\ ;\ [\![\alpha]\!]^{s,a} = \lambda c[[\![\alpha]\!]^{s,a}(\langle\!\langle \alpha \rangle\!\rangle^{s,a}(c))]$

Applied to example (35) we get the interpretation (39) for the combined illocutionary and perlocutionary act:

(39) $\lambda c\{i'''' \mid \exists i \in c \exists i', i'''[\ i' \in i + [\lambda i'' \exists e \exists j[i'' = ini(j) \wedge i''' = fin(j)$
$\wedge SAY(j)(e)([\textit{I congratulate you}])(m)(s)] \wedge i'''' \in i' + [\lambda i''' \exists e'[congratulate(i''')(e')(m)(s)]]]]\}$

One might ask exactly when the illocutionary effect happens with respect to the locutionary act. For certain performatives, the precise timing of the change can be of importance, and then can be marked by an instantaneous signal. For example, in auctions the auctioneer marks the end of the bidding with the knock of a gavel on the lectern. For most purposes, the precise timing of the illocutionary act with respect to the locutionary act is of no great importance, and in general, the final point of locutionary act is the obvious candidate.

8. *Hereby* / *hiermit* as referring to the locutionary act

Koschmieder and Austin pointed out that *hiermit* in German and *hereby* in English mark explicit performatives. Eckardt (2012) analyzes this term as referring to the "ongoing act of information transfer". In an explicit performative like *I hereby promise to clean the kitchen*, this act is introduced as an argument of the performative verb *promise* (cf. also Močnik 2015). This raises the issue how declarations that do not contain such performative verbs should be handled, such as *I hereby open the exhibition* (an example used by Eckardt).

The analysis of speech acts as a composition of a locutionary act and an illocutionary act as in (38) provides an event for the locutionary act that is independent from performative verbs like *promise*. The adverbs *hereby* and *hiermit* can be analyzed as referring to the utterance event, or to a concomitant event such as a signature under a contract or a handshake. For example, in the variant of (39), *I hereby congratulate you*, the deictic adverb *hereby* would express that the illocutionary event e′ that Sue congratulates Max is causally connected to the locutionary event e of saying this sentence. Different from Eckardt (2012), the antecedent for *hereby* is not an event that is explicitly named in the sentence (like the regret or the obligation to inform); rather, the antecedent is the utterance itself, the locutionary act.

This explains an apparent puzzle, that *hereby* can occur in embedded clauses (cf. Lee 1975):

(40) *I regret that I have to inform you that you are hereby fired.*

We do not have to assume here an embedded speech act *you are hereby fired*, which corresponds to the fact that German typically shows verb-final dependent clause syntax in such cases. Rather, *hereby* is interpreted in its host TP *you are … fired* and expresses that the state of the addressee being fired is causally connected to the utterance event of the whole sentence.

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Performative and assertive updates

von Prince, K., A. Krajinović, & M. Krifka. 2022. Irrealis is real. *Language* 98(2), 221-249.

Inference denial and concessivity: Japanese *karatoitte* 'just because'[1]

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Abstract. This paper focuses on the Japanese concessive conjunction *karatoitte* 'just because', which shows an idiosyncratic distribution. It has been reported that Japanese *karatoitte* typically appears with negation and in certain sentences that express negative sentiment. This paper suggests an analysis of Japanese *karatoitte* adopting the theoretical mechanism used in the analysis for the Negative Polarity Items (NPIs). This study is expected to bring a new perspective on the nature of concessive meaning by reconsidering the semantic function of "denial of inference" that *just because* is said to have in terms of the likelihood scalar presupposition used in NPI analysis.

Keywords: concessive conjunction, reason clause, Japanese, inference denial, negative polarity items

1. Introduction

According to Hilpert (2005), the English phrase *just because* has two usages: the CONCESSIVE usage and the CAUSAL usage as exemplified in (1) and (2) respectively.

(1) a. **Just because** you play guitars it doesn't mean you've got soul. (Hilpert 2005, (1))
b. **Just because** the data satisfy expectations does not mean they're correct. (ibid. (2))
c. You cannot leave your parents **just because** you want to. (ibid. (18))

(2) a. Utopias lead to disappointment **just because** they are utopias. (Hilpert 2005, (4))
b. A total of 37 in every 100 women believe that bankers treat them differently **just because** of their sex. (ibid. (2))
c. You cannot leave your parents **just because** you are only five years old. (ibid. (19))

The significant difference between the two usages is whether the sentences has a concessive meaning, or "inference denial" (Hirose, 1991). As Hilpert (2005) pointed out, while the CONCESSIVE type in (1) can be paraphrased with *although*, e.g. *Although you play guitars, that doesn't mean you've got soul*, the CAUSAL type in (2) cannot be paraphrased in the same way.

Another difference between the two usages, according to Hilpert (2005), is the scope of negation. As the following pair shows, while the negation in the CONCESSIVE usage takes scope over the entire sentence including the *because* clause, as in (3), the negation in the CAUSAL usage does not include the *because* clause in its scope, as in (4) .

(3) You can**not** leave your parents **just because** you want to. (That's not a good reason!)
¬ [You can leave your parents just because you want to] (Hilpert 2005, (18))

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(4) You can**not** leave your parents **just because** you are only five years old. (That's why!)
¬ [You can leave your parents] just because you are only five years old. (ibid. (19))

The above contrast raises the question whether the difference between the two usages of *just because* is merely a difference in the scope of negation. Certain Japanese data provide a suggestion on this point. As shown below, the phrase *karatoitte* in Japanese works just like English *just because* but only in the CONCESSIVE usage, as in (5). As (6) shows, Japanese *karatoitte* does not have the CAUSAL usage.[2]

(5) Oyamoto o hanaretai **karatoitte** hanareru koto wa dekinai.
Parents ACC leave.want.NPST just.because leave.NPST FN TOP can.NEG.NPST
'You cannot leave your parents just because you want to. (That's not a good reason!)'

(6) #Mada gosai da **karatoitte** hanareru koto wa dekinai.
Only five.years.old COP.NPST just.because leave.NPST FN TOP can.NEG.NPST
Intended: 'You cannot leave your parents just because you are only five years old. (That's why!)'

This contrast shows that Japanese *karatoitte* is not ambiguous as English *just because* is. If the difference between the CONCESSIVE and CAUSAL usages can be attributed only to the difference in the scope of negation, then this suggests that Japanese *karatoitte* is sensitive to the scope of negation in some way. For example, there might be a restriction that the *karatoitte* clause must appear within the scope of negation.

Such a restriction may sound peculiar for a clausal conjunction, but it is familiar from certain linguistic phenomena, namely Negative Polarity Items (NPIs), e.g. the indefinite *any*, the adverb *even*, and minimizers such as *budge an inch*. In this paper, I suggest adopting the theoretical mechanism used in the analysis of NPIs like *even* to explain the idiosyncratic distribution of Japanese *karatoitte*. The reminder of this paper is organized as follows. Section 2 presents corpus data to confirm the distribution of Japanese *karatoitte*. Section 3 explains the "inference denial" meaning of *karatoitte* in terms of the presupposition that expresses the speaker's disapproval or doubt of certain reasoning. Section 4 discusses three issues that would be crucial in adopting the idea of EXISTENTIAL PRESUPPOSITION and SCALAR PRESUPPOSITION that are employed in the analysis of *even* (e.g. Karttunen and Peters (1979); Wilkinson (1996); Crnič (2014)). Finally, Section 5 summarizes and concludes the paper.

2. Distribution of *karatoitte*

2.1. Previous observations

Morphologically, Japanese *karatoitte* consists of the conjunction *kara* 'because', the quote marker *to* and the verb *itte* 'to say'. The expression *karatoitte* appears in Japanese language

[2]Abbreviations: ACC = accusative, COP = copula, DAT = dative, EXCLM = exclamative, FN = formal noun, GEN = genative, GER = gerund, IMP = imperative, NEG = negative, NOM = nominative, NPFV = nonperfective, NPST = nonpast, PST = past, POL = polite, PRH = prohivitive, QUO = quote marker, SFP = sentence final particle, TOP = topic.

dictionaries (e.g. *Dejitaru Daijisen*[3] available online from Shogakukan) as a single lexical entry, which suggests that it has become a grammaticalized fixed expression. There are other variants, such as the colloquial expression *karatte* and the written expression *karatote*, both of which have the same meaning and usage. This study considers only *karatoitte* as representative of these.

As mentioned in the previous section, *karatoitte* typically co-occurs with negation. However, there are also cases in which no explicit negation is involved in the sentence in which *karatoitte* appears. According to Takahashi (2015), the usage of *karatoitte* can be classified as follows.[4]

(7) a. With sentential negation, e.g. *wake janai* 'It doesn't mean that...'
b. With lexical negation, e.g. *chigau* 'to be wrong', *hikaeru* 'to refrain from'
c. Without explicit negation, but when the sentence expresses...
(i) disapproval or surprise
(ii) doubt or suspicion
(iii) an unfavorable outcome
(iv) a contradictory statement
(v) an opposing statement

It is worth noting that even without explicit (grammatical) negation, sentences with *karatoitte* express negative sentiments such as disapproval and doubt, but how common are these cases without explicit negation? Are they exceptional peripheral phenomena?

Baba (2018), who conducted a quantitative study on *karatoitte* using the Balanced Corpus of Contemporary Written Japanese (BCCWJ), found 136 sentences out of 200 randomly selected *karatoitte* sentences with explicit negation (which would be classified as (a) in (7)) and 64 sentences without explicit negation. These figures show that although more than half of the *karatoitte* sentences have explicit negation, those without explicit negation are not particularly rare. Below, we confirm the distribution of *karatoitte* with examples from the BCCWJ.

2.2. The NPI-like property of *karatoitte*

As mentioned above, the most typical usage of *karatoitte* is when it occurs under the scope of negation. The following examples show *karatoitte* used with various forms of negation such as *kagirimasen* 'not necessarily' in (8), *wake de wa nai* 'not the case that' in (9), *ikemasen* 'should not' in (10), the negative imperative morpheme *na* in (11) and *NG* 'not good' in (12).

(8) Rentogenshashin ni uturanakatta **karatoitte**, seejoo da to wa
radiograph DAT reflect.NEG.PST just.because normal COP.NPST QUO TOP
kagirimasen. (LBn4_00012)
limit.POL.NEG.NPST
'Just because it does not show up on radiographs does not mean it is normal.'

[3]https://daijisen.jp/digital/
[4]Takahashi (2015) included cases in which the consequent part (*Y*) of *X karatoitte Y* is omitted under category (c) in (7).

(9) Shikashi, buaisoo da **karatoitte**, tsumetai wake de wa
but unsociable COP.NPST just.because cold.NPST reason COP.NPST TOP
nai. (LBc9_00144)
NEG.NPST
'But just because someone is unsociable doesn't mean the person is cold-hearted.'

(10) Daiettochuu da **karatoitte** gaman bakari o shite wa
on.a.diet COP.NPST just.because patience only ACC do TOP
ikemasen.(LBq5_00060)
allowed.POL.NEG
'Just because you are on a diet you shouldn't hold back all the time.'

(11) Chotto kurai yuumee da **karatoitte** eraburuna. (LBm9_00217)
little about popular COP.NPST just.because be.arrogant.PRH
'Just because you are a little popular, don't be arrogant.'

(12) Kabaashitai **karatoitte** atsunuri wa NG. (OY07_00958)
cover.want.NPST just.because thick.coating TOP NG
'Just because you want to cover (the blemish on your skin), it's not acceptable to thickly apply (the makeup).'

The above set of examples would be infelicitous, as shown below, if the negation is removed. In order to make the sentence felicitous, *kara* 'because' should be used instead of *karatoitte*.

(13) Rentogenshashin ni uturanakatta {#**karatoitte/kara**}, seejoo da.
radiograph DAT reflect.NEG.PST {just.because/because} normal COP.NPST
'It is normal because it does not show up on radiographs.'

(14) Buaisoo da {#**karatoitte/kara**}, tsumetai.
unsocialble COP.NPST {just.because/because} cold.NPST
'He is cold-hearted because he is unsociable.'

(15) Daiettochuu da {#**karatoitte/kara**} gaman o suru beki da.
on.a.diet COP {just.because/because} patience ACC do.NPST should COP.NPST
'You should hold back because you are on a diet.'

(16) Juubun yuumee da {#**karatoitte/kara**} jishin o mochinasai.
enough popular COP.NPST {just.because/because} confidence ACC hold.IMP
'Be confident because you are popular enough.'

(17) Kabaashitai {#**karatoitte/kara**} atsunuri wa OK.
cover.want.NPST {just.because/because} thick.coating TOP OK
'It's OK to thickly apply (the makeup) because we want to cover (the blemish on the skin).'

In addition to the above cases where an explicit (grammatical) negation is present in the sentence, we also find cases without such negation. As pointed out in previous observations (Takahashi, 2015; Baba, 2018), *karatoitte* appears in sentences that express some kinds of negative sentiment. Negative sentiment can be expressed in several ways. For example, negative sentiment may arise from certain lexical items such as *kiken* 'dangerous' in (18), *ranboona* 'rough' in (19), *sutookaa* 'stalker' in (20) and *chinpunkanpun* 'gibberish' in (21).

(18) Fumiato ga shikkari tsuiteiru **karatoitte** anshinshikitteshimau no
footprint NOM tightly attach.IPFV.NPST just.because relieved.completely.NPST FN
wa kiken da. (LBl7_00004)
TOP dangerous COP.NPST
'Just because the footprints are well marked, it's dangerous to feel at ease.'

(19) Ikura hitsuyoosee ga aru **karatoitte** zuibun ranboona hanashi
however necessity NOM exist.NPST just.because very rough story
desu ne. (PM11_00378)
COP.NPST SFP
'Just because it was necessary, that's a pretty rough story.'

(20) Keetai ga tsunagaranai **karatoitte** kandannaku denwasuru no wa
Cellphone NOM connect.NEG.NPST just.because continuously call.NPST FN COP
hotondo sutookaajootai dearu.
almost stalking COP.NPST
'Just because your call isn't answered, calling continuously is almost a stalker.'
(PB13_00200)

(21) Mochiron, koo kaisetsushita **karatoitte**, ookuno hito ni wa
of.course like.this explain.PST just.because many person DAT TOP
chinpunkanpun no mama da to omoimasu.
gibberish GEN as.it.is COP.NPST QUO think.POL.NPST
'Of course, even though I explained it in this way, I think it will still remain gibberish to many people.' (PN2a_00025)

Again, removing the words that appear to be the source of the negative sentiment leads to unnaturalness, as shown below.

(22) Fumiato ga shikkari tsuiteiru {#**karatoitte/kara**} anshinshite
footprint NOM tightly attach.NPTV.NPST {just.because/because} be.relieved.GER
daijoobu da.
all.right COP.NPST
'It's all right to feel relieved because there are clear footprints.'

(23) Hitsuyoosee ga aru {#**karatoitte/kara**} daijina hanashi desu
necessity NOM exist.NPST {just.because/because} important story COP.NPST
ne.
SFP
'It is an important story because it is necessary.'

(24) Keetai ga tsunagaranai {#**karatoitte/kara**} kandannaku denwasuru
cellphone NOM connect.NEG.NPST {just.because/because} continuously call.NPST
no wa subarashii taioo da.
FN COP wonderful reaction COP.NPST
'It is a wonderful reaction to call continuously because your call is never answered.'

(25) Mochiron, koo kaisetsushita {#**karatoitte/kara**}, ookuno hito ni wa
of.course like.this explain.PST {just.because/because} many person DAT TOP
wakariyasuku natta to omoimasu.
easy.to.understand become.PST QUO think.POL.NPST
'Of course, I think it became understandable to many people because I explained it in this way.'

Negative sentiment can be also found in exclamatives as in (26).

(26) Ikura kurisumasu da **karatoitte** byooin o nukedasu nante!
however Christmas COP.NPST just.because hospital ACC escape.NPST EXCLM
(OB3X_00288)

'Just because it's Christmas, how (ridiculous, stupid, etc.) it is to escape from the hospital!'

Note that the above example has only the exclamative marker *nante*, which has no negative meaning by itself. If this sentence is changed such that it can be forcibly taken as a positive expression, it becomes unnatural with *karatoitte*.

(27) Kurisumasu da {#**karatoitte/kara**} minnna ni purezento o kau
Christmas COP {just.because/because} everyone DAT present ACC buy.NPST
nante suteki!
EXCLM wonderful
'How wonderful it is to buy present for everyone because it is Christmas!'

A rhetorical question, as in (28), is another case in which a negative sentiment (doubt or suspicion) can be found. The following example is not an ordinal information-seeking question, but is interpreted as a rhetorical question that expresses the speaker's doubt as to whether there is any meaning at all.

(28) Ichinen hayaku daigaku ni nyuugakushita **karatoitte** nan no imi ga
one.year early college DAT enroll.PST just.because what GEN meaning ACC
aru no dearoo ka? (LBl0_00006)
have.NPST FN COP Q
'Just because someone entered a college a year early, is there any meaning?'

When it is frames so that its interpretation must be as a neutral information-seeking question, as in (29), the question sounds unnatural with *karatoitte*.

(29) Ichinen hayaku daigaku ni nyuugakushita {#**karatoitte/kara**} shoogakukin
one.year early college DAT enroll.PST {just.because/because} scholarship
o moraeta no desu ka?
ACC can.receive.PST FN COP.NPST Q
'Did you get the scholarship because you entered a college a year early?' (Non-rhetorical)

Finally, there are cases in which the consequent clause is incomplete, as shown below:

(30) Ikura jibun no okozukai da **karatoitte** mainichi nomu no wa...(OY03_06312)
however self GEN pocket.money COP.NPST just.because every.day drink.NPST FN TOP...
'Just because you're using your own pocket money, drinking every day is .... (no good, inadvisable, etc.)'

In this case, the sentence is used to express the speaker's disapproval or objection, so it would be unnatural if followed by a (semantically) positive expression like *kamawanai* 'does not mind' as in (31).

(31) Jibun no okozukai da {#**karatoitte/kara**} mainichi nomu no wa ikooni kamawanai.
self GEN pocket.money COP {just.because/because} every.day drink.NPST FN TOP at.all mind.NEG.NPST
'I don't mind at all if you drink every day because you are using your own pocket money.'

Note that in (31), the sentence is grammatically negative, as indicated by the negative morpheme *nai*. Still, the sentence with *karatoitte* is not natural, perhaps because it expresses the speaker's positive attitude toward drinking every day.

In summary, the Japanese conjunction *karatoitte* 'just because' is used only in "negative" sentences. However, "negative" here does not refer to grammatical negation, but rather to the speaker's negative attitude or sentiment such as denial, disapproval, or doubt. Based on the observations presented above, we now consider how to account for the distribution of Japanese *karatoitte*.

3. Toward an analysis

In this section, I suggest deriving the inference denial meaning that *karatoitte* 'just because' has from its presuppositional meaning, and account for the distribution pattern shown in the previous section.

I propose that the basic meaning of *karatoitte* 'just because' is what the conjunction *therefore* would mean. That is, *P karatoitte Q* amounts to saying that *P, therefore Q*, implying that *P* is a sufficient basis for asserting *Q*. At the same time, *karatoitte* has the inference denial presupposition, as shown in (32b). This says that, in the speaker's (or some attitude holder's) view, P is not a sufficiently compelling or appropriate reason for Q. This may be because the speaker believes or knows that there are cases in which P is true but Q is not, or P is not true and yet Q is true.

(32) *P karatoitte Q*
a. Assertion: P is a sufficient basis for concluding Q
b. Presupposition: in the speaker's (or the attitude holder's) view, P is not a sufficient basis for concluding Q.

Below, I present the direction of analysis being aimed for by showing how the usage of *karatoitte* presented in Section 2 can be accounted for.

First, let us take consider the case where an explicit sentential negation such as *kagirimasen* 'not necessarily' occurs, repeated below.

(8) Rentogenshashin ni uturanakatta **karatoitte**, seejoo da to wa
radiograph DAT reflect.NEG.PST just.because normal COP.NPST QUO TOP
kagirimasen. (LBn4_00012)
limit.POL.NEG.NPST
'Just because it does not show up on radiographs does not mean it is normal.'

In the case above, the proposition P is 'it does not show up on radiographs' and Q is 'it is normal'. Therefore, sentence (8) would mean, based on (32), as shown below:

(33) a. It is not necessarily the case that P (='it does not show up on radiographs') is a sufficient basis for concluding Q ('it is normal').
b. In the speaker's (or the attitude holder's) view, P ('it does not show up on radiographs') is not a sufficient basis for concluding Q ('it is normal').

There is no inconsistency in the above meaning. The speaker thinks that something not showing up on radiographs is not a sufficiently compelling reason to conclude that it is normal, which is compatible with what is actually said in (33a). Perhaps the speaker believes or knows that there are cases in which nothing shows up on radiographs but it is not normal (e.g., a hidden disease).

By contrast, *karatoitte* is not used in (13) because the presuppositional meaning is inconsistent with what is actually said.

(13) Rentogenshashin ni uturanakatta {**#karatoitte/kara**}, seejoo da.
radiograph DAT reflect.NEG.PST {just.because/because} normal COP.NPST
'It is normal because it does not show up on radiographs.'

On the one hand, the speaker asserts that P (= 'it does not show up on radiographs') is a sufficient basis for concluding Q (= 'it is normal'). But at the same time, the speaker presupposes that P (= 'it does not show up on radiographs') is not a sufficient basis for concluding Q (= 'it is normal'). In this case, the conjunction *kara* 'because', which does not have the inference denial meaning, should be used instead. The other examples in (9)-(12) can be explained in a similar way, where we see explicit negation such as *wake de wa nai* 'not the case that', *ikemasen* 'should not', the negative imperative morpheme *na*, and *NG* 'not good'.

We now turn to the cases in which no explicit (grammatical) negation appears. As shown in Section 2, all the examples with *karatoitte* express negative sentiment. One such case is when the source of negative sentiment is apparent. For example, the predicate *kiken* 'dangerous' signals that the speaker is giving a warning by uttering this sentence.

(18) Fumiato ga shikkari tsuiteiru **karatoitte** anshinshikitteshimau no
footprint NOM tightly attach.IPFV.NPST just.because relieved.completely.NPST FN
wa kiken da. (LBl7_00004)
TOP dangerous COP.NPST
'Just because the footprints are well marked, it's dangerous to feel at ease.'

The sentence is consistent because the speaker says that the following reasoning is dangerous: to feel at ease based on the fact that the footprints are well marked. On the other hand, if the predicate *kiken* 'dangerous' is changed to *daijoobu* 'all right', *karatoitte* is no longer used.

(22) Fumiato ga shikkari tsuiteiru {#**karatoitte/kara**} anshinshite
footprint NOM tightly attach.NPTV.NPST {just.because/because} be.relieved.GER
daijoobu da.
all.right COP.NPST
'It's all right to feel relieved because there are clear footprints.'

This is because the speaker's implications are inconsistent. While the speaker is saying that it is acceptable to feel at ease based on the fact that there are clear footprints, the speaker is also expressing the inference denial meaning, i.e., the speaker thinks that seeing clear footprints is not a sufficiently convincing reason to feel at ease.

The next case in which we see negative sentiment is exclamative, as repeated below. Although there is no particular lexical item that arouses negative sentiment, the sentence can only be indicating as the speaker's disapproval. This can be explained in terms of the presuppositional meaning of *karatoitte*; in the speaker's view, that it is Christmas is not a sufficient reason or excuse to escape from the hospital.

(26) Ikura kurisumasu da **karatoitte** byooin o nukedasu nante!
however Christmas COP.NPST just.because hospital ACC escape.NPST EXCLM
(OB3X_00288)

'Just because it's Christmas, how (ridiculous, stupid, etc.) it is to escape from the hospital!'

Therefore, the sentence becomes unnatural if it is forced to express the speaker's positive attitude by explicitly saying the predicate *suteki* 'wonderful'.

(27) Kurisumasu da {#**karatoitte/kara**} minnna ni purezento o kau
Christmas COP {just.because/because} everyone DAT present ACC buy.NPST
nante suteki!
EXCLM wonderful
'How wonderful it is to buy present for everyone because it is Christmas!'

The conjunction *kara* 'because', which does not have the presuppositional meaning, should be used instead if the exclamative is meant to express positive sentiment.

Another case is that of questions, but not the regular information-seeking type. Thus, (28), repeated below, is a rhetorical question that does not really ask what the point is of enrolling a year early, but rather expresses that there is no meaning.

(28) Ichinen hayaku daigaku ni nyuugakushita **karatoitte** nan no imi ga
one.year early college DAT enroll.PST just.because what GEN meaning ACC
aru no dearoo ka? (LBl0_00006)
have.NPST FN COP Q
'Just because someone entered college a year early, what does that mean?'

Using *karatoitte* in a non-rhetorical, information-seeking question would be unnatural, as in the examples repeated below. The sentence is not a neutral question, but more of an accusation against the addressee, e.g., 'Oh, so you got the scholarship just because you entered college a year early... that's ridiculous. I don't like it'.

(29) Ichinen hayaku daigaku ni nyuugakushita {**#karatoitte/kara**} shoogakukin
one.year early college DAT enroll.PST {just.because/because} scholarship
o moraeta no desu ka?
ACC can.receive.PST FN COP.NPST Q
'Did you get the scholarship because you entered college a year early?' (Non-rhetorical)

A rhetorical question is said to assert the negative counterpart of the question (Han, 2002). In fact, it would be inappropriate (or sound like a joke) to respond to (28) with something like "It means that...". Thus, a rhetorical question creates a suitable environment for *karatoitte* to be used, because the speaker doubts that entering college a year early is a sufficient basis for concluding that it is meaningful.

Finally, the interpretation of a *karatoitte* sentence whose consequent part is omitted or incomplete can be straightforwardly explained. As repeated below, the speaker is expressing negative attitude toward drinking every day using one's own pocket money, e.g., 'no good', 'inadvisable' etc. Thus, explicitly saying the predicate that has positive sentiment, e.g., *kamawanai* 'do not mind', makes the sentence unnatural.

(30) Ikura jibun no okozukai da **karatoitte** mainichi nomu no
however self GEN pocket.money COP.NPST just.because every.day drink.NPST FN
wa...(OY03_06312)
TOP...
'Just because you're using your own pocket money, drinking every day is .... (no good, inadvisable, etc.)'

(31) Jibun no okozukai da {**#karatoitte/kara**} mainichi nomu no wa
self GEN pocket.money COP {just.because/because} everyday drink.NPST FN TOP
ikooni kamawanai.
at.all mind.NEG.NPST
'I don't mind at all if you drink every day because you are using your own pocket money.'

(31) with *karatoitte* is unnatural, because the presuppositional meaning says that the speaker thinks that using one's own pocket money is not a sufficient reason for drinking every day, which is inconsistent with what is actually said, i.e., 'I don't mind'.

This section presented the direction of this analysis by explaining how the presuppositional meaning of *karatoitte* accounts for its usage. The following section points out what needs to be considered to obtain a full picture of the analysis.

4. Remaining issues

This section discuss three issues with regard to the formal analysis of *karatoitte* 'just because'.

4.1. Formal analysis of *because*-clauses

In order to establish a formal analysis of Japanese *karatoitte* or equivalent expressions in other languages, we first need a formal analysis of *because*-clauses. According to König and Siemund (2000), the causal expression *because p, q* asserts that both of the propositions p and q are true, and presupposes a conditional meaning "P → Q" as well as that p is true as shown in (34a).

(34) *because p, q*
  a. P → Q; p (presupposition)
  b. p & q (assertion) (from Table 3 in König and Siemund 2000)

The conditional meaning "P → Q" in (34a) should not be interpreted as material implication of propositional logic, but as "some kind of quantification and generalisation of the specific propositions p and q" (König and Siemund, 2000: p. 353), which suggests that it should be interpreted as something like '*If p, then normally/usually/generally q*'.

However, the usage of English *because* is not as simple as it appears. It has been observed that there are three different usages of *because* (Sweetser, 1990).

(35) a. John came back because he loved her.
  b. John loved her, because he came back.
  c. What are you doing tonight, because there's a good movie on. (Sweetser, 1990)

The first usage, in (35a), is said to express the real-world causal relation, i.e., John's love for Mary made him come back. The second, in (35b), is not interpreted in the same way as in (35a). Rather, it expresses that "the speaker's *knowledge* of John's return (as a premise) causes the *conclusion* that John loved her" (Sweetser, 1990: p. 77). The third, in (35c), is speech-act related. That is, the *because* clause expresses the reason for asking the question. Sweetser (1990) then explained that English *because* is three-way ambiguous and can be understood in terms of three different domains: the content domain (35a), the epistemic domain (35b), and the speech-act domain (35c). The first two types are also referred to as "clausal" and "inferential," respectively (Jespersen, 1949; Hilpert, 2005).

Now, the question is how to derive these three meanings of *because*, i.e., whether it is a case of lexical or structural ambiguity. Either way, we need a formal account to derive the three types of *because*. We also need to specify which of the three types of *because* that is involved in the concessive 'just because' constructions.

With regard to the above three interpretations of *because*, the Japanese data more explicitly illustrate the ambiguity.

(36) John wa Mary o aishiteiru kara modottekita.
John TOP Mary ACC love.NPFV.NPST because return.PST
'John came back because he loves her.' CAUSAL

(37) John wa modottekita kara Mary o aishiteiru *(no da).
John TOP return.PST because Mary ACC love.NPFV.NPST FN COP.NPST
'John likes Mary, because he cooked for her.' INFERENTIAL

(38) *Ii eiga ga yatteiru kara konban nanika yotee aru?
good movie NOM do.NPFV.NPST because tonight any plan have.NPST
Intended:'Do you have any plan tonight, because there is a good movie on.' SPEECH-ACT

As shown above, Japanese *kara* 'because' is two-way ambiguous: causal or inferential. However, the inferential one requires certain sentence-final expressions such as the *no da* ending, which consists of the formal noun *no* and the copula *da*. This *no da* ending, or the *no da* construction in Japanese, has been described as an auxiliary of "explanation" and studied extensively in Japanese linguistics (Alfonso (1966); Kuno (1973); Noda (1997); Oshima (2023) and references therein). The function of *no da* is referred to as "explanation" because it typically signals that the speaker is uttering the sentence in order to give further information (reasons, explanations, etc.) about what has been under discussion. The *no da* construction has a wide variety of discourse functions, not all of which can be introduced here, but one of them is "inferential use," which is precisely the case in (37). It is worth noting that *karatoitte* 'just because' may appear in a *no da* sentence, as shown below. Without *no da*, or the form *no de* in (39), this sentence becomes less acceptable.

(39) John wa modottekita **karatoitte** Mary o {??aishiteinai/aishiteiru
John TOP return.PST just.because Mary ACC love.NPFV.NEG.NPST/love.NPFV.NPST
no de wa nai}.
FN COP.GER TOP NEG.NPST
'Just because John returned doesn't mean that he loves her.'

If this can be understood as a case of "inferential" *no da*, what the negation doing here is to negate the inference. Then it would make sense that *karatoitte* 'just because' is used because that is exactly what *karatoitte* 'just because' means, i.e., the denial of inference.

Based on what we have seen so far, how should the *because* clause be formally analyzed? In particular, how should we account for the difference between the causal and inferential uses of *because*? The distinction is crucial because what we need to formally account for *karatoitte* 'just because' is the inferential type, as suggested by the Japanese data above.

4.2. Formal analysis of concession

In addition to causal *because*, König and Siemund (2000) also proposed the analysis of concessive constructions as follows.

(40) *although p, q*
a. $P \rightarrow \neg Q$; p (presupposition)
b. p & q (assertion) (from Table 3 in König and Siemund 2000)

What is described in (40) is essentially the same as the causal constructions in (34). The only difference lies in the inference presupposition. While the causal *because* presupposes "if P then usually Q," the concessive *although* presupposes "if P then usually not Q".

This idea of concession corresponds to the inferential approaches of *but* (Winterstein, 2012). It has been said that the conjunction *but* has at least three usages; (i) contrast, (ii) concessive, and (iii) corrective (Izutsu, 2008). Among these, the concessive usage of *but* conveys denials of

expectation, which can be "characterized by the fact that their second conjunct contradicts an expectation raised or activated by the first one" (Winterstein, 2012: p. 1866). For example, in the following sentence, what is actually said contradicts the expectation that if Lemmy smokes a lot, he would not be in good health.

(41) Lemmy smokes a lot, but he's in good health.

Thus, the expectation, which will be denied by what is actually said, corresponds to the presuppositional meaning "P $\rightarrow \neg$Q" in (40b) above.

However, this does not mean that we can simply adopt the analysis of concessive *but* to *karatoitte* 'just because'. While having the common semantic function of concession, *karatoitte* 'just because' shows a unique distribution, as seen in Section 2. Furthermore, there are cases in which *karatoitte* 'just because' is not interchangeable with *noni* 'although' or *kedo* 'but'. As shown in the following examples, which are constructed based on examples (20-22) in Koganemaru (1990), *noni* 'although' and *kedo* 'but' are perfectly natural, whereas *karatoitte* 'just because' is not.

(42) Sakka na **noni**, {dokusho wa kirai da/hon o yomanai}.
writer COP although reading TOP dislike COP.NPST/book ACC read.NEG.NPST
'Although he is a writer, he {hates reading/doesn't read books}.'

(43) Sakka da **kedo**, {dokusho wa kirai da/hon o yomanai}.
writer COP.NPST but reading TOP dislike COP.NPST/book ACC read.NEG.NPST
'He is a writer, but he {hates reading/doesn't read books}.'

(44) Sakka da **karatoitte**, {*dokusho wa kirai da/??hon o yomanai}.
writer COP just.because reading TOP dislike COP.NPST/book ACC read.NEG.NPST
Intended: 'Just because he is a writer doesn't mean he {likes reading/reads books}.'

As for (42) and (43), we can understand that the underlying inference is that if someone is a writer, he or she likes reading and reads many books. If the same inference arises in (44), why does the sentence not mean what it is intended to mean? Following the analysis proposed in Section 3, what (44) means is that being a writer is a sufficient basis for saying that he hates reading or does not read books. At the same time, it presupposes that in the speaker's view, being a writer is not a sufficient basis for saying that he hates reading or does not read books, which is contradictory to what it is actually said. (See also (8).)

Now, compare (44) with (45), which is the correct way of saying what (44) was trying to say.

(45) Sakka da **karatoitte**, {dokusho ga suki da/hon o yomu} to
writer COP just.because reading TOP like COP.NPST/book ACC read.NPST QUO
wa kagirimasen.
TOP limit.POL.NEG
'Just because he is a writer doesn't mean he {likes reading/reads books}.'

The point is that there is a periphrastic sentential negation *to wa kagirimasen* 'not necessarily the case that'. As pointed out by Koganemaru (1990), *karatoitte* 'just because' typically does not appear with simple negation (i.e., a negative morpheme that is directly attached to the stem of predicates) but with the negative expressions such as *to wa kagirimasen* 'not necessarily the case that' and *wake de wa nai* 'not the case that,' as already shown in Section 2. What this

suggests is that negation in the *karatoitte* sentences does not just negate the consequent clause but the entire sentence, including the various modal (or modal related) expressions such as *to wa kagirimasen* 'not necessarily' (epistemic) in (8), *ikemasen* 'not allowed' (deontic) in (10), and *na* 'do not' (prohibition) in (11). The key in the analysis of *karatoitte* 'just because' is not the negation itself (although that is very much involved), but actually the modal of the main clause.

The formal analysis of concession still seems primitive compared to that of other areas of meaning such as conditionals. For example, one of the well-known theories of conditionals is Kratzer's restrictor analysis (Kratzer, 1986). The distinctive feature of this theory is that, unlike the classical analysis that treats conditionals as a two-place connective, the antecedent of the conditional is analyzed as a restrictor of the modality in the consequent. That there is a deep connection between conditionals and modality is now the standard view (Portner, 2009). The theory of concession might be another case in which modality plays a crucial role.

4.3. Incorporating theoretical mechanisms of NPI analysis

Finally, I would like to briefly mention the relation between concession and NPIs. As we have seen in Section 4.2, the meaning of concession is described as 'inference denial'. The general idea of "inference denial" is that what is actually said in a sentence contradicts what is expected or thought likely to occur. This meaning is not only found in the conjunctions of concessions but also in NPIs.

For example, English *even* is one of the best studied NPIs, which clearly illustrates this point. Since the work by Karttunen and Peters (1979), *even* has been analyzed as a focus-sensitive propositional operator that requires its propositional argument to be less likely than all the relevant alternative propositions determined by focus and context (Wilkinson (1996); Guerzoni and Lim (2007); Crnič (2014), and many others). In example (46), where *John* is focus-marked, the asserted meaning is the same as that without *even* (47a). The contribution of *even* is to introduce the existential (or additive) presupposition (47b) and the scalar presupposition (47c).

(46) Even $[\text{John}]_F$ likes Mary.

(47) a. Assertion: John likes Mary.
b. Existential (or additive) presupposition: Other people besides John like Mary.
c. Scalar presupposition: Of the people under consideration, John is the least likely to like Mary.

The scalar presupposition (47c) introduces the notion of likelihood. It compares the target proposition 'John likes Mary' and all the relevant alternative propositions {Adam likes Mary, Bill likes Mary, Charlie likes Mary,...} in terms of the scale of likelihood, saying that the target proposition is less likely than all the relevant alternatives.

Here, let us remind ourselves the meaning of *karatoitte* 'just because' sentences. For example, in (8), what is presupposed is that nothing showing up on a radiograph is not a sufficient basis for asserting that it is normal. In other words, nothing showing up on radiographs is less likely

to be a good reason or basis for claiming that it is normal.

(8) Rentogenshashin ni uturanakatta **karatoitte**, seejoo da to wa
radiograph DAT reflect.NEG.PST just.because normal COP.NPST QUO TOP
kagirimasen. (LBn4_00012)
limit.POL.NEG.NPST
'Just because it does not show up on radiographs does not mean it is normal.'

But 'less likely' compared to what? One way to think of this is that it is less likely than all the other relevant reasons for claiming that it is normal. For example, the speaker knows or believes that there are more appropriate and reliable diagnostic methods than radiographs for determining whether it is normal. Thus, the speaker believes that it is difficult to determine whether a patient is normal based on radiographs alone.

However, the notion of likelihood may not be the only measurement to be used in scalar presupposition. As shown in Section 2, *karatoitte* 'just because' appears with various modal expressions besides epistemic ones. For example, (10) has deontic or teleological modality.

(10) Daiettochuu da **karatoitte** gaman bakari o shite wa
on.a.diet COP.NPST just.because patience only ACC do TOP
ikemasen.(LBq5_00060)
allowed.POL.NEG
'Just because you are on a diet you shouldn't hold back all the time.'

In cases like this, using the likelihood scale may not be the most appropriate way, since the presupposition will be something like the following: 'the speaker thinks that being on a diet is less likely to be a reason for holding back all the time'. Instead, it is more natural to think of the scale in terms of desirability or deservingness, rather than merely in terms of probabilistic likelihood of an event.

In fact, as Rullmann (1997) pointed out, it is not uncontroversial to assume that the scales invoked by *even* are always based on likelihood.

(48) John is a political non-conformist. He even read *Manufacturing Consent* although it has been banned by the censorship committee. (Rullmann, 1997)

In the above example, the scale associated with *even* is not necessarily likelihood, because "*Manufacturing Consent* need not be a particularly unlikely book for John to read. Because of his political views he may be even drawn to controversial or censored books. Rather, the relevant scale on which *Manufacturing Consent* occupies the topmost position could be one that ranks books according to the degree to which they reflect non-conformist thinking or their suitability for banning" (Rullmann, 1997: p. 56).

This suggests that the type of scale introduced by the scalar presupposition of *even* is not always based on likelihood but depends on context. I argue that this is also the case for *karatoitte* 'just because'.

In this subsection, I compared *karatoitte* 'just because' and *even* to show the similarities between the two. I believe that this opens up the possibilities of adopting the analysis of NPIs for concessive conjunctions. To pursue this, however, we need to consider the following two

issues: (i) how to derive the alternative propositions (i.e. the existential or additive presupposition) and (ii) how to determine the relevant scale to be used to compare what is said and the alternative propositions (i.e., the scalar propositions). As for the first issue, one possibility is to adopt the focus alternative semantics (Rooth, 1985), and derive a set of alternative propositions by assuming that the *because*-clause is focus-marked. As for the second issue, it may be possible to determine the relevant scale based on the modality of the matrix clause. In other words, the idea is that the interpretation of *karatoitte* 'just because' is context-dependent and determined by the same modal base and ordering source as the modality of the matrix clause.

5. Conclusion

This paper presented the usage of the Japanese concessive conjunction *karatoitte* 'just because'. Particular attention was paid to its appearance in negative environments in relation to NPIs. Specifically, the semantic function of *karatoitte* 'just because' as "inference denial" is explained in terms of the presupposition which expresses the speaker's disapproval or doubt of certain reasoning. It is argued that this corresponds to the scalar presupposition that NPIs such as *even* are said to have.

However, while this paper has been able to provide an analytical orientation, it has yet to propose a complete formal analysis. To this end, it is necessary to discuss three points: (i) the formal analysis of *because*, (ii) the formal analysis of concession, and (iii) the incorporation of the theoretical mechanisms of NPI analysis. This study is expected to contribute to the development of the semantic analysis of concessions by incorporating the analytical methods proposed in theories of NPIs.

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Revisiting stativity in pictorial narratives[1]

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Abstract. This paper revisits the issue of stativity in pictorial narratives, specifically those found in comics and manga. The standard model holds that the contents of a picture, as defined by geometric projection, are semantically stative and integrated via a Dowty-style narrative interpretation. Here, I propose an alternative interpretation of pictorial narratives. Under this account, most pictorial narrative cases remain stative, as is posited in Abusch. When pictorial narratives include movement lines, however, additional supplemental content generates an eventive interpretation of pictorial representations. This is not pragmatically enriched content. The content contributed by movement lines is treated as semantic because movement lines are non-veridical in the way projection-style pictorial interpretations must be. Ultimately I argue for a dynamic, non-stative interpretation of pictorial narratives that include movement lines.

Keywords: *pictorial narrative, narrative, semantics, stativity, comics*

1. Introduction

This paper revisits the issue of stativity in pictorial narratives, specifically those found in comics and manga. Dorit Abusch has formulated an invariant model to account for temporal succession in pictorial narratives (Abusch, 2014). That model holds that the contents of a picture, as defined by geometric projection, are semantically stative and integrated via a Dowty-style narrative interpretation. Her view has become a default position in the literature since. The way that we talk about these pictorial narratives, though, is by using aspectually eventive terms. This creates an apparent tension between the way we colloquially talk about pictures and the prevailing account of the semantics of comics. One way we might diffuse the apparent tension is by claiming that pictures are semantically stative, although they can be pragmatically enriched to eventive understandings. This is Abusch's claim, namely that eventive reading of individual pictures or panels is purely a matter of pragmatics. Countervailing intuitions, intuitions, in particular, about movement lines encoding real semantic content, gives us reason to revisit the issue at hand.

I clarify the base case (for the present purposes) which covers pictorial narratives without movement lines in section 2 by adopting Abusch's stative account. In section 3, I argue for a semantically eventive reading of pictures which include movement lines by first highlighting my intuitions about our understanding of pictures with movement lines and making room for these intuitions, proceeding from the base case. I then consider some implications for this account in section 4, including how understanding movement lines in this way affects our concept of panel integration. Finally, I give some concluding remarks and consider some objections. Ultimately, I argue here that although the Abuschian base case is sufficient to handle many pictorial narratives, comics and manga that include movement lines ought to be

[1] I would like to thank Robert Henderson and Jonathan Weinberg for their comments on various drafts. I also would like to thank the participants of Sinn und Bedeutung 28 for their helpful comments and suggestions.

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understood as representing aspectually eventive claims in the same way that conventional implicatures semantically encode two or more meanings.

2. Base Cases

The base case, for these purposes, will be one where the inverted geometric projection account from Greenberg is sufficient for handling narrative semantics of pictures (Greenberg, 2013). In this case, pictorial semantics are obtained by inverting projections from a specified point. This can be understood as the following.

(1) **Stative Picture:** ⟦• ⟧= the set of pairs, ⟨v, σ⟩, the viewpoints, v, and scenes, σ, projected to A via the picture plane at a convergence point, A, encoded in v.[2]

This is what I call the standard snapshot view, where a picture is stative because it provides a snapshot within time, from a specific viewpoint[3]. Intuitively, if a picture provides a snapshot in the relevant sense, it will be semantically stative. In this standard snapshot view, pictures are either completely stative, or subinterval statives. Schlöder and Altshuler note that even the subinterval property does not get Abusch the eventive descriptions inherent to many narrative progression accounts (Schlöder & Altshuler, 2023). In committing to a fully stative account, Abusch rejects the Aspect Hypothesis, which is defended by Kamp and Rohrer. The Aspect Hypothesis states the following.

(2) **Aspect Hypothesis:** Aspectual information partially determines narrative progression: states are typically understood to overlap prominent discourse events. (Kamp & Rohrer, 1983)

In response to this, Schlöder and Altshuler propose a choice we must make.

(3) **Schlöder and Altshuler's Dilemma:** Either (i) aspect interacts differently with narrative progression depending on the medium (so, the aspect hypothesis is true), or (ii) we should reject the idea that aspect is relevant to narrative progression (and then do everything with common sense reasoning).

The motivation for committing to (ii) (as Abusch and *partially* Schlöder & Altshuler do), is simple: they believe the Aspect Hypothesis is largely unsatisfying. Further, committing to (i) requires a nuanced answer to the issue of mixed-media narratives—which seems complicated, but possible. That is to say, though, the issue of mix-media narratives is outside the breadth of the topic at issue here, and so will not be addressed. So, although it does seem possible to commit fully to (i), it requires a more complicated semantic picture. For now, all we need is a

[2] More formally, this is understood as: ⟦• ⟧ = {⟨v, σ⟩^{w,v} | • }.

[3] We should set aside a persuasive concern of this interpretation of the semantics of pictures raised in (Maier, 2019), namely the concern that many times we lack the ability to infer further properties of the viewpoint (especially in fictional cases). This seems to be a central issue for determining whether something is true in a fiction, although it seems tangential to the issue of whether or not Abusch's stative interpretation of pictorial narrative semantics can handle movement lines *per se*.

commitment to the belief that, in pure-pictorial narratives, it seems *plausible* that aspect interacts differently with narrative progression depending on medium. I will argue more fully for this in Section 4. For now, consider the way that viewers of pictorial narratives commonly have to return to previous panels to attend to different parts of the images, identify emotions on the faces of characters, and generate cohesive narrative meaning. We might think this repetition is a medium-dependent factor in how we understand narrative progression to occur.

If this intuition resonates, we should consider (i) more seriously, and should consider reviving the Aspect Hypothesis. For now, it seems sufficient to show that although it is intuitive that the base case (the purely stative image) is covered by Abusch's stative pictorial narrative schema, we need an additional schema to understand what is happening when there are movement lines present. The projection account works perfectly for a large number of simple images. However, when we consider more complex examples, we need additional semantic complexity to adequately capture narrative meaning.

3. Movement Lines and Events

As Abusch points out, a geometric projection account of pictorial representations has difficulty interpreting the semantics of movement lines (Abusch, 2014). She posits that movement lines are not *semantic* depictions of movement, but rather a pragmatic enrichment of a geometric projection of a state. The sentences depicted by pictorial representations are then, as a consequence, always *linguistically* stative. We might think this is a bit misleading, especially considering the way that we talk about these kinds of images in everyday life.

It seems that in at least some cases, pictures can depict events—in particular, pictures can depict events when they have movement lines. Although this is surely not the *only* scenario in which we can have an eventive interpretation of an image, pictures with movement lines will be the central kind of case I consider here. When thinking about movement lines within a geometric projection account of representation, we get a confusing result. Movement lines are not physically present when movement occurs. So there is something strictly depicted which is not really present. It's not obvious that the snapshot account can handle these cases. So, there are two related issues occurring in pictures with movement lines: (i) their stativity and (ii) their veridicality. Take, for instance, the following picture by (Daiphi, 2023).

(4)

Figure 4a

Figure 4b

Addressing (i), we can describe Figure 4a as depicting the state of affairs: {Phi is tripping over a rock}. The image in Figure 4a is veridical in the sense that everything portrayed would be visible should this be a real-life geometric projection. However, in Figure 4b, the addition of movement lines make the interpretation more tricky. Rather than an ambiguous {Phi is tripping over a rock} interpretation, I think we naturally describe the meaning of Figure 4b as {Phi trips

over a rock}. The difference between these two cases (and the reason we might describe one in stative terms or eventive terms) hinges on the presence of movement lines. These lines (as the name implies) indicate movement, and further clarify the specific nature of the interaction between the two objects within the image[4].

Addressing (ii), the movement lines are non-veridical, in that movement lines are not *literally* a visible aspect of a geometric projection. If this was a photograph taken of Phi tripping, movement lines would not be present. Maybe what is happening here is an artistic means to show something like a blurring effect we would see in a photograph. Even if we deny the veridicality point on a kind of blurring basis, it still would be the case that the blur effect indicates movement, and affects the way we ascribe meaning to the image. In short, even if you deny (ii) here, (i) is still quite convincing.

3.1. Movement Line Meaning

So, although the content in Figure 4a is intelligible *without* movement lines, the information communicated is far more informationally rich in Figure 4b with the addition of the movement lines. When there are movement lines, like those in Figure 4b, the lines provide supplemental content which, combined with the base case stative understanding, generate an eventive reading of the whole image.

(5) (**Stative Picture):** $[\![\bullet\ ]\!]$= the set of pairs, $\langle v, \sigma \rangle$, the viewpoints, v, and scenes, σ, projected to A via the picture plane at a convergence point, A, encoded in v.
(**Movement Lines):** $[\![\bullet_{m}]\!]$= {e for all e' in the spatial trace of e', which includes a point in space indicated by the movement lines}

The formal understanding, then, of movement lines is a set of points on the spatial trace, which correspond to points on the movement lines, given the movement lines within the image itself. The base case image is processed first, and represents some moment in time within the event's temporal projection, although it does not have to be the start-point for the spatial trace. Remember from 4a and 4b:

(6)

Figure 4c

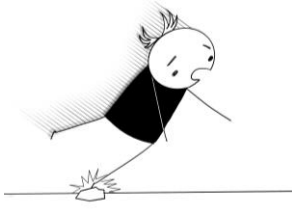


Figure 4d

4a constitutes the base image, but 4b does not only project temporally forward. The movement lines both provides a spatial trace which shows viewers that Phi is tripping

[4] There are different kinds of cases, like trajectory lines and emotive lines, which are similarly non-literal, but arguably at issue. I do not have the space here to consider these kinds of cases although they present an interesting wrinkle to this account. I have in mind here something like the "spidey sense" lines seen frequently in Marvel's Spiderman comics, or trajectory lines which show where a character has come from or where they will land when they complete a fall.

forward and gives us an indication of where they were previously located as well as where they are going forward. We also get impact movement lines that highlight the impact of Phi's foot with the rock. These movement lines provide *disambiguating* information about what is occurring within the image.

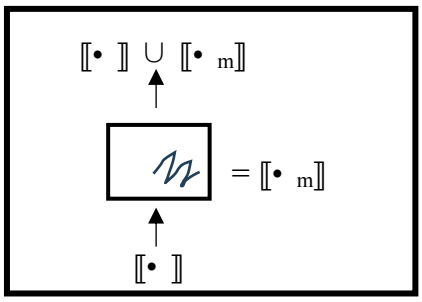
Notably, the lines aren't in-world. Instead, movement lines are conventional marks on a page. They conventionally *do* denote an event. The movement portion denotes a set of events (or even a single event of type e), namely, events whose spatial trace follows the movement lines. Some state along the spatial trace (although this does not have to be the starting state, or ending state) is denoted by **(Stative Picture)**. Remember here that **(Stative Picture)** is going to be the base case image, without movement lines. This process can be repeated should multiple sets of movement lines denote multiple simultaneous events[5]. Integrated together, we have a multidimensional eventive understanding of a picture.

To formalize this further, we can use Christopher Potts' framework for conventional implicature. Conventional implicatures are secondary entailments which can be used to communicate a variety of different expressive content or controversial propositions (Potts, 2004). The at issue entailment, or the content that is regularly asserted by the discourse (the "what is said" (Grice, 1975)) is supplemented with the conventional implicature, providing additional supplemental or secondary content. It is helpful to think of movement lines as a kind of conventional implicature, or some bit of secondary content which adds to the at issue entailments of the stative projection.

So, while we can understand the base image as providing semantic content, movement lines provide supplemental eventive propositional content which adds to the at-issue content given in a stative (Abuschian) pictorial narrative. Movement lines, therefore, *enrich* the stative, at issue content within a given pictorial to eventive propositional content, but notably this is not done pragmatically. The enrichment given here is semantically encoded by the movement lines themselves. Since we can understand conventional implicatures as semantically encoding a secondary meaning to an utterance, we can use the same kind of framework to the pictorial narrative case. So, we can understand the way movement lines provide additional meaning to the content of a picture as the following.

(7) (**Stative Picture):** $[\![\bullet\ ]\!]$= the set of pairs, $\langle v, \sigma \rangle$, the viewpoints, v, and scenes, σ, projected to A via the picture plane at a convergence point, A, encoded in v.
Movement Lines): $[\![\bullet_{m}]\!]$= {e for all e' in the spatial trace of e', which includes a point in space indicated by the movement lines}
(Picture with Movement Lines): $[\![\bullet\ ]\!] \cup [\![\bullet_{m}]\!]$; where both the base case meaning and additional semantic content are joined together to generate an eventive aspect.

[5] More complex images, like those found in most manga, likely have a few separate layers of movement lines, indicating different kinds of movement occurring at once. This seems completely compatible with what I present here, although I am not (at this time) committing to one particular method of formalizing the separation of movement lines in complex, dynamic pictures.



This multidimensional semantics for pictures with movement lines allows the viewer of complex comics to be understood in a variety of different eventive propositions. Like Potts' claims in (Potts, 2012), although there is *an aspect* of pragmatic enrichment available to the viewer (in virtue of there being multiple secondary meanings) this does not require that all there is to these conventional implicatures is pragmatic enrichment[6]. We add, in these cases, additional information to the context set (e given from the spatial trace of the movement lines) in order to supplement the at-issue content from the stative picture. Together with the at-issue content, the movement lines provide the viewer with an eventive interpretation of the picture.

So, why can we describe Figure 4b in eventive terms? This is *not* because of pragmatic enrichment of stative geometric projections. Instead, we can do this because there are movement lines which encode the instructions to construct an eventive understanding of the image, just as conventional implicatures encode secondary meanings. These informationally rich "readings" of pictures help us to project forward or backward from the given base case geometric projection in order to conceptualize movement occurring.

4. Panel Integration and Narrative Understanding

Given that comics do not usually appear as individual pictures, but as collections of panels, I should also address panel integration and conventional implicature. Abusch sets out an algorithmic parsing structure for panels, but with the addition of movement lines functioning like conventional implicature, the parsing structure becomes more complicated. Under her account, this algorithmic panel structure is what gives pictorial narratives their distinct linear structure (Abusch, 2014). This streamlines the issue of temporal ordering for adjacent panels and pages in most cases. So, forming cohesive pictorial narratives is quite simple. We have a base temporal ordering schema which is pragmatically overridden in cases where there appears to be no temporal progression. Schlöder & Altshuler outline coherence relations to make sense of these kinds of images which do not neatly fit the temporal progression schema (Schlöder & Altshuler, 2023). Since these coherence relations are pragmatic, we should set their proposal aside for the time being.

Assuming the addition of movement lines as a conventional implicature is not outright rejected, One might rebut that even in the case of movement lines, we have ordered pictures with

[6] Another way to reject pragmatic enrichment would be to treat movement lines as a kind of co-speech gesture. Although I do not pursue that idea fully here, it seems to be another viable interpretation of movement lines in pictorial narratives, should this view be rejected. For more on co-speech gestures in both conventional speech and sign language see (Ebert et al., 2022; Kita et al., 2007).

individual focal points ⟨α_1, α_2,… α_n⟩ which *still* represent a flat, projected cohesive image. The problem with this arises when we get into more complicated and intricate pictorial narratives. If we think pictorial narratives convey only central, uniform information, then flat cohesive image sequencing is sufficient to understand what is going on in a panel.

That being said, more detailed and aesthetically rich panels, including those in serialized comics and manga, require *dynamic* interpretation, wherein the viewer does not have to fully 'move on' from the picture at hand to process to the next image. Eye tracking studies back this dynamic interpretation up. Notably Kirtley et al. have shown that when viewers are confronted with pictorial narrative panels, it is not uncommon for individuals to skip over full images and return to panels (Kirtley et al., 2023). Although I won't go more into the specifics of these studies, the empirical data seems friendly to what I propose here.

Consider the following example.

(8) In the following panel, Phi rears back to punch Chlo in the face. Chlo appears scared. Phi's fist is thrown forward while Phi cries out triumphantly. We then see the punch connect, while Chlo's glasses are broken and she spits blood. (Daiphi, 2023)

In panel-based examples, movement lines invite the viewer to temporally project forward and/or backward to construct an eventive reading of the image. Semantically this is formalized as a set of events, like in **(Movement Lines)**. This is why viewing images like those in (8) can frequently produce a variety of linguistic descriptions that are eventive, while we may without fault, describe singular images in stative terms.

Assuming the puncher is named Phi, while the punchee is called Chlo, we can interpret the linguistic meaning of each picture, and the panel as a whole, in a few different ways.

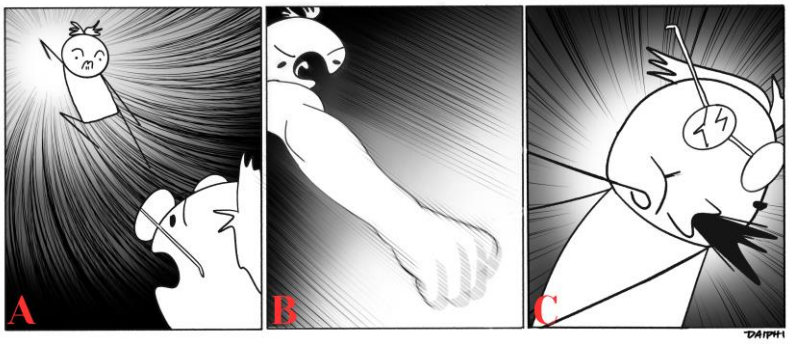
(9) a. Phi jumps up, ready to punch, while Chlo looks on in fear.
?Stative: Phi is jumping. Phi is about to punch Chlo. Chlo is shocked.
b. Phi throws her fist down, punching someone.
?Stative: Phi is punching someone.
c. The fist strikes Chlo, and she spits blood as her glasses crack.
?Stative: Chlo is punched. Chlo spits blood.
d. Panel: Phi jumps up to punch Chlo. After the punch connects, Chlo spits blood as her glasses crack.
?Stative Panel: Phi is jumping up and is punching Chlo. Chlo is spitting blood.

Although the stative descriptions of these panels and images is not strictly incorrect, it is certainly less informationally rich than the eventive interpretation. Although there is something to be said for concise meanings for images, avid lovers of the comic and manga genres would likely reject a stative reading of this panel[7].

This becomes more intuitive if an algorithmic panel sequencing account is supplemented with the dynamic account presented here. Under this view, an image is not interpreted once, like a sentence, and then integrated into discourse. We do not simply extract meaning and move forward. Instead, we process (i) the base image, (ii) the movement lines, and (iii) adjacent panels repeatedly to generate a cohesive meaning. We may, for instance, when looking at panels such as (8), go from left to right, then back to the first panel image, then continue left to right throughout the panel.

This is intuitive because when we generate cohesive narratives for panels, we do not merely process images in an algorithmic, linear, left to right fashion. The presence of movement lines and partial perspectives of the action given in the panel might require algorithmic panel sequencing to be broken in exchange for a more dynamic interaction with the images in panels[8]. Consider this labeled version of the panel from (8).

(10)



Recalling the various ambiguous meaning options provided in (9), there are ambiguities with respect to meaning that are resolved by looking ahead at panels and returning back. For instance, we could wonder what in particular Phi is doing in panel A. Evaluated in isolation, one could think that they are jumping up, they are jumping on a trampoline, or that they are preparing to pose like the well-known superhero Blade. Panel B gives us more insight as to what the intended meaning of A is. We might also ask what particular emotion Chlo is depicted as feeling in A. Perhaps she is relieved to see Phi coming to save the day. Perhaps Chlo is worried that Phi will injure themselves. After viewing panel C, we can return to A to resolve that ambiguity, and we can revise the meaning of the image. This panel is quite simple, though,

[7] In truth, we likely don't need to turn to just avid comic and manga readers to find eventive interpretations of this panel. For more on this, see (Cohn & Maher, 2015). For now, this limited claim will do.

[8] We can also presume that this is what occurs in the edge cases Abusch discusses. She mentions cases like from Ode to Kirihito, where the 'panel' lacks recursively divided blocks. Instead, in these cases, the individual panel parts are composed of different shapes which fit together on the page. See (Abusch, 2014).

in comparison with the more complex ones in most manga or comic books, so we might imagine this issue amplifying given more complex composition.

Therefore, while the base case is handled well by the algorithmic cross-panel ordering that Abusch outlines, formulating panel ordering with movement lines in the Aubuschian method flattens the dynamic meaning that emerges when we break strict panel ordering to resolve ambiguities *within* and *across* panels. This seems in part to be specific to the particular medium. We might think, then, that pictorial narratives have some medium-specific properties that affect things like temporal ordering based on aspect.

4.1. Return to the Aspect Dilemma

Back to the dilemma Schlöder and Altshuler present in their paper mentioned here in section 2, either (i) aspect interacts differently with narrative progression depending on the medium, or (ii) we should reject the idea that aspect is relevant to narrative progression (and then do everything with common sense reasoning). Contrary to many views in the literature, it seems plausible given what I've said up to this point that aspect interacts differently with narrative progression depending on medium. In particular, it seems plausible that aspect interacts differently with narrative progression in pictorial narrative cases. This seems plausible because of genre conventions about pictorial narratives with movement lines, in particular, that require repeated attention to generate eventive meaning and to resolve meaning ambiguities. Integrating the particular information we get from evaluating movement lines, or paying particular attention to certain aspects of the image generate different meanings than flat, simplistic projections. This becomes especially salient when looking at increasingly detailed manga, or comic panels with complex artistic composition. Meant in the most charitable of ways, not all comics are Calvin and Hobbes, and not all pictures have the same robust meaning in isolation as they do within contextual panels. Many complex pictorial narratives require the reading and re-reading of panels in order to 'pick up on' the details provided by the author[9].

So, we might think at this point that there is a need to reject, or at least amend, a Dowty style theory of narrative progression, since it is the basis for Abusch's account.

(11) Dowty's Temporal Discourse Interpretation Principle (TDIP): Given a sequence of sentences S_1, S_2, … S_n to be interpreted as a narrative discourse, the reference time of each sentence S_i (for i such that $1 < i \leq n$) is interpreted to be:
   a. A time consistent with the definite time adverbials in S_i, if there are any;
   b. Otherwise, a time which immediately follows the reference time of the previous sentence S_{i-1}. (Dowty, 1986)

[9] Although there are undoubtedly more nuanced examples, we can look at cases like The Sandman by Neil Gaiman and published by DC Comics. In issue 33, *Lullabies on Broadway*, George undoes his shirt to reveal a bare ribcage filled with cuckoo birds, which fly out, representing his personality shift (Gaiman, 1991). The artistic composition of the panels where George undoes his shirt is a clear 'easter egg,' a nod to another DC superhero, Superman. Without careful attention to the canon, landscape of the DC Universe, and the meaning of the image within the context of the pictorial narrative, this 'easter egg' is likely overlooked.

Abusch amends TDIP a bit (to fit better with pictorial narrative cases) by allowing pragmatic enrichment to provide temporal overlap, though strict temporal overlap is not *strictly* given by pictorial narratives. As Schlöder and Altshuler put it: "Like linguistic narratives, pictorial narratives are subject to fixed rules that force pictures to be understood in succession and common sense pragmatics can "extend" a state in time to infer temporal overlap" (Schlöder & Altshuler, 2023)[10]. What is happening here, with movement lines, is not pragmatic, but semantically encoded conventional implicature. We should not think this is an issue, though.

Suppose we just use Abusch's temporal ordering schema, which is based on the Dowty TDIP. As a reminder, the account presented here uses Abusch's stativity hypothesis for the base case, which provides the at-issue content. The non-at-issue content, the movement lines, provide the semantic encoding for an eventive reading of the image. Since this account has movement lines as conventional implicatures, they are non-veridical in the same way that the base case, at-issue content, will be. So, using Abusch's temporal ordering schema works great for the at-issue content. Since we do not have issue temporally ordering these stative images, we should not have an issue temporally ordering pictorial narratives with movement lines. Although we are given additional meaning in virtue of these movement lines, when temporal ordering of the eventive meaning creates issues, we can revert back to the temporal ordering provided by the base case image.

5. Objections

Here are two serious objections we should take seriously if this account is to be adopted. The first I consider is the wrong category objection, which holds that although conventional implicature seems like a good way to understand movement lines, conversational implicature seems to be a just-as-good alternative. I look at Grice's tests for cancelability and whether the content is at-issue or not. Then, I address a convincing objection against cumulativity, along the lines of an anticipated objection Abusch defeats quite nicely in her 2014 paper.

5.1. The Wrong Category Objection

We might worry, at this point, that although conventional implicature seems to be an intuitive candidate for understanding movement lines, conversational implicature might be a just-as-good alternative. The difference would lie in whether or not the additional content was cancelable[11] (or whether the movement lines are part of the truth conditional meaning of the picture). Once it is determined that movement lines are non-cancelable in the relevant sense, we should determine whether or not the content is at-issue or not.

First, the issue of cancelability. Let's say the target meaning for Figure 3b is as proposed above: {Phi trips over a rock}. The additional information provided by the movement lines would be cancelable just in case the negation of the target meaning is semantically encoded.

[10] Pictorial Discourse Representation Theory, or PicDRT, seeks to revive some variety of the Aspect Hypothesis (or (i) from the dilemma presented by Schlöder and Altshuler). This might be another way to solve the temporal ordering issue, although it is also a pragmatics schema. I am hoping to leave open the question of whether or not that temporal ordering schema is compatible with what I lay out here.

[11] It should be noted here that cancelability is not the only important difference between conversational and conventional implicature. It does seem like a sufficient test, considering that what is at issue here

(12) The meaning of interest here is:
   a. {Phi is tripping over a rock} is true.
   b. #? {Phi trips over a rock} is false.

That reading would be odd, but maybe not impossible. We could squabble over the success conditions of the eventive reading. If Phi is tripping over the rock but catches themself before falling, then maybe this eventive reading would be cancelable. It might not be the case that they trip over the rock. This would certainly be right if our understanding of the image was instead that {Phi is falling over a rock} and for the image with movement lines, {Phi falls over a rock}. But, this reading of the pictures in (4) would be even more odd than (12)b being cancelable! Even suppose that we had such an image, where Phi catches themself right before falling over the rock. This new information, given our dynamic panel interpretation movement story, might even shift our understood meaning from {Phi is falling} to {Phi is tripping} since the success conditions for tripping are compatible with Phi catching themself. This seems perfectly in line with the account presented here.

Let's look at a case (borrowed from Schlöder & Altshuler) to show when pictorial content can be cancelable.

(13) The meaning of interest here is:
   a. {The person is falling} is true.
   b. {The person falls} is false.

In this case, {The person is falling} is strictly true. You can see the person in the image presumably stumble and certainly begin to fall. Then, they seem to catch themselves, recovering. In this kind of a case, the additional meaning from (13)b is cancelable. It is cancelable because of the information we get from the second image, where we know that it cannot be the case that the person falls, since they seem to recover. In this case, then, there is not a conventional implicature at play.

The other main issue we need to address is whether or not the movement lines are in fact at-issue or actually conventional implicatures. This seems a bit easier to discharge quickly. At issue meanings are strictly, as Grice says, 'what is said,' whereas conventional implicatures provide additional supplemental content that can be speaker (or, in this case, viewer) relativized (Grice, 1975; Potts, 2007). Think back to my discussion of veridicality and movement lines. Strictly speaking, if we were living in the cartoon world of DaiPhi's comics, we would see a projection more like Figure (4a) than (4b). The movement lines are non-veridical for this very reason! The movement lines themselves are not literally a visible aspect of geometric projection, and are therefore not at-issue. Since we've discharged these two related worries, it seems that we can discharge this objection. If movement lines were actually a form of

is not the kind *conventional implicatures*, but the application of the kind to different contexts. For more on whether cancelability is a reliable test see (Zakkou, 2018).

conversational implicature, they would be cancelable. It doesn't look like this is the case. If the movement lines were merely at-issue, they would be objectively veridical in the same way the base case images are. They are not, so this doesn't seem to be defeating either. Now, we can turn to the other objection we should consider here, one on the basis of cumulativity.

5.2. Cumulativity Objection

This objection, in line with Abusch's reasoning in her 2014 paper, holds that pictures cannot be eventive because events are not temporally cumulative in the same way that states are. Because we are committed to a (revised) Dowty-style narrative interpretation, we need the pictorial panels to possibly be temporally cumulative. In short, it has to be the case that two or more images which are temporally cumulative (happening at the same time interval) can be interpreted that way. This assists in narrative progression and therefore temporal ordering in a way that is not accessible to us if we understand pictures as always eventive.

That being said, remember (10). Were we to understand this panel as being three stative (or intervally stative) images, we can assume a cumulative meaning of at least B and C. So, for σ_B (or the second image in the panel) and σ_C (or the third image in the panel), $\sigma_B \cup \sigma_C$ could be true. While stative and activity propositions can be true at a time, eventive propositions cannot. Since what I have developed here is a *semantic* enrichment, rather than pragmatic enrichment we might think that we need to reject my account for cumulativity reasons. But, this is not the case.

When outlining this cumulativity concern, Abusch states that "for pictures, there are no non-stative literal contents" (Abusch, 2014). Since movment lines are *not* literal contents of the image, but are non-veridical conventional implicatures, we might think we can get around the cumulativity concern by just appealing to our base case (which, in fact, is just Abusch's stative account). We need to be able to have base-stative interpretations of pictures in order to order them temporally and get clear narrative progression. As Abusch claims, "it is a mathematical fact that the informational content of the picture is cumulative, and in fact stative, because it can be satisfied by an instantaneous situation" (Abusch, 2014). The key here is that what we are looking at needs to amount to an instantaneous slice of σ_B and σ_C to satisfy $\sigma_B \cup \sigma_C$. This seems given. This allows us to engage in temporal ordering and to formulate narrative progression in a more straightforward manner. Abusch is right that we should have our at-issue meaning be stative and be subject to cumulativity concerns. That, though, does not tell us anything about non-literal contents of the picture, namely the movement lines. Movement lines do give us a more informationally rich eventive understanding of the image, but they are notably non-veridical. Although this enriched meaning might be more *useful* to viewers of the pictorial narratives, as it conveys information not given in just the base case, it is simply not at issue, and veridically can be collapsed to the instantaneous slice Abusch appeals to.

If this still seems like an unappealing response to Abusch's cumulativity concern, we might consider taking a second look at the discourse construction rules laid out within the 2014 paper. These rules would help to distinguish between temporal succession and overlap based on aspect (whether or not the picture is eventive or stative). By reopening the discourse construction rule, we can rely less heavily on an amended Dowty-style narrative

interpretation and focus more clearly on a unique pictorial narrative progression account. This approach, while lofty and appealing, requires more care than can be given here, so I leave it as an open question whether or not that is the best solution to the problem.

6. Conclusion

So if what I have said here has some promise, we should still accept Abusch's stative interpretation of pictures for standard pictorial narratives. However, in cases where movement lines are present, we might think the non-veridical lines function like conventional implicature, semantically enriching the picture to an eventive proposition. It should be noted that I am not arguing for the universal claim that all pictures are eventive. Instead, here, I argued that there are at least *some* pictorial narratives comprised of stative depictions, with additional implicatures which enrich the understanding of the depiction to an event. We might even want something notably stronger than what is presented here, which would have, as it's starting place, the same intuitions I appeal to here.

On the present account, strong compositional narratives and pictorials with movement lines should not be interpreted as *merely* stative, as previously theorized. This has implications for the way we talk about temporal ordering in pictorial narratives, and does not require that we commit to a super-pragmatic account. Instead, a super-semantics can be developed to enrich the given stative meaning of pictorials to give us dynamic, informationally rich pictorial representations.

Defining movement lines for pictures in this way requires us to formulate a more dynamic understanding of panel integration, where individual panels are not seen as flat images, but eventive depictions. With this account, we might be able to accept the first horn of Schlöder and Altshuler's Dilemma, under which aspect interacts differently with narrative progression depending on the medium. If we accept that position, Abusch's discourse construction rule can come back into consideration—this would distinguish between temporal overlap and temporal succession based on whether or not the content of the picture is stative or eventive. These possibilities revive the issue of whether or not we should consider pictures as essentially stative.

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The evidential reading of German locative *an*[1]

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Abstract. German inferential perception verbs license an evidential reading of PPs headed by *an*: They refer to the information source of an inference and to directly perceived entities (Müller, 2020). This paper aims to show that this reading of *an* is derivable from its basic locative meaning by compositional means. This is achieved by analyzing evidential *an*PPs as event-internal modifiers in the framework of Two-level-semantics (Lang and Maienborn, 2019). Results of a corpus study show that evidential *an*PPs refer to bearers of tropes which provide the contextually relevant information source and are perceivable on the bearer's boundary surface. This is predicted by the locative meaning of *an* as worked out in Carstensen's (2000; 2015) cognitivist-attentional approach.

Keywords: Perception, inferences, *an*, evidentiality, tropes.

1. Introduction

In German, prepositional *an*-phrases[2] (in the following: *an*PPs) may indicate the source of an inference drawn by the subject referent. In this sense, the *an*PPs in (1)–(2) are interpreted evidentially: the conclusion, expressed by the *that*-clause, is based on the content of the *an*PP. Following Aikhenvald (2007), evidentiality is here taken as a semantic-functional domain referring to information sources, or evidence, on which attitude holders base their conclusions.

(1) a. Kim merkte an den Blättern, dass Herbst war.
Kim noticed at the leaves that autumn was
'Kim noticed from the leaves that it was autumn.'
b. An der offenen Tür merkte Marie, dass John zuhause war.
at the open door noticed Mary that John home was
'Mary noticed from the open door that John was home.'

(2) a. An dem blutigen Messer sah Margarete, dass Maria den König umgebracht hat.
at the bloody knife saw Margret that Mary the king killed has
'Marget saw from the bloody knife that Mary has killed the king.'
b. An dem Geräusch hörte Margarete, dass Maria den König umgebracht hat.
at the sound heard Margret that Mary the king killed has
'Margret heard from the sound that Mary has killed the king.'
(Müller, 2020: 60, (13a-b))

*An*PPs that exhibit an evidential interpretation are already attested in earlier stages of the German language for *scheinen* 'to appear', 'to seem'; cf. Axel-Tober and Müller (2017); Müller (2022), and refer to directly perceived entities (Müller, 2020). They are semantically restricted

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[2]The German preposition *an* in this reading is not easily translatable to English. In the evidential reading, it is probably best translated with 'from'. However, I will use the English locative preposition 'at' as translation throughout this paper, because my main desideratum is to derive the evidential reading from the locative one.

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to predicates that express a reasoning that is based on perception. Typically, inferences as results of reasoning processes are expressed by finite *that*-clauses as complements of cognitive verbs. Perception, on the other hand, is a sensory experience and typically expressed by perception verbs (PVs) that may encode a specific sensory channel (like the auditory system for the verb *hear*).

This paper addresses the following questions: (i) In which contexts does the evidential reading arise, and how does the *an*PP compose with the embedding verbs? (ii) What is the specific, lexical meaning contribution of the preposition *an*? (iii) To what kind of entities do information sources refer? The aim of this work is to show that the evidential reading of *an* is entirely derivable from the locative one, which is taken as its primary basic meaning. The key argumentation is that the embedding verbs form a certain group of experiencer-stimulus-verbs that provide an implicit stimulus argument in their event structure. Evidential *an*PPs overtly realize the thematic role of the stimulus. The basic locative meaning of *an* predicts that the stimulus is located at the surface of the *an*-internal referent or constitutes a part of it.
The paper is structured as follows: Section 2 introduces the contexts that license the evidential reading of *an* and proposes a lexical structure for the embedding verbs. Section 3 offers an overview to relevant works on the preposition *an* and proposes an analysis of evidential *an*PPs as event-internal modifiers along the lines of Maienborn (1996; 2001; 2003). A compositional analysis based on the locative reading of *an* is given in Section 4. Section 5 presents the results of a corpus study that permit a more detailed look on the phenomenon from an ontological perspective. This is elaborated in Section 6. A brief conclusion is given in Section 7.

2. Semantic restrictions on the context for evidential *an*

In this section, I will show that the evidential reading of *an*PPs arises only in the context of predicates that a) have a propositional complement that expresses an inference, and b) imply a perception stimulus. Verbs showing these properties can be grouped together under the notion of *inferential perception verbs* (IPVs)[3]. Based on the observed data, a decompositional structure for IPVs is set up at the end of this section.

2.1. The inferential component

Evidential *an*PPs are only compatible with predicates that describe an inference of the subject referent. Major evidence for this is found in the incompatibility of evidential *an*PPs with PVs in their direct reading. The PV *see* in (3) shows a direct or 'epistemic neutral' reading (see e.g. Gisborne, 2010; Bayer, 1986), in that the complement refers to a directly perceived entity and realizes the thematic role of a stimulus.

(3) a. Margret saw Mary.
b. Margret saw Mary kill the king.

[3]IPVs are selectional flexible in embedding not only *that*-clauses, but also *wh*-clauses, as well as trope-referring NPs like in (12). Since this paper focuses on the meaning of *an*PPs, I will not discuss the status of the verb complements here.

The syntactic form of the complements reflects ontological restrictions for direct (sensory) perception: Possible objects of perception are concrete entities that are situated in space and time and realized in a unique way. This is fulfilled by physical objects as in (3a) and Davidsonian eventualites[4] as in (3b). Evidential *an*PPs are not compatible with the direct reading of PVs (Müller, 2020: 61), because it lacks an inferential component:

(4) a. *Margarete sah Maria / den Mord an dem blutigen Messer.
Margret saw Mary / the murder at the bloody knife
b. *Margarete hörte Maria den König umbringen an dem Geräusch.
Margret heard Mary kill the king at the sound

Instead, they only occur with PVs in their indirect or inferential reading with a propositional complement as shown in (2). It is commonly acknowlegded that *see* in (2a) is used in a cognitive sense such that the complement clause expresses a conclusion made by the subject referent, see e.g. Bayer (1986); Gisborne (2010); Whitt (2010); Müller (2020).

Further, Müller (2020: 69,73) points out that the clausal complement must indeed exhibit an inferential reading. This restriction is best illustrated with the PV *hören* 'hear', which is typically interpreted as reportative when it embeds a finite *that*-clause as in (5a). In this reading, the *that*-clause refers to the content of a report that Mary received from a third party like the news. As (5b) shows, it is not possible to refer to the report-medium with an *an*PP. Thus, *an*PPs are ruled out in the reportative reading of *höören*.

(5) a. Margarete hörte, dass Marie den König umgebracht hatte.
Margret heard that Mary the king killed has
(Müller, 2020: 60, (12a))
b. *An den Nachrichten hörte Margarete, dass Maria den König umgebracht hat.
at the news heard Margaret that Mary the king killed has

However, if the *an*PP refers to a sound-object like in (2b), an inferential reading of *hören* is triggered, leading to an evidential interpretation of the *an*PP. Thus, only in case the embedded proposition expresses an inference, an *an*PP may refer to a "piece of evidence from which a conclusion can be drawn" (Müller, 2020: 69).

2.2. The perception component

The notion of IPVs also excludes pure mental verbs like *denken* 'think' or *schlussfolgern* 'infer' in (6) with a propositional complement but lacking a perception component:

(6) a. Margarete dachte / schlussfolgerte, dass Marie den König umgebracht hat.
Margret thought / inferred that Mary the king killed has
b. §An der offenen Tür dachte / schlussfolgerte Marie, dass John zuhause war.
at the open door thought / inferred Mary that John home was

Propositions are non-physical, abstract entities which cannot be perceived because they are not bound in space and time; they are "timeless and placeless" (Gisborne, 2010: 120). *An*PPs in the context of mental verbs like in (6b) are restricted to a spatiotemporal reading such that the

[4]These include events and Davidsonian states, but not Kimian states, see Maienborn (2019).

*an*PP is understood as a frame-setting locative.[5] This triggers a temporal reading that can be paraphrased as 'When Marie was at the door, she thought/inferred that John was home' (cf. Maienborn, 2001: 196f.). *Belief*-predicates are not compatible with evidential *an*PPs. They are disqualified as IPVs because of their lack of a perception component.

At this point it is worth to note that *an*PPs in the context of IPVs are not restricted to an evidential interpretation. A regular locative *an*PP similar to (6b) is always possible. This is not contradictory, as (7) shows.

(7) An der Treppe sah Marie an der offenen Tür, dass John zuhause war.
at the stairs saw Mary at the open door that John home was

Here, the first *an*PP exhibits a spatiotemporal reading, while the second one is evidential. Section 3 will return to this point. In the remainder of this paper it will become clear that the two readings of the *an*PPs in (7) result from different syntactic positions.

2.3. The group of inferential perception verbs

The distribution of evidential *an* permits generalizations on the event structure of the embedding predicates. Based on the observations above, Müller (2020) argues for a uniform lexical analysis of PVs in their direct use and in their inferential use, in that both involve a regular stimulus argument. In the direct reading of PVs, the stimulus is syntactically realized as direct object of the verb, while in the inferential reading, it may be realized by an *an*PP. Verbs that are compatible with evidential *an*PPs embed inferential propositions as complements and crucially involve an implicit perception argument. The access to a perception stimulus is a key factor to the notion of evidentiality for the phenomenon investigated here: it is acknowledged that the most direct evidence is that of perception as a first-hand experience. The two most prominent sensory modalities that serve evidential functions are that of visual and auditory perception (Whitt, 2010). This is reflected in the frequency of the verbs modified by evidential *an*PPs.

Evidential *an*PPs occur not only with PVs in their inferential reading, but also with the two rather cognitive verbs *merken* 'notice', 'realize' and *erkennen* 'recognize'. Both impose stricter constraints on the selection of complement types than PVs. Neither *merken* nor *erkennen* licenses complements in accusative with infinitive construction, and the selection of nominal complements is highly restricted for *merken*. On the other hand, *erkennen* has less restrictions on the combination of nominal complements and evidential *an*PPs than PVs and *merken*.[6] These observations conflict with the classification of *merken* and *erkennen* as PVs, cf. (3), and corrobates instead the classification of IPVs. The following verbs constitute the group of IPVs:

- PVs in their inferential use: *sehen* 'see', *hören* 'hear', and with less frequency *spüren* 'feel', *riechen* 'smell', *schmecken* 'taste'; see (8)–(12)

[5]The judgment § indicates that the intended reading is not available.

[6]See (i) for an object-denoting NP combined with an evidential *an*PP with *erkennen*. PVs as well as *merken* restrict this combination to NPs referring to tropes like in (12).

(i) Marie erkennt / *merkt das Kind am Klang seiner Stimme.
Mary recognizes / notices the child at.the tone of.its voice

- Inferential verbs implying perception without specification of the sensory channel: *merken* 'notice', 'realize' and *erkennen* 'recognize'; see (13)–(14)

(8) Dass der Anbau von Soja für die burgenländischen Landwirte immer mehr an Bedeutung gewinnt, sieht man schon alleine an der Anbaufläche. [Burgenländische Volkszeitung, 19.08.2010]
'That soybean cultivation is becoming increasingly important for farmers in Burgenland can be seen from the area under cultivation alone.'

(9) An ihrem Englisch – an der Betonung, an der Wortwahl und an den Flüchen – hört man sofort, dass sie nicht zur feinen Oberschicht gehören. [Die Südostschweiz, 14.09.2010]
'From their English – the accent, the choice of words and the swearing – you can immediately hear that they do not belong to the upper class.'

(10) Und dass das Team der Bücherei mit seiner Entscheidung richtig lag, das spürte man an den Gesprächen mit den Eltern und den Kindern. [Rhein-Zeitung, 22.09.2011]
'That the library team was right in its decision can be felt in the conversations with parents and children.'

(11) Sie riecht an ihrem Liebhaber, dass er sie betrogen hat. [Braunschweiger Zeitung, 19.04.2010]
'She smells on her lover that he has betrayed her.'

(12) Gäste des Hauses wissen, dass man die Freude, die die Köchin an der Arbeit hat, an den Speisen schmecken kann. [Niederösterreichische Nachrichten, 06.02.2014]
'The guests know that you can taste the joy that the chef has in her work in her dishes.'

(13) Wir merken an der regen Nachfrage nach WM-Artikeln, dass alle auf das Turnier warten. [Mannheimer Morgen, 10.06.2014]
'We can notice from the brisk demand for World Cup merchandise that everyone is waiting for the tournament.'

(14) Auch die Kleinsten sind bereits dabei – und an ihrem blau umrandeten Mund erkennt man, dass auch sie die Kirschen mögen. [St. Galler Tagblatt, 07.07.2010]
'Even the little ones are already involved – one can recognize by their blue-rimmed mouths that they also like the cherries.'

2.4. Decomposition of inferential perception verbs

IPVs belong to the group of subject-experiencer verbs similar to PVs. They select a subject argument with the thematic role of an experiencer that non-volitionally perceives an independently existing entity, that is, a stimulus; see e.g. Dowty (1991). The stimulus evokes a change of mental state in the experiencer.[7] Crucially, I want to argue that an implicit perception stimulus acts as causer of a mental state of the experiencer. The content of the evoked mental state is the embedded proposition. There is an ongoing debate on the view that stimuli are causers

[7]Müller (2020) points out with help of a context where Holmes and Watson perceive the same stimulus, but only Holmes draws a conclusion from it, that inferences are not solely due to the stimulus, but depend on the experiencer's previous knowlegde. It is a crucial fact that inferences involve prior knowlegde and thus a kind of abductive reasoning by the experiencer. Since this paper focuses on the lexical contribution of *an*PPs, I do not go into details here.

of mental states in the experiencer. This is mainly discussed for psych verbs like *admire* or *surprise*, cf. Dowty (1991); Pesetsky (1995); Rapp (1997); Primus (2012). More recent studies by Bott and Solstad (2014) show that sentences like (15) trigger the search for an explanation of John's attitude towards Mary. Notably, causing factors are more often ascribed to the stimulus (Mary) than to the experiencer (John) in their experimental studies.

(15) John admires Mary.

The conceptual availability of a causal relation between the stimulus und the mental state of the experiencer seems to be quite substantial for IPVs. The cancellation of an implicit perception stimulus leads to a contradiction. (16) provides strong evidence that a stimulus is presupposed:

(16) #Kim merkte, dass Herbst war, aber es gab nichts, woran sie es merkte.
Kim noticed that autumn was but there was nothing where.at she it noticed

Sensory perception is always factive (but see Higginbotham (1983) for a deeper discussion of veridicality constraints). The experiencer's mental state with the embedded proposition as its content is thus justified by factive perception. That IPVs are typically veridical and factive by presupposing the truth of the embedded proposition (Müller, 2020), may result from causally linked factive perception. In this work I therefore propose a lexical approach in positing a semantically implicit causal relation in the event structure of IPVs as given in (17).[8] The lexical entry (17) is based on the above observations. Here, I focus on the denotation of *merken*. Yet, the event structure in (17) should remain the same within the group of IPVs, besides the verb-specific meaning component marked with'.[9]

(17) $[\![\text{merken}]\!] = \lambda p \lambda x \lambda e \exists s \exists c$ [merken'(e) & experiencer(e,x) & stimulus(e,c) & cause(c,s) & belief(s) & experiencer(s,x) & content(s,p)]

As shown in (17), *merken* denotes an event that involves an experiencer x as subject referent, a stimulus c that causes a belief state s of experiencer x with proposition p as content. The stimulus c is presupposed and therefore existentially bound. It is thus not grammatically available, but only on a conceptual level. Instead, only the content p of the belief-state is lambda-bound and grammatically available. In other words, *merken* involves a kind of split of two conceptually involved arguments – one stimulus argument, and one propositional argument – in that only the latter is available on the surface structure. The stimulus argument may be syntactically realized by an *an*PP. The next section first focuses on the basic lexical meaning of *an* and then provides a compositional tool to link the *an*PP to the implicit stimulus argument.

3. Lexical meaning contribution of *an*

The preposition *an* is highly polysemous. Most prominently, *an* expresses relations of spatial proximity (18a) and of physical contact (18b), and is suitable for the expression of part-whole-relations (18c). Note that any part-whole-relation entails contact, and any contact relation entails proximity.

[8]Other authors argue against a lexically involved causal relation for psych verbs like *admire*, f.i. Härtl (2008) who takes it as a conversational implicature. If a pragmatic approach to the causal interpretation is reasonable in the context of IPVs, is deferred for future work. Here, I propose a lexical analysis.

[9]Thus, [[schmecken]] should contain the verb-specific meaning component *schmecken'* and restrict the implicit perception stimulus to a taste-object.

(18) a. Der Stuhl steht an der Bar.
the chair stands at the bar
b. Das Bild hängt an der Wand.
the picture hangs at the wall
c. Der Daumen ist an der Hand.
the thumb is at the hand

Prevalent transferred uses of *an* apply to temporal relations like *an diesem Montag* 'at this monday' which are derived from a spatial meaning via time-is-space metaphors, as well as to cognitive proximity like *Das Kind hängt an seinen Eltern* 'The child is (emotionally) dependant on its parents'. Furthermore, *an* frequently triggers a causal interpretation in the context of experiencer verbs, like in (19).

(19) John leidet an einer Krankheit.
John suffers at a disease

For a recent overview on the relations expressed with *an*, see Kiss et al. (2020). The evidential reading of *an* is rarely mentioned in the relevant literature, but see Blatz (1896: 456) who refers to it with the term 'Erkenntnisgrund' ("reason of inference"), as well as Müller (2020) and Diewald and Smirnova (2010). However, the spatial locative reading as in (18) is commonly regarded as the primary basic meaning. As I will show below, work on the spatial meaning of *an*, in particular the work of Klein (1991) and Carstensen (2000; 2015) form indeed a solid basis to derive its evidential reading.

3.1. The locative reading

Following standard theory, Klein (1991) takes prepositions as two-place functions. In his region-based account, a locative preposition maps the location of a theme (the localized entity) to the preposition-specific region of the relatum (the reference object). For *an*, he proposes a physical contact relation as abstract basic meaning. The localized entity is located in the *an*-region of the reference object, if the location of the localized entity is adjacent to the location of the reference object. A major evidence for this approach is that *an* is the obligatory locative preposition for contact verbs like *lehnen* 'to lean', or *hängen* 'to hang' in (18b).

Carstensen (2000; 2015) departs from a pure spatial account and seizes instead the role of cognitive attention expressed with prepositions. His cognitivist approach is based on the assumption that the detection of a suitable reference object involves a certain conceptualization of it, like a visuo-spatial referent that is associated with the reference object. Spatial *an* implies the categorization of the *an*-internal referent as 'boundary' (Carstensen, 2015: 115); that is, the reference object of *an* is not conceptualized holistically, but involves an attentional shift to its surface structure. This view explains the obligatory use of *an* for contact relations and with reference objects denoting boundaries like *am Strand* 'at the beach'. The author points out that the boundary of an object constitutes a part of the object, such that *an* is more specifically suitable to express part-whole-relations like in (18c). Laptieva (2022) formalizes Carstensen's approach in proposing the lexical entry (20) for *an*. She argues that the denotation in (20) fits best to the range of spatial constellations possibly expressed by *an*, as it may account for relations of parts to their wholes, of physical contact, and of spatial proximity as in (18).

(20) $\lambda y \lambda x$ [loc(x,boundary(y))] (Laptieva, 2022: 157, (159))

While proximity and physical contact depend on the spatial adjacency of the localized entity to the boundary of the reference object, a part-whole-relation holds in case the localized entity is a proper part (of the boundary) of the reference object. As will be shown in Sections 5 and 6, evidential *an* exploits this most specific part-whole-relation. The preferred reading of (1b), repeated in (21a), is such that Mary perceives certain properties of the door that cause her inference. The stimulus is thus a particularized property that constitutes a part of the door. Evidential *an* relates the stimulus involved in an IPV-event to its reference object. If the reference object is concrete, the stimulus is located on its surface, that is, its boundary. This is what makes the stimulus perceivable and essential for the cognitive discernment of objects. The attentional shift to a part of the *an*-internal referent plays an essential role for the qualification as suitable information source. Grammatically, the reference object of evidential *an*PPs may be underspecified with regard to their contextually salient part.

The less specific proximity relation is only suitable in a non-evidential reading as in (21b). Here, no perception stimulus is overtly realized. Instead, the described event, or Mary in the moment of inferring, is situated in spatial proximity of the open door. In this spatiotemporal or locative reading, *an* is replaceable with *bei* 'near', 'next to'. As Carstensen: 115 argues, *bei* is only compatible with a holistic conceptualization of the reference object. It follows that the *an*PP in (21b) comes up with a conceptualization of the boundary of the door as a 'holistic location', whereas *bei* is ruled out in the evidential reading (21a).

(21) a. An / *bei der offenen Tür merkte Marie, dass John zuhause war.
'From the open door, Mary noticed that John was home.'
b. An / bei der offenen Tür merkte Marie, dass John zuhause war.
'Mary noticed that John was home when she was near the open door.'

Whether the *an*PPs is locative or evidential depends further on the entity it relates to its reference object. I argue that in (21a), the *an*PP relates an event participant – the stimulus – to the reference object, whereas in (21b), it relates the event referent to the reference object. In the remainder of this section I will therefore propose an analysis of evidential *an*PPs as event-internal modifiers. This permits the *an*PP to access event participants. The general idea is that they introduce a spatial relation that holds within the event such that the implicit stimulus is related to the reference object of *an*.

3.2. Event-internal modification

The following approach is based on Maienborn's (1996; 2001) analysis on the syntax and semantics of local adjuncts. She argues for different syntactic base positions of lexically unaltered locative PPs, that result in different compositional meaning contributions. Adjuncts on the V-level of the VP are what Maienborn calls event-internal modifiers. It follows from this verbadjacent position that the meaning of the adjunct relates to the internal structure of the event denoted by the VP (Maienborn, 1996: 145). Event-internal modifiers do not target the event referent as a 'whole'. Instead, they modify an integral part of the event, that is, an entity that serves some function within the event (Maienborn, 2001, 2003). The relevant part of the

event is determined on a conceptual level and need not be overtly lexicalized (Maienborn, 2001: 218f.). In contrast, event-external modifiers relate to the event referent and trigger a holistic perspective on the event referent. Syntactically, they are adjuncts on the VP-level.

Maienborn's (1996) example (22) shall serve as a sample of an event-internal *an*PP that locates an integral part of the described event to its reference object. Maienborn bases her analysis mainly on Klein's (1991) approach to the lexical meaning of *an* denoting a physical contact relation of the localized entity to the reference object.

(22) Paul zieht Maria an den Haaren. (Maienborn, 1996: 236, (43a))
Paul pulls Mary at the hairs

According to Maienborn, an integral part of Paul's pulling event is located at and in contact to Mary's hair. At this stage of linguistic processing, conceptual knowledge comes into play. As Maienborn points out, it belongs to our conceptual knowledge that humans perform pulling events stereotypically by using their hand(s). This, in addition to the conceptual knowledge that hands are parts of humans and, in (22), of Paul, leads to the intended interpretation that a part of the described event in (22), namely Paul's hand(s) as (instrument) participants of the pulling event, is located on Mary's hair. In this respect, the locative meaning of the event-internal *an*PP may be augmented by an instrumental or manner reading, depending on the particular functional embedding (Maienborn, 1996; 2001).

In the following example from Laptieva (2022), an *an*PP modifies the detransitivized incremental predicate *malen* 'paint' and triggers an atelic interpretation of the described event.

(23) Mia malt an einem Bild. (Laptieva, 2022: 172, (192))
Mia paints at a picture

Laptieva shows that the incremental and thus atelic reading of (23) follows a) from the meaning of *an* along the lines of Carstensen as given in (20), and b) from the verbadjacent position of the *an*PP such that it acts as an event-internal modifier. Crucially, the *an*PP modifies the painting event in such a way that a subpart of painting – f.i. a stroke of the brush which is the incremental theme of the event – is conceptualized as boundary and part of the picture. Here again, an implicit participant of the painting event is conceptually inferred.

The fact that the *an*PP has access to the verb's internal event structure and realizes an implicit participant argument, can be proven with appropriate interrogatives. In German, the interrogative *Wo?* is used for the reference to locations and thus compatible with event-external PPs, see the questionning of the external locative *am Strand* 'at the beach' in (24a). On the contrary, the interrogatives *Woran*/*worin*/*worauf*/*womit* (literally 'where-at', 'where-in', 'where-on', 'where-with') etc. are not suitable for the reference to locations of events. Instead, their theme argument is restricted to objects (Maienborn, 2003: 483). Those interrogatives are only suitable to event-internal entities, like participants, instruments, or other object-like entities. To question the atelic *an*PP in (23), the use of *Woran?* is required, see (24b).

(24) Mia malt am Strand an einem Bild.
Mia paints at.the beach at a picture
a. A: Wo malt Mia?
B: Am Strand. / §An einem Bild.

b. A: Woran malt Mia?
B: §Am Strand. / An einem Bild.

Evidential *an*PPs are only compatible with the interrogative *Woran?*, cf. also (16). While (21a) requires the *woran*-interrogative, (21b) requires the *wo*-interrogative. This observation shall give further evidence for the current approach to evidential *an*PPs.

A formal template for modification as proposed by Maienborn (2001; 2003) and refined in Bücking (2018) is provided in (25). According to that, a modifier introduces a free variable v that links the modifier's external argument x to the modifier's referent via a relation R. The notation $\lambda P \lambda \overrightarrow{y}$ means that nonsaturated arguments of P will be forwarded to the modifier.

(25) MOD* template: (Bücking, 2018: (84))
a. $\lambda Q \lambda P \lambda \overrightarrow{y} \lambda x[P(\overrightarrow{y})(x) \wedge R(x,v) \wedge Q(v)]$
b. Condition on the application of MOD*: If MOD* is applied in a structural environment of categorial type X^0, then R = **internal-component** (that is, R = **part**, **manner** or **degree**); if it is applied in an XP-environment, then R = **identity**.

In case of event modification, $x = e$. According to condition (25b), R is of type *int(ernal-component)* if the modifier is a V-adjunct. That is, R pairs the event denoted by the verb to one of its internal components. Importantly, the specific value of $R(e,v)$ is not instantiated in this case and thus underspecified for event-internal modifiers: "The identification of v and its exact role in e can only be spelled out [...] by taking into account contextually available world knowledge." (Lang and Maienborn, 2019: 136)

I argue that the evidential reading of *an*PPs arises in case they are V-adjuncts of IPVs.[10] In this sense, evidential *an*PPs act as event-internal modifiers of IPVs. The implicit perception stimulus provided in the event structure of IPVs instantiates an internal component v of e and constitutes a proper part of the observable surface of the *an*-referent. Thus, the boundary-relation contributed by *an* is of the most specific part-whole type. This approach provides a uniform lexical meaning of *an*PPs.[11] In the next section, I will give a detailed analysis of the composition of event-internal *an*PPs with IPVs, and elaborate on the conceptual specification of underspecified meaning components.

[10]Evidence for a verbadjacent base position, that is, a position between the direct object and the verb, is provided by (i). Only a whole constituent may be moved into the prefield. The acceptability of (ia) attests that the locative *bei*PP is external, while the evidential *an*PP in (ib) is not. A structure as in (ii) is not possible because t_i is not c-commanded by its antecedent. This speaks for a position of the *an*PP below the direct object.

(i) a. Es gemerkt hat sie bei der Treppe.
b. *Es gemerkt hat sie an den Blättern.

(ii) *[Es t_i gemerkt]$_j$ hat sie [an den Blättern]$_i$ t_j.

[11]Note that event-external locative *an*PPs are also captured by MOD* and the boundary-relation of *an*. In this case, the PP is applied on the VP-level, such that R is the identity function and e is related to the reference object (which is conceptualized as boundary). Since e is not a proper part of the reference object of *an*, the boundary-relation is less specific and of proximity-type. The *an*PPs in (6b)/(21b) locate e in the spatial proximity of the *an*-referent.

4. Compositional analysis of evidential *an*

To implement the conceptual instantiation of underspecified components in a formal theory, I make use of the framework of Two-level semantics as presented in Lang and Maienborn (2019). The interpretation of a linguistic expression is two-fold: The Semantic Form (SF) is strictly compositionally derived and based on the lexical meaning of the involved expressions. On this level, underspecified meaning components will not be instantiated and remain underspecified. The Conceptual Structure (CS) is the level of representation that involves pragmatic enrichment. On the basis of the knowledge provided by the conceptual system, underspecified meaning components will be instantiated.

4.1. Composition to Semantic Form

As example shall serve (1a), repeated as (26). Composition is based on the lexical entries of *merken* in (17) and of *an* in (20), each repeated in (27) and (28), as well as on MOD* in (25). Underspecified components are encoded as free variables and are highlighted in bold below.

(26) Kim merkte an den Blättern, dass Herbst ist.

(27) $[\![\text{merken}]\!] = \lambda p \lambda x \lambda e \exists s \exists c$ [merken'(e) & experiencer(e,x) & stimulus(e,c) & cause(c,s) & belief(s) & experiencer(s,x) & content(s,p)]

(28) $[\![\text{an}]\!] = \lambda y \lambda x$ [loc(x,boundary(y))]

The application of MOD* to the PP *an den Blättern* yields (29).

(29) $[\![\text{an den Blättern}]\!] = \lambda P \lambda \overrightarrow{y} \lambda x$ [$P(\overrightarrow{y})(x)$ & $R(x, \boldsymbol{v})$ & loc($\boldsymbol{v}$,boundary(def-leaves))]

Functional application of *merken* to the modifier *an den Blättern* yields (30). The arguments of *merken* are forwarded to the PP. According to condition (25b), *R* is specified as *int(ernal component)* because it is applied inside the V-projection.

(30) $[\![\text{an den Blättern merken}]\!]$
$= \lambda p \lambda x \lambda e \exists s \exists c$ [merken'(e) & experiencer(e,x) & stimulus(e,c) & cause(c,s) & belief'(s) & experiencer(s,x) & content(s,p) & $\boldsymbol{R}_{int}(e,\boldsymbol{v})$ & loc($\boldsymbol{v}$,boundary(def-leaves))]

Application of the propositional complement *dass Herbst ist*, followed by introduction of the subject and existential closure of the event variable lead to the Semantic Form of (26) in (31).

(31) $[\![\text{Kim merkt an den Blättern, dass Herbst ist}]\!]$ (SF)
$= \exists e \exists s \exists c$ [merken'(e) & experiencer(e,K) & stimulus(e,c) & cause(c,s) & belief'(s) & experiencer(s,K) & content(s,'it is autumn') & $\boldsymbol{R}_{int}(e,\boldsymbol{v})$ & loc($\boldsymbol{v}$,boundary(def-leaves))]

(31) says that Kim is experiencer in an event e such that a stimulus c causes her belief state s that has the proposition 'it is autumn' as content, and that some internal component v of e is located at the boundary of the leaves. At this point, semantic composition stops. The instantiation of $R_{int}(e,v)$ has to be passed to the conceptual system which makes use of contextual and conceptual knowledge about *merk*-events, autumn and leaves.

4.2. Conceptual specification of underspecified variables

On the conceptual level, underspecified SF-components are pragmatically or conceptually enriched. Principally, their instantiation with a linguistically provided referent is preferred: "A free variable x is instantiated preferentially by a referent that is introduced by linguistic means, always provided that it meets the conditions on x" (Maienborn, 2003: 496). The condition on R_{int} states that v is an internal component of e. Since *merken* involves a stimulus c as participant that is provided conceptually (c is bound existentially, but not via lambda), c constitutes an internal component of the event e:

(32) $\forall ec$ [stimulus(e,c) $\rightarrow$ internal-component(e,c)]

The stimulus is a suitable candidate for $R_{int}(e,v)$ and instantiates it in an economical way. Formally, $R_{int}(e,v)$ is identified with stimulus(e,c), yielding the conceptual structure in (33):

(33) Kim merkt an den Blättern, dass Herbst ist: (CS)
$\exists e \exists s \exists c$ [merken'(e) & experiencer(e,K) & **stimulus(e,c)** & cause(c,s) & belief'(s) & experiencer(s,K) & content(s,'it is autumn') & loc(**c**,boundary(def-leaves))]

(33) in prose: Kim is experiencer in an event e such that a stimulus c causes her belief state s that has the proposition 'it is autumn' as content, and c is located at the boundary of the leaves. The conceptual structure in (33) predicts that the stimulus c, that is causer of the mental state, is located and thus perceived on the boundary of the *an*-referent, but not fully specified. This is attested by results of a corpus study that show that the reference objects of evidential *an*PPs are underspecified and interpreted as bearers of tropes (see Section 5). A trope is a particularized property that is perceivable and causally efficacious, and manifests in its bearer – and thus is part of its bearer (Moltmann, 2013; Maienborn and Herdtfelder, 2017; Campbell, 1981). Inferences are therefore not based on the perception of the whole entity the *an*PP refers to, but on the perception of particular aspects of this entity that are observable. In example (33), the stimulus c may be the specific coloredness of the leaves. Notably, this meets the general idea of Carstensen's cognitive attentional semantics of *an*.

The evidential reading of *an* arises because the underspecified relation R_{int}, introduced by the modifier, is conceptually instantiated by an indirect causal relation between the inferring event and the *an*-referent. That is why the content of *an*PP qualifies as 'information source' to the inference drawn by the subject.

5. Corpus study on ontological features of *an*PPs

Grammatically, an evidential *an*PP is the anchor of an implicit stimulus argument in the embedding verb and relates it to the boundary of the reference object. But, what about the ontology of information sources? I want to shed light on this question and present results of a corpus study that will round up the picture drawn on *an* and emphasize why specifically the preposition *an* is used for evidential information sources.

5.1. Idea and setup

In order to get an idea about the ontological nature of information sources in IPVs, I conducted a corpus study in the context of *merken* in DeReKo.[12] In 932 records, *merken* is modified by an *an*PP. Under exclusion of *an*PPs with vague head nouns like *Ding(e)* 'thing(s)', *Punkt(e)* or *Stelle(n)* 'point(s)', *Detail(s)* 'detail(s)', and the like, the first 300 records were investigated. In a first step, the sortal types of the *an*-internal head nouns were annotated along the lines of annotation criteria developed by Metzger et al. (2019). A second step addressed the ontological type of the stimulus itself. A suitable tool to grasp the 'conceptual' meaning components of evidential *an*PPs consists in paraphrasing them. To preserve the contextual/conceptual appropriate interpretation, attributes to the *an*-internal head were considered in this step.

5.2. Quantitative results

Out of 300, the vast majority of 240 records involves *an*PPs in the evidential reading. Of the remaining 60, 44 records exhibit a locative reading such that the described event is situated in space or time. In all of these cases, the head noun contextually refers to a landmark, or to a path section or time section at which the *merken*-event takes place. In these cases, the *an*PP can be questioned with *Wo?* and replaced with phrases headed with *bei* or *während* 'during'. In the remaining 16 cases, it is not decidable if *an* is used in a locative sense or a non-locative sense. Hence, in sum 60 records were expelled for the further inquiry about the ontological nature of information sources. The annotation of the sortal type of the head noun in accordance to the given criteria turned out to be tricky and in particular cases hardly possible. Nevertheless, the first step does not reveal any strict sortal type restrictions on the head noun of evidential *an*. Reference to any ontological type is represented. Even though the numbers below should be taken into account with care, a strong tendency to head nouns referring to tropes and to eventualities is observable: 26% of all head nouns refer to tropes[13] and about 23% to eventualities. This is followed by reference to animate objects including body parts, and to abstract categories with both about 14%; 8% refer to content objects; 5,4% to inanimate concrete objects; a minimal rest to domains. About 6% of head nouns were ambiguous in their reference to eventualities or to objects as results of an event and annotated as such. A quantitative summary in absolute numbers for both readings is given in Table 1. Table 2 provides typical examples of the categories that occur in the evidential reading of *an*.

[12]Deutsches Referenzkorpus, DeReKo-2014-I, archive TAGGED-T2-öffentlich, using CosmasII, search was done via the search key "(&merken /0s,Max (an %+1w,Max (, or (; or (. or :)))))". The exclusion of interpunction marks intended to exlude occurrences of *an* as verb particle; yet a manual selection of relevant records in the *merken*+*an*PP-construction was inevitable.

[13]The category of tropes comprises not only those entities to which NPs like *Johns Angespanntheit* 'John's edginess' refer to, but also so-called number tropes, that refer to a particular number of elements of a sum. Moltmann (2009; 2016) speaks of instantiations of the 'property of being so-and-so many'.

reading \ head	sum	Institution	Temporal Relation	Spatial Relation	Inanimate Object	Eventuality	Trope	Animate/ BodyPart	Abstract Category	Content Object	Event/ Result	Domain
locative	**44**	7	22	3	7	5	0	0	0	0	0	0
evidential	**240**	0	2	1	13	58	63	33	33	20	15	2
sum	**284**	7	24	4	20	63	63	33	33	20	15	2

Table 1: Ontological types of *an*-internal head nouns ordered by reading

Ontological category	Example noun	Translation
TROPE:	*Angespanntheit*, *Anzahl*	edginess, number
EVENTUALITY:	*Reaktion(en)*, *Verkäufe*	reaction(s), sales
ANIMATE/BODY PART:	*Besucher*, *Augen*	attendees, eyes
ABSTRACT CATEGORY:	*Gewohnheiten*, *Namen*	habits, names
CONTENT OBJECT:	*Mail(s)*, *Text(e)*	mail(s), text(s)
INANIMATE OBJECT:	*Wein(e)*, *Geschenk(e)*	wine(s), gift(s)
EVENT/RESULT:	*Rückmeldung(en)*, *Vortrag*	feedback, lecture
DOMAIN:	*Politik* (2x)	politics (2x)

Table 2: Typical head nouns in the evidential reading ordered by frequency

5.3. Qualitative results and discussion

The second step of the study intends to identitify the ontological status of the stimulus. It is based on the compositional prediction that the reference objects of evidential *an*PPs are underspecified with respect to the actual perception stimulus (see Section 4). The salient stimulus has to be conceptually inferred, preferentially by exploiting linguistically given referents (cf. to Maienborn's (2003) principle on the preferred instantiation of underspecified meaning components cited above). This motivates the consideration of attributes to the head nouns to grasp the intended interpretation of evidential *an*PPs, if present. It turns out that, independently of the presence of attributes, more than 95% of all evidential *an*PPs are paraphrasable with terms like *an der Art von* 'at the kind/manner of', *an der Anzahl von* 'at the number of', *an der Höhe von* 'at the extent of', *am Grad von* 'at the degree of', *am Geschmack/Klang/Aussehen von* 'at the taste/sound/look of', and the like. Crucially, expressions of this sort describe tropes. Generally, tropes are the kind of entities adjectives and definite deadjectival nominalizations refer to (Moltmann, 2009, 2013). Evidential *an*PPs generally imply reference to tropes. The point shall be made clear with example (34), involving an eventive nominal as reference object of *an*.

(34) Und ich erinnere mich noch, wie eines Tages der Briefträger zu meiner
and I remember REFL *still how one day the postman to my*
Oma in den Garten kam. An seinem zögernden Schritt merkte ich, dass er
grandmother in the garden came. at his hesitant step noticed I that he
schlechte Nachrichten brachte. Einer meiner drei Onkel war gefallen.
bad news brought. one.of my three uncles has fallen
[Die Zeit (Online-Ausgabe), 01.07.2010]

In (34), it is surely not the holistic event of the postman's stepping that causes the speaker's inference. Instead, the information source for the inference is based in the particular manner

in which the event is realized. This can be paraphrased as *how the postman realizes his steps* or simply *the manner of his steps* (see e.g. Moltmann (2009) for the trope-related reading of *how*-sentences). This holds respectively for the *an*PPs in the context of IPVs given in Section 1. In (8), it is the particular size of the soy cultivation area that gives evidence for its increasing importance. In (9), it is the particular kind of intonation, diction and cussing that causes the belief that the persons do not belong to the upper class. It is worth to emphasize that the specific kind of information source is determined by the ontological type of the reference object. *An*PPs referring to physical objects may be paraphrased by expressions referring f.i. to shape, colour, taste, age, or volume if it is a sound object. Suitable paraphrases for *an*PPs referring to eventualities refer f.i. to manner or duration. *An*PPs referring to pluralities are paraphrased with the expressions *number of* or *amount of*. Trope-referring *an*PPs allow paraphrases referring to the extent or degree of the manifestation of a property, or the tropes they refer to constitute the relevant information source by themselves.

A main result of the corpus study is that the reference objects of evidential *an*PPs are not conceptualized 'as a whole'. The relevant information source for a further inference is a particularized property – a trope – that is manifested in the referent. In other words, evidential *an*PPs are underspecified and refer to bearers of tropes. The contextually salient trope is inferred from its bearer by exploiting contextual and conceptual knowlegde. That tropes are best identified through their bearers has already been commented by Maienborn and Herdtfelder (2017: 289). Crucially, I claim that the implicit perception stimulus involved in IPVs is of type TROPE and constitutes an internal aspect of its bearer.[14] In the next section, the discussion of tropes as relevant information sources will complete the observations on evidential *an*.

6. Tropes as information sources

Tropes are dependent on their bearers and are thus conceptualized as parts of their bearers. The attentional focus to a part of the reference object thus meets Carstensen's analysis of locative *an*. The partitive conceptualization rules out the use of *bei* to refer to information sources, cf. (21a)/(21b). That the relevant stimulus is restricted to be a proper part of the *an*-referent can be shown by stipulating a specific context for (1a), repeated below as (35). Suppose, it is not the colour of the leaves that causes Kim's inference that it is autumn, but the amount of leaves she perceives on the ground. Then it would still be felicitous to utter (35a), because the specific amount is a particular number trope that manifests in the sum individual consisting of the leaves. But it is not suitable to describe this situation by (35b), because the amount-trope of the leaves is not part of the ground.

(35) a. Kim merkte an den Blättern, dass Herbst war.
Kim noticed at the leaves that autumn was

[14]The relevant trope may, but most not, overtly realized by an adjectival modifier inside the *an*PP. From the speaker's perspective, the linguistic realization of an adjective is motivated by the intention to assure that the hearer appropriatly identifies the underspecified stimulus *c*. According to Maienborn's (2003) principle on the instantiation of underspecified meaning components, the modified *an*PP *an den roten Blättern* 'at the red leaves' would augment the CS (33) with a specification of *c* as in (i):
(i) stimulus(*e*,***c***) & loc(***c***,boundary(def-red-leaves)) & red(***c***)

b. §Kim merkte am Boden, dass Herbst war.
Kim noticed at.the ground that autumn was

Further, tropes are perceivable because they are concrete entities in the world. Notably, they realize a particular quality or instantiation of properties which define the different ontological types of entitites. As Kaufmann (1995) points out, different kinds of entities are defined with regard to the property dimensions they always display. Concrete physical objects are thus defined by displaying spatial properties like shape or size, visual properties like colour, material properties like substance, and so forth, and "any change affecting a specific object defining property may only lead to another quality (or 'instantiation') of this property" (Kaufmann, 1995: 380). What Kaufmann calls 'object defining properties' are the specific properties to which the paraphrases used in the corpus study refer. Thus, inferences are based on an attentional shift to certain quality manifestations of an entity, and do not only involve the cognitive detection of entities as such, but the detection of altering quality manifestations in these entities. Information sources thus always imply comparison to former experiences of the same or similar entities. The latter point is crucial for the causing character of the stimulus. I want to make the point clear with the help of (34). Notably, the specific realization of the postman's steps obviously deviates from his standard steps. What happens in the experiencer's mind is the assumption that the postman has a reason to walk in a non-standard, hesitant manner. The perception of the deviation of the standard quality of his steps triggers the search for an explanation, thus, causes the experiencer's inference. Note that Kaufmann's object defining properties constitute the perceivable boundaries of concrete entities. Trope perception thus entails the perception of its bearer. Conversely, we cannot perceive a concrete physical object without perceiving its shape, colour, or size. Neither can we perceive an eventuality without recognizing its specific manner of realization. Tropes not only constitute parts of the respective entities, but also are perceivable on their 'surface structure' and are in physical contact to its bearer. The use of *an* thus follows straightforwardly from its basic locative meaning. Nevertheless, as the results of the corpus study show, evidential *an* also allows for more abstract referents. How could habits be directly perceived, since they are only observable during a longer time period and hence are ruled out for direct sensory perception? Similarly, a continuously increasing number of patients like in (36) is surely no possible object of direct perception and on the first sight runs contra the claim that evidential *an*PPs refer to directly perceived entities.

(36) "An der kontinuierlich steigenden Patientenzahl merken wir, dass unser
at the continously increasing number.of.patients notice we that our
Pflegekonzept angenommen wird", freut sich die Geschäftsführerin.
care.concept embraced is, pleases REFL *the director*
[Braunschweiger Zeitung, 17.04.2013]

According to Whitt (2010), those cases nonetheless involve perceived entities. Several perception stimuli are merged into a set of data from which tendencies and behaviours are derived. In (36), the perception data set comprises a sequence of variable number tropes manifested in its bearer, a variable sum of patients. The distinction between direct sensory perception and more abstract observation seems not to be reflected in evidential *an*PPs, as long as an underlying stimulus of type TROPE is involved.

Another crucial feature of tropes is that they are causally efficacious, see Maienborn and Herdtfelder (2017). Concrete objects do not enter causal relations, such that (37a) requires pragmatic enrichment along the lines discussed. (37b) is indeed conceptually much more felicitous.

(37) a. #The leaves caused Kim to infer that it is autumn.
b. The golden colour of the leaves caused Kim to infer that it is autumn.

The causal efficacy of tropes lets Campbell (1981: 481) claim that "the philosophy of cause calls for tropes." To sum up, the ontological category of tropes meets perfectly the conditions on the implicit stimulus of IPVs: they are perceivable on the boundary surface of concrete entities or constitute proper parts of entities as such, and may act as causers of mental states.

7. Conclusion

Evidential *an*PPs refer to directly perceived entities that constitute the basis of an inference drawn by an experiencer. As a result, they are restricted to IPVs because these select a propositional argument that expresses an inference and simultaneously provide an implicit argument for a perception stimulus. Analyzing evidential *an*PPs as event-internal modifiers best captures the interpretation that the implicit stimulus is conceptualized as part of the *an*-referent. Perceivable stimuli are of type TROPE and located on the reference object's surface, or defining its conceptual boundaries. The causal efficacy of tropes matches the causal relation between the stimulus and the evoked mental state of the experiencer. While the relation between the stimulus and the modifier results from the latter's verbadjacent position, the conceptualization of internal aspects of the reference object as information source follows the lexical semantics of *an*. The evidential reading of *an* is thus derivable by compositional means from the locative one. This work provides evidence for a uniform analysis of modification with *an*PPs. Further, it highlights the cognitive pertinence of the ontological category of tropes.

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Scope ambiguities in future questions: Reflection and *queclamative* with Italian *mica*[1]

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Abstract. The paper studies the interpretation of Italian future questions with and without MICA. While bare future questions are reflective and enhance uncertainty, MICA future questions reveal bias, if not mirativity, and are exclamative in nature. We argue that these differences are grounded in a difference in scope. When FUT scopes over QUES, the question becomes reflective and enhances un-answerability. When QUES embeds the modal FUT the resulting interpretation is ill-formed. MICA offers the content needed to repair the question, contributing an alternative. This alternative has an expressive status whose content is adjoined by expressive application, and is thereby highlighted, with the enhancement of bias. Our paper offers three main insights: (i), modals, like attitudes, can embed sets of propositions. (iii) Expressive content can be adjoined to questions, creating an exclamative biased questions, which we call *queclamative*. (iii) Italian MICA belongs to the broad class of mirative evidentials sensitive to defeasible generalization rather than to the one of common ground management devices.

Keywords: future, modality, questions, *mica*, exclamation, surprise, concessivity

1. Introduction

This paper studies the interactions between modality and speech acts focusing on Italian modal future and questions.

The emphasis will be on 'bare' future questions:

(1) Quanti anni avrai (mai)?
How-many year have.FUT.2SG (ever)?
How old might you ever be ?

and on MICA future (exclamative)-questions.

(2) Non avrai mica fame ?!
Not have.FUT.2SG MICA hunger ?!
You are not hungry, don't you ?!

The paper makes two main points.

First, we argue that (1) is a reflective question, akin to conjectural questions cross-linguistically (see e.g. Eckardt and Beltrama, 2019; Matthewson, 2010a), and we newly derive the reflection

[1]We would like to thank the audiences of the Tel Aviv Workshop on Alternatives, Expectations and Domain Widening, Ralfe 2023, SLE 2023 and Sinn und Bedeutung 2023 for the precious feedback. A special thank to Yael Greenberg, Benjamin Spector, Carlo Geraci, Caterina Donati and to the many Italians who faultlessly and passionately discuss the *mica* data at length. Lots of gratitude to Salvador Mascarheñas for key discussions on questions and inquisitiveness. The research on reflective questions is part of a larger project on modals culminating in the book *Modal Sentences* in preparation for Cambridge University Press with Anastasia Giannakidou. All the errors here are mine.

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from the interpretation of FUT over QUES, thus arguing that the modal can scope not only over propositions, but over sets of propositions.[2]

Second, we argue that MICA is a disconfirmational particle that denies a defeasible generalizations based on evidence available in the context of utterance. Its contribution is akin to mirative evidentials cross-linguistically (Aikhenvald, 2004). Its role becomes crucial in the specific configuration where QUES scopes over FUT. Echoing the idea that questions denote three possible spaces corresponding to possible answers (yes, no and maybe) (see discussion in Ciardelli et al. (2009); Enguehard (2021) and, for the initial insights, Mascarenhas (2009)), we argue that MICA repairs the question produced by QUES $>$ FUT by adding an alternative by expressive application à la Potts (2007). We also argue that this alternative is highlighted, explaining the exclamative flavor of the question (hence the term *queclamative*, reminiscent of Sadock (1971) 'queclarative' for inquisitive assertions[3]).

An attempt is made to set a parallelism between MICA questions and concessive questions cross-linguistically.

The paper is structured as follows. Section 2 is dedicated to future reflective questions. Section 3 is dedicated to MICA and MICA future questions. Section 4 concludes.

2. Modality of the future and questions: FUT $>$ QUES and reflection

2.1. The modality of future

It has now been robustly and cross-linguistically established that, semantically, the future tense is not the dual of the past tense (see a.m.o. Enç, 1987; Bertinetto, 1979; Copley, 2009; Mari, 2009; De Saussure and Morency, 2012; Giannakidou and Mari, 2013b, 2018a; Frana and Menéndez-Benito, 2019; Ippolito and Farkas, 2019; Escandell-Vidal, 2021); (*pace* Prior, 1962; Kissine, 2008). Unlike the past, the future is open, and, even if we were to consider the future as metaphysically settled, we cannot deny that we cannot know the future. A sentence in the future tense is perceived as a prediction that could turn out to be true or false (Huddleston and Pullum, 2005; MacFarlane, 2003).

(3) Domani pioverà. (Italian)
Tomorrow rain.FUT.3sg
It will rain tomorrow.

For Italian future, this epistemic openness, together with the fact that the future can have present and past orientation in a way akin to *dovere* (*must*) and *potere* (*might*), has lead several theoreticians to conceive of the future as an epistemic modal (Bertinetto, 1979; Mari, 2009; Pietrandrea, 2005; Giannakidou and Mari, 2013a, 2018a).

(4) Flavio sarà nella sua camera.
Flavio be.FUT.3SG in-the his room
Flavio must/might be in his room.'

[2]See Roelofsen and Uegaki (2020) for a similar claim for Japanese *daroo*-.
[3]See Giannakidou (2013) and references therein.

(5) Flavio deve essere nella sua camera.
Flavio must be in-the his room
Flavio might be in his room.

(6) Flavio può essere nella sua camera.
Flavio might be in-the his room
Flavio might be in his room.

As observed since Bertinetto (1979), Italian future can combine with weak or strong adverbs and is a very flexible modal, with some amount of disagreement as to the force of future, underspecified for some (e.g. Pietrandrea, 2005; Baranzini and Mari, 2019), and universal for others (Giannakidou and Mari, 2018a).

(7) a. Sarà sicuramente a casa.
Be.FUT certainly at home.
He must certainly be home.
b. Sarà forse a casa.
Be.FUT maybe at home.
He might maybe be home.

This flexibility reflects the ability of future to combine with evidence of different types, which range from inferential to absence of evidence. The strengths of epistemic commitment that modals convey are indeed rooted in the evidence upon which they rely (Karttunen, 1972). Giannakidou and Mari (2016) propose a 'scale of epistemic commitment', according to which by asserting *p* the speaker is 'fully committed to *p*'[4]; with MUST *p* the speaker is partially committed to *p* (Giannakidou and Mari, 2021b). With MIGHT *p* the speaker is in a state of hesitation.

This scale of epistemic commitment is anchored to a scale of information reliability. The assertion of *p* requires the speaker to have reliable information; MUST *p* relies on partial information (Giannakidou and Mari, 2016); MIGHT *p* may rely on unreliable information. FUT *p* can use no evidence at all as the use of 'Bo' reveals (see discussion in Mari, 2010, 2021; Ippolito and Farkas, 2019; Giannakidou and Mari, 2023a).

(8) Where is Gianni ?
a. Bo'. Sarà a casa !
bah! Be.FUT.3SG at home !
He might be home!
b. Bo'. #Deve essere a casa !
bah! Must be at home !
He must be home!
c. Bo'. #Può essere a casa !
bah! Might be at home !
He might be home!

This explains why it is weird for a doctor to use a sentence in the future.[5] Context: the doctor

[4]Or at least takes *p* on his own account by pretending to be fully committed to his truth; except in the case of lies
[5]See Ippolito and Farkas (2019) for discussion of a similar example but a different, subjectivity-based explanation, which we show to be incorrect later in this section.

has visited John and utters:

(9) Sarà il Covid.
Be.FUT.3sg the Covid.
It will be Covid.

As Giannakidou and Mari (2016) note, a MUST sentence is also weird in the context of a medical visit, as the doctor is revealing a certain amount of lack of knowledge. If MUST is felt as slightly less inappropriate with respect to a medical statement in the future tense (see e.g. Ippolito and Farkas, 2019) it is because it rules out cases in which the attitude holder (here, the doctor) relies on no evidence whatsoever. Context: the doctor has visited John and utters:

(10) ??Deve essere il Covid.
Must be the Covid.
It will be Covid.

Interestingly, the fact that FUT can be used without any clue, whereas MUST uses evidence,[6] explains the most striking difference between the two: FUT is used to project a world that does not yet exist (temporal use of the future), MUST mandatorily uses clues and thus requires that facts of the matter are available. It cannot therefore be future oriented and epistemic at once.

(11) John must come with us. (#Epistemic)

Note, however, that it would be erroneous to state that Italian future associates with subjectivity as Mari (2010) and Ippolito and Farkas (2019) claim. The core idea that Mari (*ibid.*, p. 1-8) advanced in this early work is that the Italian future uses a 'subjective stereotypicality' set of preferences, and ranks 'according to what it is more likely for the speaker.' She also establishes a relation between subjectivity as credence and (lack of) reliability. In their recent paper Ippolito and Farkas (2019) propose a similar idea, in their terms: 'subjective likelihood'.

While appealing, this line of analysis is not on the right track. Italian future statements can also rely on exogenous evidence, as in (12). In the context where the lights at John's house are on:

(12) Gianni sarà a casa.
John be.FUT at home.
Gianni must/might be home.

To conclude: MUST requires clues and indices in the context of evaluation, whereas FUT does not. The future, however, is not a subjective evidential *simpliciter*. It can be compatible with clues and stereotypicality conditions (Mari, 2009; Giannakidou and Mari, 2016, 2018b). This renders the future a flexible modal, which, we consider a non-biased necessity modal by default, which can be weakened or strengthened (Mari, 2021; Giannakidou and Mari, 2023a).

2.2. On the interrogative flip

If Italian future is sensitive to evidence, the question arises whether the future is an evidential. We refer to Mari (2021) for extended discussion of very fine-grained arguments. We specifi-

[6] See also Dendale (2001) for French.

cally focus here on the interrogative flip, as an argument for the evidentiality of Italian future in the context of questions, which is relevant here.

While most of the existing theories are based on the idea that the future in Italian features an evidential component (Mari, 2009, 2010; Squartini, 2010; Frana and Menéndez-Benito, 2019; Eckardt and Beltrama, 2019; Ippolito and Farkas, 2019), authors diverge as of whether evidentiality is at issue (Mari, 2010; Squartini, 2010; Frana and Menéndez-Benito, 2019; Eckardt and Beltrama, 2019) or non-at-issue (Mari, 2009; Giannakidou and Mari, 2016, 2018b). In the latter case, FUT has been claimed to be an epistemic modal with an evidential presupposition.

These analytical options have been considered crucial when it comes to the behavior of future in questions.

(13) Dove sarà Anna? Non la vedo.
Where. be.FUT.3sg Ann. Not her see
Where might Ann be? I do not see her.

(14) Anna sarà a casa, ora ?
Ann be.FUT.3sg at home, now
Might Ann be at home now?

It has been claimed that Italian future questions flip and this has been considered as an argument for the at-issue evidentiality of the future (Frana and Menéndez-Benito, 2019; Ippolito and Farkas, 2019).

The interrogative flip is argued to be triggered by evidentials in biased questions (Bhadra, 2020; Korotkova, 2016; Murray, 2016: a.o.), and is the phenomenon whereby the source of the evidence needed to answer the question is the addressee, unlike in assertives, whose source of evidence is the speaker.

The reasoning goes as follows: (i) a question containing an evidential expects that the hearer has the relevant type of evidence (interrogative flip e.g. Speas and Tenny, 2003; Aikhenvald, 2004; Murray, 2016; San Roque et al., 2017; Bhadra, 2020: a.o.) (ii) the evidential future is an inferential (iii) the future question is well-formed only if the hearer does not have direct evidence to answer the question. This elegantly explains the infelicity of (15) as an information seeking question.

(15) #Quanti anni avrai ?
How many years have.FUT.2sg
How old might you be?

This claim deserves several comments.

First, we note that the same explanation applies for theories holding that the future is an epistemic modal with an evidential presupposition, as the infelicity of (15) as an information seeking question would be a case of presupposition failure.

Second, and more generally, it could be claimed that, after all, epistemic modals including might also trigger the interrogative flip as the infelicity of (16) as an information seeking questions reveals. In this case, the knowledge of the addressee would be at stake, and of course, the

addressee has complete knowledge about their own age, contrary to what the presupposition of the modal might requires.

(16) #Quanti anni puoi avere ?
How many years can.FUT.2sg have
How old might you be?

Finally, cross-linguistic analysis, has shown that evidentiality does not necessarily trigger the interrogative flip in questions. This effect is robustly documented across languages of very different families as illustrated in (17):

(17) From (Littell et al., 2010), for Gitksan:
a. sdin=**ima**=hl xbiist.
be.heavy=infer=CND box
The box might be heavy.
b. nee=hl sdin=hl xbiist=a?
YNQ=CND be.heavy=CND box=INTERROG
Is the box heavy?
c. nee=**ima**=hl sdin=hl xbiist=a.
YNQ=infer=CND be.heavy=CND box=INTERROG
I wonder if the box is heavy.

To conclude: evidentiality is neither necessary nor sufficient to trigger the interrogative flip, and the interrogative flip is thus not an argument for evidentiality of the future.

2.3. Reflection with Italian future questions.

The infelicity of (15) and (16) only stands when these questions are interpreted as information seeking one. Mari (2021) shows that, in Italian, existential epistemic modal questions (18) – which include Italian future questions (19), (20) – are by default self-addressed (see for previous discussion Eckardt and Beltrama (2019)).

(18) Dove possono essere i miei occhiali ?
where might be the my glasses
Where might my glasses be ?

(19) Dove saranno i miei occhiali ?
where be.FUT.3pl the my glasses
Where might my glasses be ?

(20) Sarà a casa ?
be.FUT.3sg at home ?
Might he be home ?

Such questions are akin to questions with *forse* which is the possibility adverb 'maybe' in Italian:

(21) a. È a casa ?
Is at home ?
Is he at home ?

b. È forse a casa ?
Is maybe at home ?
Is he maybe at home ?

Questions with possibility modals have been claimed to be weakened versions of the information seeking question, in the sense that that they involve more uncertainty. Indeed, they can be continued by "Who knows?", a continuation that is odd in regular information seeking questions.

(22) Sarà a casa ? Chi lo sa !
be.FUT.3sg at home ? Who that knows !
Might he be home ? Who knows !

The enhancing of uncertainty with existential modals is a wide-spread phenomenon cross-linguistically, observed for instance in Greek (23) (Giannakidou and Mari, 2023b), Korean (24) (Kang, 2016) and German (25) (Zimmermann, 2011):

(23) Pjos (arage) na irthe sto party? Pjos kseri!
Who arage-partcile SUBJ came.3SG to-the party who knows
Who might have come to the party? Who knows!

(24) Con-i wusungca-i-nka?
John.NOM winner-be-NKA
Could John possibly be the winner?

(25) Hat Hans wohl Maria eingeladen?
has Hans prt Mary invited
What do you reckon: Has Hans invited Mary?

These questions have been dubbed 'conjectural' (Matthewson, 2010b; Eckardt and Beltrama, 2019), or 'reflective' (Giannakidou and Mari, 2023b). They are questions that the speaker poses to herself and that do not even require an answer.

2.4. Analysis

2.4.1. Background analysis of Italian future

To delineate the analysis we will capitalize on the work of Giannakidou and Mari (2016, 2018b, 2021a, b),[7] recalling only the main building blocks. Our starting notion will be the one of the epistemic state of an individual anchor *i*, which, for Italian future, is always the speaker.

(26) *Epistemic state of an individual anchor i*
An epistemic state M(*i*) is a set of worlds associated with an individual *i* representing worlds compatible with what *i* knows or believes in the context of utterance.

A nonveridical state conveys epistemic uncertainty if (and only if) it is partitioned into p and $\neg p$ worlds.

[7] All the definitions in section 2.4.1 are from Giannakidou and Mari (2021b).

(27) *Nonveridical information state*
An information state M(i) is nonveridical about p iff M(i) contains both p and $\neg p$ worlds.

FUT use a primary epistemic modal base, M(i) encoding the assumption that lack of knowledge is due to partial or corrupted evidence, or even lack of evidence that leaves the speaker in uncertainty (Giannakidou and Mari, 2016).

Ideal$_{\mathscr{S}}$ delivers the worlds in the modal base in which all the propositions in $\mathscr{S}$ are true.

(28) $\text{Ideal}_{\mathscr{S}}\,\text{M}(i) = \{w' \in \text{M}(i) : \forall q \in \mathscr{S}(w' \in q)\}$

$\mathscr{S}$ is a set of heterogeneous propositions that correspond to common ground norms/personal but also personal convictions etc. Ideal$_{\mathscr{S}}$ can encodes i's beliefs, but not necessarily only mere credences. One's beliefs can also rely on considerations of stereotypicality conditions or normalcy conditions. Note that Ideal$_{\mathscr{S}}$ is a secondary modal base and does not provide ranking: Ideal$_{\mathscr{S}}$ worlds are not ranked as higher than Ideal$_{\mathscr{S}}$ ones (Mari, 2021; Giannakidou and Mari, 2023a). With Ideal$_{\mathscr{S}}$ in place, the non-final analysis for Italian future is as follows (see Giannakidou and Mari, 2016, 2018b).

(29) $[\![\text{FUT (PRES (} p \text{))}]\!]^{\text{M,Ideal},i,\mathscr{S}}$ is defined only if (i) M(i) is nonveridical and (ii) M(i) is partitioned into Ideal$_{\mathscr{S}}$ and $\neg$Ideal$_{\mathscr{S}}$ worlds, and (iii) i has potentially no clues.
If defined,
$[\![\text{FUT (PRES } (p))]\!]^{\text{M,Ideal},i,\mathscr{S}} = 1$ iff $\forall w' \in \text{Ideal}_{\mathscr{S}} : p(w', t_u)$
Paraphrase: (presupposition) The modal base M(i) is partitioned into p and $\neg p$ worlds as well as into Ideal$_{\mathscr{S}}$ and $\neg$Ideal$_{\mathscr{S}}$ worlds. i has potentially no clues for p. (assertion). All Ideal worlds are p worlds.

The following picture summarizes our analysis of future as a non-veridical and unbiased universal epistemic modal. Note, indeed, that there is no notion of ordering at play, an issue discussed at length in Giannakidou and Mari (2023a).

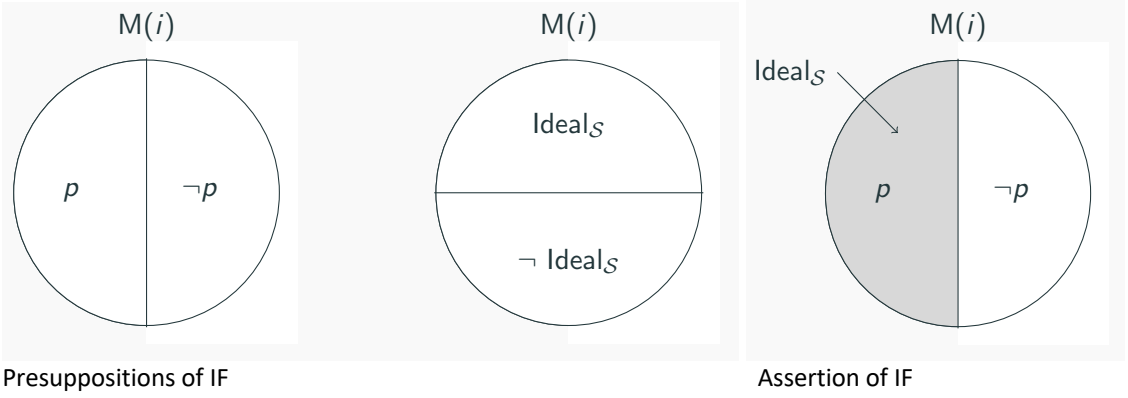

Figure 1: Our analysis of future as a non-veridical and unbiased universal epistemic modal.

2.4.2. Italian future in question

In questions, Italian future enhances reflection. A reflective question does not require an answer and it is typically a question that the speaker poses to herself.

We propose that the modal FUT scopes over QUES and thus over a set of propositions rather than a proposition.

(30) $[\![\text{FUT (QUES } (p))]\!]^{\mathscr{O},\mathrm{M},i,\mathscr{S}}$ is defined only if:
M(i) is nonveridical and is partitioned into $\text{Ideal}_{\mathscr{S}}$ and $\neg\text{Ideal}_{\mathscr{S}}$ worlds.
$[\![\text{FUT (QUES } (p))]\!]^{\mathscr{O},\mathrm{M},i,\mathscr{S}} = \forall w' \in \text{Ideal}_{\mathscr{S}} : p(w', t_u) \vee \neg p(w', t_u)$

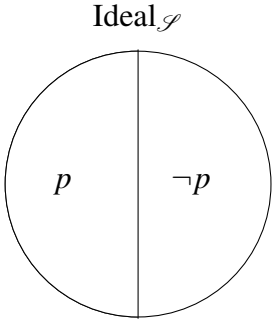

Figure 2: FUT > QUES

The scope of the modal over the QUES operator accounts for the observations. First, QUES does not act as a speech act, and the question is not addressed. Second, reflection is derived insofar as the inner mental state is represented as partitioned. Third, the question is unaddressed: the question is relativized to a state of mind. Finally, the question is considered as potentially unanswerable by the speaker: adding information through $\text{Ideal}_{\mathscr{S}}$ does not solve the issue.

3. MICA and MICA future questions

Future questions are one of the many contexts in which the Italian discourse particle (NON) MICA can be found.[8] In this context, MICA creates a biased question, and, more specifically, an exclamative question (as the punctuation highlights in the following attested example).

(31) Oh, no! (Sara) non avrà mica detto ad Anna che ho un altro figlio da lei (Sara)?!? Non può averlo fatto! Cielo, e se invece fosse così?[9]
Oh no ! Sara will have not told Anna that I have another son from her (Sara)?!? She cannot have done it! God, what if instead she did it?

As the punctuation '?!?' reveals, the MICA-question is imbued with surprise (also spelled out in the preceding 'Oh, no!'), and it is loaded with a series of presuppositions that surface as

[8]We assume with much of the literature that NON MICA and MICA are in free distribution, a fact that will deserve further attention in future work and which is dialect dependent.
[9]`https://www.wattpad.com/277641804-pensami-federico-rossi-20-vendetta-o-quasi`

expectations that have been referred to as 'biases' in the literature.[10] (i) the speaker believes that Sara would not be able to tell Anna that the speaker has another son from her (Sara). (This has been called the *speaker bias* and it is spelled out later in the discourse as 'Non può averlo fatto!' *She cannot have done it!*.) (ii) Second, the speaker might have evidence, in the context of utterance, that Sara has told Anna. This is the *evidence bias*. (iii) Third, the speaker expects a positive answer to the question (*answer bias*). Furthermore, the question is a true question[11] that reveals uncertainty and requires a clarification, as the follow up with 'Cielo, e se invece fosse così?' *God and what if it is indeed the case?* shows.

The ability of MICA to create bias and enhance surprise can be appreciated by comparing MICA future questions with future questions without MICA, which as we have claimed are anti-biased questions that enhance uncertainty.

The idea that MICA is presuppositional is not new and theoreticians disagree on whether MICA presupposes an expectation that p is true or an expectation that $\neg p$ is true in the common ground. The debate is the one that we now present.

3.1. MICA: The debate

First attempt: speaker bias towards p According to Cinque (1991), MICA can deny a proposition that has never been expressed linguistically, but simply inferred or believed to be believed by the addressee. Cinque discusses the context in which the speaker S sees the addressee A pouring milk into a dish for S's cat. S infers that p (in this case: the milk is good for cats) is assumed by A.

(32) Guarda che il latte non fa mica bene al gatto.
look that the milk NEG does MICA good to-the cat
Look, milk is NOT good for cats !

According to Cinque's analysis, NON introduces a regular negation and MICA adds a definedness condition: in the context c, p is presupposed by some participant in the conversation.

Second attempt: in questions, the speaker is biased towards $\neg p$ Frana and Rawlins (2019) provide new evidence against Cinque's analysis, and elaborate a scenario where Clara invites Miles for dinner and makes clear to him that she will prepare her best dishes. When he gets there, Miles barely touches any food. Clara asks him:

(33) Non hai mica già mangiato?
not have.PRES.2sg MICA already eaten?
You haven't eaten, don't you ?

Clara expects that Miles has *not* eaten yet, she is biased towards $\neg p$, but has evidence (evidence bias) that p (Miles barely touches any food).

[10] See, among many others Krifka (2015), Sudo (2013), Malamud and Stephenson (2015), AnderBois (2019), Buring and Gunlogson (2000), Larrivée and Mari (2022) a.o.
[11] *Pace* Frana and Rawlins (2019).

Frana and Rawlins (2019) maintain Cinque's generalization for assertions, but provide a different generalization for questions, overall proposing what follows:

(34) Frana and Rawlins (2019) generalization.
   a. In **assertions**, MICA sentences are felicitous in contexts where p is assumed by some participant in the conversation (as in Cinque (1991)).
   b. **Questions** with MICA are felicitous if the speaker as prior bias (prior to the exchange) for $\neg p$.

We show that this generalization is not correct for questions, and that a unified account for both assertions and questions is possible.

New observation: the valence of the speaker's bias is not relevant We observe that, even in questions, p can be expected to be part of the common ground (rather not $\neg p$), as the following case, where p is expected to be true by the speaker, shows. The context is one in which I am eating a whole bag of chips and my friend asks me :

(35) Scusa, non sei mica a dieta ?
Sorry, not are MICA on diet ?
Sorry to ask, aren't you on a diet ?

The speaker expects p to be true (that I am on a diet) and has evidence for $\neg p$ (that I am not on a diet as I am eating a whole bag of chips). We conclude that MICA is not sensitive to the valence of the speaker's bias presupposition.

3.2. MICA: new proposal

We newly propose that MICA is anaphoric to rules and generalizations of the form (36), where E is a body of evidence (a set of propositions) available in the context of utterance c.

(36) E then *normally* q

(36) is a defeasible inference that can be based on stereotypes, norms, commonsense reasoning. It is enhanced by contextual information or general knowledge (see a.o. Dowty, 1979; König, 1986, 1991; Krifka et al., 1995; Mari et al., 2012; Mari, 2014). If we restate this rule in the framework that we have been designed, we obtain what follows:

(37) MICA Non-at-issue.
$\forall w' \in Ideal_{\mathscr{S}} p(w')$

MICA states that a certain generalization does not hold and that the inference associated with the generic generalization should not go through, according to the speaker.

(38) MICA At-issue.
$\forall w' \in Ideal_{\mathscr{S}} \neg p(w')$

Unfolding (35), the reasoning goes as follows. Let the Ideal$_{\mathscr{S}}$ worlds be those worlds in which I am eating eating a lot and $\neg p$ worlds, worlds in which I am not on a diet.

(39) a. $\forall w' \in Ideal_{\mathscr{S}} \neg p(w')$ *defeasible generalization*
b. $\forall w' \in Ideal_{\mathscr{S}} p(w')$ *MICA content*
c. p and $\neg p$ are valid alternatives in view of Ideal$_{\mathscr{S}}$. *question*

In creating a question that is grounded in Ideal$_{\mathscr{S}}$, the speaker is ready to endorse the contextual evidence, and nonetheless refuses to endorse $\neg p$. MICA turns out to be a disconfirmational particle, that rejects contextual evidence as valid (see also Aikhenvald (2004)).

Consider the scenario in which the addressee (A) is far away and the speaker (S) announces that the addressee's sister will pick him up (Cinque (1991); Frana and Rawlins (2019)). In so doing the speaker seems to presuppose that the addressee's sister can drive. The addressee clarifies that his sister is not able to drive.

(40) S: Sei lontano. Ti viene a prendere tua sorella.
You are far away. Your sister is going to pick you up.
A: Non sà mica guidare.
She is not MICA able to drive.

According to our account, what matters for MICA is that there is a contextually available generalization according to which if someone picks up a person who is far away, she will probably use the car. While endorsing the evidence, MICA asserts that all evidence worlds are also worlds in which $\neg p$ is true.

3.3. MICA in future questions

To account for the effect of MICA in questions, we start with the interpretation of future questions, on the assumption that QUES is a speech act operator that scopes over FUT. QUES creates two alternatives. One in which all Ideal$_{\mathscr{S}}$ are p worlds, and one in which only some of the Ideal$_{\mathscr{S}}$ are p worlds.

(41) $[\![\text{QUES (FUT } (p))]\!]^{\mathscr{O},\text{M},i,\mathscr{S}}$ is defined only if:
M(i) is nonveridical and is partitioned into Ideal$_{\mathscr{S}}$ and $\neg$Ideal$_{\mathscr{S}}$ worlds.
$[\![\text{QUES (FUT } (p))]\!]^{\mathscr{O},\text{M},i,\mathscr{S}}$ =
$\{\{\forall w' \in \text{Ideal}_{\mathscr{S}} : p(w', t_u)\}, \{\neg\forall w' \in \text{Ideal}_{\mathscr{S}} : p(w', t_u)\}\}$

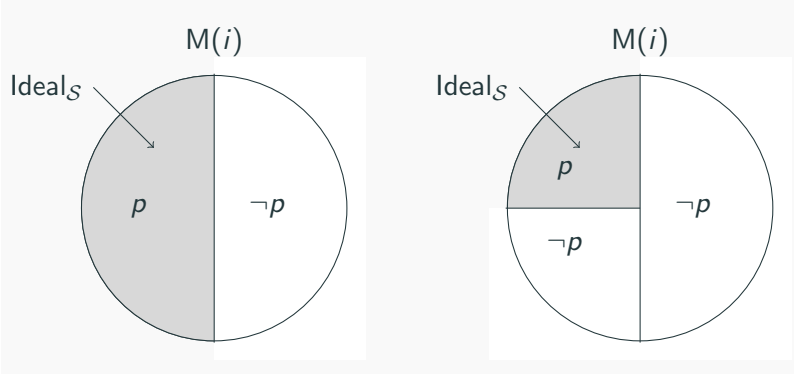

Figure 3: Non optimal question QUES > FUT – with uninterpreted MICA

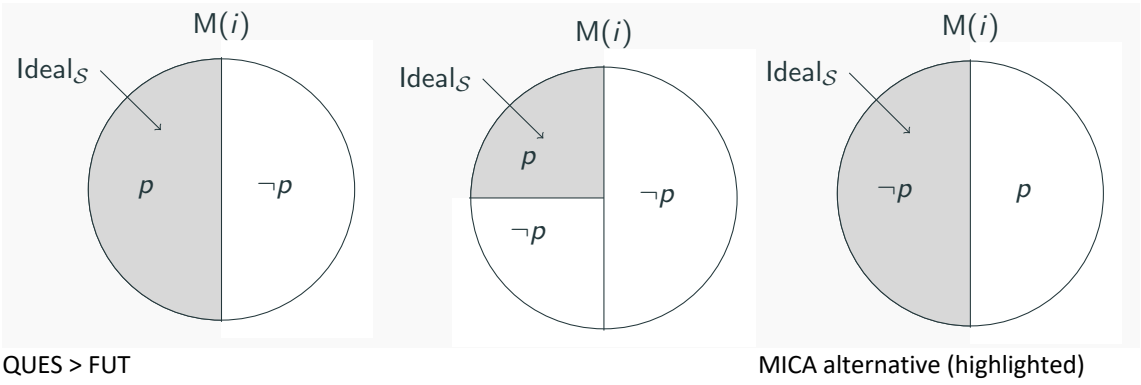

Figure 4: MICA future *queclamative*

This question is not 'optimal'. Rephrasing it, it asks whether all worlds compatible with Ideal$_{\mathscr{S}}$ p is true or whether there are only some of the worlds in Ideal$_{\mathscr{S}}$ in which p is true.

There are various reasons why this question is not not well-formed, depending on the theory adopted. As per Hamblin (1958), Groenendijk and Stokhof (1982) and Mascarenhas (2009), questions denote sets of mutually disjoint alternatives. The alternatives pictured in Figure 3 are not disjoint.

According to a different view, any question opens up three options, which correspond to the possible answers *yes*, *no* and *I do not know* (Ciardelli et al., 2009; Enguehard, 2021).

Along these lines, we propose that MICA adds the alternative necessary to form a well-formed question, which we depict in Figure 4. The first alternative corresponds to the affirmative answer, the second alternative to the 'I do not know' answer, and the third alternative to the negative answer.

We also propose that the alternative contributed by MICA is added to the set via Pott's expressive application and is expressive content Potts (2007).

(42) $[\![\text{MICA} \bullet \text{QUES (FUT } (p))]\!]^{\mathscr{O},\text{M},i,\mathscr{S}} = \{\forall w' \in \text{Ideal}_{\mathscr{S}} : \neg p(w', t_u\}, \{\{\forall w' \in \text{Ideal}_{\mathscr{S}} : p(w', t_u)\}, \{\neg\forall w' \in \text{Ideal}_{\mathscr{S}} : p(w', t_u)\}\}$

The status of the MICA-alternative is peculiar with respect to the two other alternatives, with two main consequences. First, the expressive dimension explains the exclamative flavor of the question. Second the highly subjective status reveals the speaker commitment: the alternative is highlighted as the most prominent one, and the resulting question is biased.

Note that this addition is possible insofar as future and MICA are both sensitive to a body of information available in the context of utterance from which inferences are derived, and which, in our analysis, is encoded in Ideal$_{\mathscr{S}}$.

3.3.1. Further comments

1. We would like to point to a constraint on the co-occurrence FUT in MICA in questions. Recall the contrast between the diet case and the Miles-is-not-eating case. In the diet case (43), the defeasible generalization undone by MICA leads to conclude that p. In Miles-is-not-eating case the defeasible generalization leads to conclude that $\neg p$. Note also the indicative present in (43), and the future tense in (44).

(43) Scusa, non sei mica a dieta ? (= (35))
Sorry, not are MICA on diet ?
Sorry to ask, aren't you on a diet ?
Previous belief that p evidence that $\neg p$

(44) Non avrai mica già mangiato? (= (33))
not have.FUT.2sg MICA already eaten?
You haven't eaten yet, don't you ?
Previous belief that $\neg p$ evidence that p

The future can only be used if the contextual evidence leads to the conclusion that p, in particular, it cannot be used in (43) under Scenario 1.

Scenario 1: The speaker has contextual evidence that the addressee is *not* on a diet and she is eating a whole bag of chips.

(45) Scusa, non #sarai mica a dieta ?
Sorry, not be.FUT.2SG MICA on diet ?
Sorry to ask, aren't you on a diet ?

Consider Scenario 2. In this context, the future can be used.

Scenario 2: The speaker has evidence that the addressee *is* on a diet. There is a bag of chips on the table and the addressee refrains from eating them all.

(46) Scusa, non sarai mica a dieta ?
Sorry, not are MICA on diet ?
Sorry to ask, aren't you on a diet ?

FUT and MICA can co-occurs only in the cases where the evidence supports p. The indicative with MICA is admitted in both scenarios.

2. As we have shown, MICA acts as a disconfirmational evidential (Aikhenvald, 2004) that leads to consider the evidence as irrelevant, and this can explain two facts.

First, the *irrelevance* of the evidence might explain that the use of MICA can be extended to 'by any chance' questions:

(47) Mica hai una penna per caso?
MICA have.PRES.IND.2SG a pen by chance
Do you have a pen, by any chance?

Second, we observe that MICA (future) questions can be cross-linguistically translated into concessive questions. This is the case in French, which resorts to the concessive *quand même*

('nonetheless'). The question arising in the Miles-is-not-eating scenario, where Susan is asking Miles whether she has already eaten (contrary to what she expects) is as follows:

(48) Tu n'as quand même *pas* mangé ?
you not-has nonetheless not eaten
You haven't eaten, don't you ?

The question that my french addressee would formulate wondering whether I am really on a diet, seeing me eating a whole bag of chips will be as:

(49) Tu es à la diète, quand même, n'est-ce pas ?
You are at the diet, nonetheless, TAG ?
You are on a diet, don't you ?

As well-known since König (1986), the concessive reasoning relies on rules and generalizations. The speaker acknowledges (and accepts) the premises, but refuses to draw the normal conclusion that would follow from those premises.[12]

The concessive reasoning replicates the semantics of MICA, rendering the cross-linguistic comparison potentially fertile. Needless to add that this just opens a series of questions, including those pertaining to the role of negation (which is transparent in French (48)), which we have left unaddressed.

4. Conclusion

This paper has studied the interpretation of Italian future questions with and without MICA. While bare future questions are reflective and enhance uncertainty, MICA future questions reveal bias, if not mirativity, and are exclamative in nature.

We have explained these differences by appealing to a difference in scope between FUT and QUES. When FUT scopes over question, the question becomes reflective and enhances unanswerability. When QUES scopes over FUT, MICA repairs the question, contributing an alternative with a special expressive status.

Our paper has offered three contributions: first, it shows that modals can also embed sets of propositions, just like attitudes. Second, it revisits the semantics of MICA, which is considered as belonging to the class mirative evidentials, and most specifically to the sub-class of disconfirmational evidentials rather than as a common ground management device.[13] Third, it proposes that expressive content can be adjoined to a question, producing a *queclamative*, in which one of the alternatives highlighted as revealing subjective bias.

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[12] For an extended study of the concessivity of the future, see Baranzini and Mari (2019).

[13] See Frana and Rawlins (2019) for an account of MICA as a common ground management device. See Korotkova (2023) on Russian *razve*, for related, cross-linguistic discussion.

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When subjects do not agree: A semantic perspective[1]

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Abstract. In this paper we examine a number of constructions that show lack of agreement between the subject and either the verb or some constituent within the predicate. We focus on Non-Agreeing Degree constructions (Mendia and Espinal, 2024), which we compare with so-called Pancake Sentences (Enger, 2004; Wechsler, 2011; Haugen and Enger, 2019) and Topic Categorical Sentences (Britto, 2000). All three constructions show a non-standard agreement pattern that nevertheless signals some form of semantic shift in interpretation. We argue that, despite surface similarities, these constructions do not belong to the same category.

Keywords: semantic agreement, degree expressions, copular clauses

1. Introduction

1.1. Varieties of agreement mismatch

Number agreement is a form of grammatical dependency whereby the morphological form of a word varies depending on the properties of some other word in a given syntactic context. In the examples below, the form of the target of agreement (the copula) depends on the form of the subject of the sentence (the controller).

(1) **Syntactic agreement**

a. *Singular*

(i) $[_{DP[\phi_{SG}]}$ Part of the residents] **has**.SG opposed the plan.

(ii) $[_{DP[\phi_{SG}]}$ The committee] **has**.SG decided on the issue.

(iii) $[_{DP[\phi_{SG}]}$ Each of us] **thinks**.SG that we can win the nomination.

b. *Plural*

(i) $[_{DP[\phi_{PL}]}$ Parts of the residents] **have**.PL opposed the plan.

(ii) $[_{DP[\phi_{PL}]}$ The committees] **have**.PL decided on the issue.

(iii) $[_{DP[\phi_{PL}]}$ All of us] **think**.PL that we can win the nomination.

In this respect agreement is traditionally viewed as involving the interaction between two areas of grammar, morphology and syntax. There are cases however where this "standard" dependency is disrupted: a number of agreement patterns have been argued to involve so-called meaning-based shifts. For instance, in contraposition to the examples in (1), the variants in (2) involve a seemingly defective mismatch between the ϕ-features on the controller and its target (examples from Danon 2013, Landau 2016, and Rullman 2010 respectively).

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(2) **Semantic agreement**
a. $[_{DP[\phi_{SG}]}$ Part of the residents] **have**.PL opposed the plan.
b. $[_{DP[\phi_{SG}]}$ The committee] **have**.PL decided on the issue.
c. $[_{DP[\phi_{SG}]}$ Each of us] **think**.PL that we can win the nomination.

According to Corbett (2006: 155–157), this so-called "semantic agreement" is consistent with the meaning of the controller, whereas "syntactic agreement" is consistent with its form. The fact that this divergent agreement pattern is somehow related to the semantic content of the expressions in subject position is what sets these constructions apart from other forms of defective agreement patterns, such as *unagreement*,[3] and *hyperagreement*, illustrated below: (3a)/(4a) show the expected ordinary agreement patterns whereas (3b)/(4b) show the unagreeing and hyperagreeing variants, respectively:

(3) **Unagreement**
a. Me **faltan** $[_{DP[\phi_{PL}]}$ varias piezas del puzzle].
PR.DAT.1SG lack.3PL several.F.PL piece.F.PL of.the puzzle
'I am missing several pieces of the puzzle.'
b. Me **falta** $[_{DP[\phi_{PL}]}$ varias piezas del puzzle].
PR.DAT.1SG lack.3SG several.F.PL piece.F.PL of.the puzzle
'I am missing several pieces of the puzzle.'

(Villa-García, 2010: 255)

(4) **Hyperagreement**
a. Me **encanta** $[_{DP[\phi_{SG}]}$ hacer planes].
PR.DAT.1SG love.3SG make.INF plans
'I love making plans.'
b. Me **encantan** $[_{DP[\phi_{SG}]}$ hacer planes].
PR.DAT.1SG love.3PL make.INF plans
'I love making plans.'

(Fernández-Serrano, 2022: 2)

The main difference between the patterns in (2) and (3)/(4) is the role played by the lexical semantics of the subjects in (2) *vis-à-vis* the lack of such effects in (3)/(4). In other words, while the pattern in (1)/(2) seems to be semantically driven—at some level at least—patterns like (3)/(4) seem to be optional (see discussions in e.g. Danon 2013 and Landau 2016 for (2) and Fernández-Serrano 2022 for (3)/(4)).

It is important to note at this point that even in the case of "semantic agreement" cases illustrated by the pattern in (2), the purported semantic interpretations of the two relevant variants—i.e. with ordinary (singular) agreement in (1) and with plural "semantic agreement" in (2)—are semantically equivalent. In other words, despite being semantically driven, these non-standard forms of agreement do not affect the overall interpretations of the sentences, and so the sentences in (2) are truth-conditionally equivalent to those in (1).

[3]Note that unagreement may also involve person as well as number ϕ-features; see e.g. Höhn (2016).

1.2. Semantic effects

In this paper we aim to contribute to this body of non-standard constructions by looking into a family of examples where the contrast between standard and non-standard agreeing patterns is indeed semantically noticeable. In particular, we focus on examples involving a morphologically plural subject that fails to control plural agreement on the verb, delivering not only a grammatical sentence but one diverging in truth-conditions from its standard agreeing counterpart.

Consider example (5b) below in contrast to (5a), which we will refer to as illustrating non-agreeing degree constructions (NAD, for short; see Mendia and Espinal 2024):

(5) **Non-Agreeing Degree Constructions**

a. $[_{DP[\phi_{PL}]}$ Cuatro pizzas] **son** { suficiente**s** / demasiada**s** }.
four pizzas are enough.PL too much.PL
'Four pizzas are enough.'

b. $[_{DP[\phi_{PL}]}$ Cuatro pizzas] **es** { suficiente / demasiado }.
four pizzas is enough.SG enough.SG
'Four pizzas is enough.'

Examples like (5a) are unremarkable in that they do not involve any form of agreement disruption; semantically, they constitute an ordinary instance of predication whereby the subject *four pizzas* are said to be such and such. In this particular case, (5a) states that a plurality of four pizzas is sufficient for (or exceeds) some threshold of quantity of pizzas. Example (5b) on the other hand, in addition to being fully grammatical, is not semantically equivalent to (5a). What counts as too much in this second case is largely underspecified: it could be virtually *any* property that may be sensibly predicated of its subject, *four pizzas*. For instance, (5b) could refer to the fact that eating or cooking four pizzas is too much (to meet certain criteria), that the weight of four pizzas exceeds some contextually relevant limitation (e.g., they are too big to heat in a small kitchen oven), that the height of a stack of four pizzas would be too much (to carry on the delivery motorbike), etc. The contrast between these two interpretations is what sets patterns like (5) apart from (1)/(2) and (3)/(4).

NAD constructions are not alone is displaying a form of non-standard agreement with noticeable semantic effects. For instance, as Selkirk (1977) originally noted, agreement differences in pseudo-partitive constructions often lead to noticeable differences in interpretation.

(6) **Object/Quantity ambiguity**

a. A bunch of flowers **was** thrown out of the window *object*

b. A bunch of flowers **were** thrown out of the window *quantity*

(Selkirk, 1977: 311)

More interestingly, NAD constructions resemble as well so-called Pancake Sentences in Scandinavian languages (after Enger, 2004), a construction which shares a similar non-standard agreement pattern. The following examples illustrate the phenomenon in Norwegian.

(7) **Pancake Sentences**

a. Pannekakene er gode
pancake.F.DEF.PL be.PRS good.F.PL

'The pancakes are good.'

b. Pannekaker er godt
pancake.F.INDEF.PL be.PRS good.N.SG
'Pancakes are good.'

(Haugen and Enger, 2019: 532–533, exs. (6), (4))

The point of connection between such pancake sentences and NADs is their heavy semantic underspecification. As Faarlund (1977) already observed, (7b) may be paraphrased by appealing to situations involving pancakes which are are good (e.g., eating, cooking pancakes), and thus, like the NAD in (5b) above, (7b) is not about particular pancakes, but about situations involving any individual pancake.

The last construction we consider here is a variant of NAD constructions involving a left dislocated topic constituent and a neuter pronoun in subject position; we refer to them as Topic Categorical Sentences. We illustrate the construction in French:

(8) **Topic Categorical Sentences**

a. Quatre pizzas, c'est suffisant.
four pizzas PR.N is enough
'Four pizzas is enough.'

b. *Quatre pizzas, ce sont suffisantes.
four pizzas PR.N are enough

c. *Quatre pizzas est suffisant.

d. *Quatre pizzas sont suffisantes.

The only interpretation available to (8a) is that of a NAD construction, whereby what counts as sufficient is heavily underspecified, as it could be any aspect vaguely related to such an amount of pizzas (i.e. eating them, cooking them, carrying them, etc.). Remarkably, French only allows left dislocated topic constructions in such contexts, as the ungrammaticality of the (b) through (d) examples show in (8).[4]

Given that all three types of constructions share semantic underspecification as one of their signature properties, a couple of questions arise naturally: are the three of them variants of the same construction? Do the three of them share a common underlying semantic procedure? In this paper we argue that NAD constructions must be distinguished from both pancake sentences and topic categorical sentences, as the three of them have sufficiently distinct distributions.[5]

[4]We found variation in acceptability across-speakers for (8c), with some speakers being a bit more lax about its judgments. At any rate, we found no speaker for whom (8c) was fully acceptable, hence our choice of marking it with a star.

[5]The list of constructions where non-standard agreement patterns lead to semantic effects is not exhaustive. For instance, Greenberg (2008) discusses the use of the pronominal copula in Hebrew (homophonous to a demonstrative or impersonal pronoun), which never agrees with the subject but has similar semantic effects to those of pancake sentences. For instance, about (i) below Danon (2012: 86) writes that it "means that something related to little children, such as raising them or dealing with them, is hard work—not that children themselves are hard work."

(i) yeladim ktanim ze avoda kaša.
children.M.PL little.M.PL ze.M.SG work.F.SG hard.F.SG
'(Raising/dealing with) little children is hard work.'

Similarly, Martin et al. (2021: 179) mention that (iia) below can be paraphrased as "selling steroids is big business," and report that the choice of number ϕ-features in (iib) is also meaningful: while the plural variant is

We focus on the distributional differences between the three constructions and discuss different ways of accounting for their semantic underspecification, which we take to be tentative evidence in favor of the need for separate analyses in each case.

2. Syntactic distribution of NADs

In this section we summarize the main properties that we take to be characteristic of NAD constructions.[6] We focus exclusively on NAD constructions involving expressions of sufficiency and excess, as illustrated in (5), leaving other types for a future occasion. What we find is that from a distributional point of view NAD constructions involve four main ingredients:

- A quantificational phrase in subject position that is interpreted as a non-conventional unit of measurement.
- A copula BE.
- A degree expression of some form in predicative position.
- A nominal complement to the degree expression.[7]

In what follows we elaborate on each of these points.

2.1. Subjects

The first of the distributional properties of NAD constructions that deserves attention concerns the form of the subject. As we saw above, cardinal numerals make good NAD subjects; the same is true of modified cardinal number phrases.

(9) { Más de / Menos de / Unas } cuatro pizzas es demasiado.
more than less than some four pizzas is too much
'{More than / Less than / Some } four pizzas is too much.'

In contrast, other indefinite quantifiers (10a) and extensional definite descriptions (10b) of various sorts may not be subjects of NAD constructions:

(10) a. *{ Varias / Muchas / Pocas / Algunas / Unas } pizzas es demasiado.
several many few some sm pizzas is too much
b. *{ Las / Éstas / Aquellas } pizzas es demasiado.
the these those pizzas is too much

claimed to be about eggs themselves, the singular variant states that "making, preparing, etc. scrambled eggs is what makes a good breakfast."

(ii) a. Steroids is big business.
b. Scrambled eggs make(s) a good breakfast.

[6]For a broader discussion and more related data, see Mendia and Espinal (2024).

[7]This is true of NAD constructions such as those in (5). More syntactically contrived NADs, such as those involving comparative or superlative constructions do not require nominal complements.

2.2. Copula

NAD constructions are strictly limited to predicational copular constructions. We can probe this limitation by looking into copular constructions that, due to the lexical semantics of the nominal predicate they involve, have semantically equivalent lexical verb counterparts. Consider:

(11) a. Cuatro pizzas es demasiado peso (para llevar en la mano).
four pizzas is too much weight to carry in the hand
'Four pizzas is too much weight to carry in your hand.'
b. Cuatro pizzas { *pesa / pesan } demasiado (para llevar en la mano).
four pizzas weighs weigh too much to carry in the hand
'Four pizzas weigh too much to carry in your hand.'

One would imagine that the meaning conveyed by the NAD in (11a) with a copular predicate *be too much weight to carry* could be expressed by the semantically equivalent predicate *weigh too much to carry*. And while this is the case, the verbal predicate *pesar* "weigh" requires its standard agreement relation with the subject of the sentence, in sharp contrast with the NAD construction in (11a). It is not difficult to find similar cases. For instance, in discussing whether we have time to cook four pizzas one might suggest that in fact we do not have enough time, since cooking four pizzas may take too long. A NAD construction like (12a) is perfectly acceptable in this context, but its verbal counterpart (12b) is not.

(12) a. Cuatro pizzas es demasiado tiempo (para cocinar ahora).
four pizzas is too much time to cook now
'Four pizzas is too much time to cook now.'
b. Cuatro pizzas { *lleva / llevan } demasiado tiempo (para cocinar).
four pizzas carries carry too much time to cook
'Four pizzas take too long to cook now.'

2.3. Degree heads

Not any copular construction may form a good NAD construction. The main limitation we find in this respect is that NAD constructions, as their name suggests, are first and foremost degree constructions, and thus require some form of degree expression in post-copular position. The form of the actual degree expression involved in NAD constructions is inconsequential, as long as there is one. Thus, in addition to the degree expressions of excess and sufficiency in (5), we also find NADs in comparative, superlative, equative and proportional constructions:

(13) a. Cuatro pizzas { es / ?son } más de lo que necesitamos.
four pizzas is are more of the what need
'Four pizzas is more than we need.'
b. Cuatro pizzas { es / *son } lo más que he comido nunca.
four pizzas is are the most that AUX eaten ever
'Four pizzas is the most I have ever eaten.'
c. Cuatro pizzas { es / son } lo mismo que siete hamburguesas.
four pizzas is are the same as seven burgers
'Four pizzas is the same as seven burgers .'

d. Cuatro pizzas { es / ?son } { mucho / bastante / poco }.
four pizzas is are much quite-a-bit little
'Four pizzas is {a lot / little}.'

Note that even in the absence of an overt degree expression, as in (14), the only interpretation available is one where an amount of four pizzas is said to count as *a lot of* food, to be *very* expensive, or to be *very* involved too cook, etc, for instance:

(14) Cuatro pizzas es { comida / dinero / tiempo / ...}.
four pizzas is food money time
'Four pizzas is a lot of { food / money / time }.'

This kind of interpretation survives even in the presence of negation:

(15) Cuatro pizzas no es comida.
four pizzas is not food
'Four pizzas is not a lot of food.'

2.4. Nominal complements

Any nominal in predicative position may be part of a NAD construction like those in (5). However, NADs of sufficiency and excess with *demasiado*/*suficiente* 'too much'/'enough' are strictly limited to nominal complements. These nominal complements then help determine some scale on the fly along which the NAD construction is then interpreted. In (11) and (12) we saw how verbal predicates may not form NADs. The same is true of other types of predicates, such as adjectives, despite being themselves expressions of degree. For instance, in (14) one may not simply exchange an adjective for a semantically related nominal, as shown bellow:

(16) a. Cuatro pizzas es { *caro / dinero }.
four pizzas is expensive money
'Four pizzas is { expensive / too much money }.'
b. Cuatro pizzas es { *pesado / peso }.
four pizzas is heavy weight
'Four pizzas is { heavy / too much weight }.'

In short, like we saw in the previous section, despite the semantic similarity between some nominal/adjectival predicative pairs, NAD are only possible with nominal predicates.

Summing up, the distribution of NAD constructions is limited, broadly speaking, to numeral indefinites in subject position that provide the sole argument of a predicational copular sentence with a degree expression taking a nominal complement. In the next section we further elaborate on the overall semantic consequences of such configurations for the interpretation of the whole sentence.

3. Pinpointing the semantic effect of nonstandard agreement in NADs

Recall that our initial intuition was that the contrast in (5), repeated below, follows from the fact that unlike (5a), (5b) is not in fact a statement about pizza. Instead, we suggest that determining what (5b) is about depends highly on the context: for a restaurant guest it may be about food, for a cook it may be a measure of work, for a delivery person it may be about size, etc. These interpretations are all ruled out in the standard agreeing variant in (5a).

(5) a. $[_{DP[\phi_{PL}]}$ Cuatro pizzas] **son** { suficiente**s** / demasiada**s** }.
four pizzas are enough.PL too much.PL
'Four pizzas are enough.'

b. $[_{DP[\phi_{PL}]}$ Cuatro pizzas] **es** { suficiente / demasiado }.
four pizzas is enough.SG too much.SG
'Four pizzas is enough.'

For concreteness, we suggest the following as the interpretation of (5a):[8]

(17) $\exists x[^{*}pizza'(x) \wedge |x| = 4 \wedge 4 \geq TH^{C}_{\{min/max\}}(|pizza'|)]$

This interpretation states that a plurality of four pizzas reaches/exceeds a context dependent threshold of pizza cardinalities. While intuitively correct for (5a), this result is clearly inadequate as an analysis of (5b), since it cannot account for its semantic underspecification. The guiding intuition that we pursued in Mendia and Espinal (2024) is that the semantic role of the subject *cuatro pizzas* in (5b) is analogous to that of measure phrases such as *three kilos* in sentences of the form *three kilos is too much weight*. Take for instance the case in which (5b) is uttered in a context where four pizzas are said to exceed some context dependent weight threshold:

(18) Four pizzas is too much weight.

Because (18) is not about any one pizza—and in fact (18) does not commit us to the existence of any actual pizza—we suggest to interpret the subject intensionally, by applying a general nominalizing operator "$^{\downarrow}$" (Chierchia, 1985; McNally, 1997).

(19) $[\![\text{cuatro pizzas}]\!] = {}^{\downarrow}(\lambda x_e.{}^{*}pizza'(x) \wedge |x| = 4)$

The result is the entity correlate of the property of being four pizzas, a spatio-temporally discontinuous abstract entity (much like, but different from, kinds). We then may feed this entity correlate to the main degree predicate, with a very different result from (17): we now obtain a degree d as the result of applying a measuring function μ—set to some contextually determined dimension DIM—to the entity correlate of the property *four pizzas*. Then, this d is said to reach/exceed some context dependent threshold on DIM, $TH^{C}_{\{min/max\}}(\text{DIM})$. We thus obtain (20) as the general interpretation of the NAD constructions in (5b):[9]

(20) $\mu_{\text{DIM}}({}^{\downarrow}(\lambda x_e.{}^{*}pizza'(x) \wedge |x| = 4)) = d \wedge d \geq TH^{C}_{\{min/max\}}(\text{DIM})$

[8]Reaching this analysis compositionally is straightforward using run-of-the-mill tool offered by degree semantics. For one such analysis, we refer the reader to Mendia and Espinal (2024).

[9]This is a simplified version of the analysis we defend in Mendia and Espinal (2024).

In the absence of an overt nominal such as *weight* in (18), as is the case with our original (5b) example, the dimension that the measuring function is defined on must also be retrieved in the context, thereby capturing the large semantic underspecification of NAD constructions.

4. NADs vs Pancakes

As we suggested earlier, one might hypothesize that NADS are simply a variant of so-called Pancake Sentences (PS, from now on) in Scandinavian languages, given the noticeable similarities among the two types of constructions. In this section we review these similarities, as well as their differences, and conclude that they do not constitute the same construction.

Prototypical PS constructions are illustrated in (7b) above and (21) below, which most characteristically show an indefinite plural or a mass noun in what looks like a pre-sentential subject position and a neuter singular adjective in predicate position:

(21) Konjakk er sunt.
cognac.M.INDEF.SG be.PRS healthy.N.SG
'Cognac is healthy.'

(Haugen and Enger, 2019: 532, ex (5))

In the light of the properties characteristic of NAD constructions presented in Section 2, we observe that the following similarities between PS and NADs are quite prominent.

4.1. Similarities between NADs and PS

4.1.1. Subjects

Subjects of NAD and PS constructions share the following properties. We first observe that in neither construction is the subject specified for definiteness.[10] Second, the subject of the two constructions is usually specified for plural number, unless it is a mass noun. Third, the subject of the two constructions may be a non-finite clause. This is illustrated for PS in (22).

(22) Å ete pannekaker er godt
to eat pancakes is good.N.SG

(Enger, 2004: 7, ex. (9))

NAD constructions in Spanish share the same property:[11]

(23) Cocinar y comer cuatro pizzas es demasiado
to cook and to eat four pizzas is too much

Fourth, sometimes, the subject can be interpreted as referring to a proposition. In fact, syntactic

[10] Although, in contrast to NADs, the subject of PS can be indefinite, as illustrated in (21).

[11] Note that the standard agreement pattern of conjoined non-finite clauses would typically involve plural agreement:

(i) Cocinar y comer cuatro pizzas { *es / son } dos cosas diferentes
to cook and to eat four pizzas is are two different things

analyses of PS as the one in Faarlund (1977) have postulated that the subject of PS like (7b) and (21) above is underlyingly the object of a verb that has been deleted (i.e. in a construction such as (22) above).

Fifth, PS can be paraphrased by the use of *med* 'with' constructions (Faarlund 1977, Faarlund et al. 1997). Compare (21) above with (24) below:

(24) Det er sunt med vodka.
it is healthy.N.SG with vodka.M.SG
(Enger, 2004: 15, ex. (44))

Interestingly, the Spanish preposition *con* 'with' can be used to rescue NAD constructions that otherwise would be ungrammatical (for details see Mendia and Espinal 2023).

(25) *(Con) algunas pizzas será suficiente (para la comida).
with some pizzas be.FUT enough for the meal
'With some pizzas is enough (for the meal).'

And finally, semantically, the subject receives a non-extensional reading. Haugen and Enger (2019) refer to subjects of PS as constituents that denote unbounded processes; in this respect they claim that the subjects of PS quite often look like entities that are metonymic for the eventuality that involves them: they are metonymic for the process in which they are understood to be participants.[12] As mentioned in Section 2, subjects of NADs also share an intensional reading, which we captured in Section 3 by appealing to a nominalization process.

4.1.2. Predicates

When it comes to the types of predicates that appear in each construction we find two main similarities. On the one hand, the verb in both NADs and PS is always a copula, as extensively argued for NADs in Section 2 and as reported in the literature on PS (Faarlund 1977, Enger 2004, Wechsler 2011, Haugen and Enger 2019, a.o.). On the other hand, the two share non-standard subject-predicate agreement. The two patterns show however slight differences. Whereas in PS the copula has the same form *er* no matter whether the subject is singular or plural (see the examples in (7b) and (21)) and the adjective in predicate position must be N.SG, in NADs the copular verb can show a default SG number, as well as an plural agreement pattern between the subject and the copula, as in (26). Importantly, however, the resulting construction with the plural copula remains a NAD as long as the degree predicate is still in singular, corresponding still to a non-standard agreement pattern.

(26) $[_{DP[\phi_{PL}]}$ Cuatro pizzas] **son** { suficiente / demasiado }.
four pizzas are enough.SG enough.SG
'Four pizzas is enough.'

[12] More specifically, Enger (2004: 27) claims that subject of PS refer to kind entities, not to specific individual objects.

4.2. Differences between NADs and PS

So far we have highlighted the main points of connection between NADs and PS from a descriptive standpoint. But there exist important differences as well, enough to make a case in favor of considering them distinct constructions altogether.

4.2.1. Subjects

When it comes to the form of the subjects allowed in NAD *vis-à-vis* PS, the main difference involves the ability of PS subjects to be proper names, whereas this is never the case in NADs.[13]

(27) Skogbygda kunne være fint.
Skogbygda could be fine.N.SG
(Enger, 2004: 12, ex. (28))

4.2.2. Predicates

The predicate of a PS is an adjective that standardly expresses a relation between an (extensional) individual and a degree along some conventionally determined dimension. By contrast, the predicate of a NAD is always a noun and thus NADs as a whole involve degree predicates that introduce a non-conventional dimension.[14]

Given this distinction, NADs only admit the copula *ser*, whereas the corresponding PS follow ordinary copular patterns and thus require the use of both *ser* and *estar*.

(28) **PS in Spanish**
a. Los pancakes son buenos.
the pancakes are good
b. El coñac está delicioso.
the cognac is delicious

Notice too that while the predicate of PS allows a demonstrative pronoun subject in a neuter form preceded by a left-dislocated topic constituent (see below the examples in (29a), predicates of NADs only allow a QP subject that is ultimately moved to Spec,TP. There is no place for demonstrative neuter pronouns in NAD constructions, (30).

(29) a. Pannekaker, det er godt.
pancake.F.INDEF.PL it.N be.PRS good.N.SG
'Pancakes are good.'
b. Konjakk, det er sunt.
cognac.M.INDEF.SG it.N be.PRS healthy.N.SG
'Cognac is healthy.' (Enger, 2004: 19, exs. (52), (53))

[13] Other types of restrictions, such as the inability of NADs to have bare plurals/singulars, follow from independent restrictions in Spanish and thus will not be considered here.

[14] By "non-conventional" we mean that, unlike adjectives, whose associated dimensions are fully conventionalized, scales build upon the dimensions introduced by the nominal in NAD constructions are not so. E.g., in *Four pizzas is too much effort*, there is no convention about quantities of pizzas constituting units of effort, and thus this must be resolved in context.

(30) *Cuatro pizzas, ello es suficiente.
four pizzas it.N is enough

Because of the inability of Spanish to host left dislocated topics with a neuter pronoun, we believe that these constructions cannot be counted among bona fide NAD constructions.

5. Topic categorical sentences

The Scandinavian PS illustrated at the end of Section 4 show a phenomenon that is widely spread among natural languages and corresponds to an instance of so-called categorical judgments (Kuroda 1972). A "categorical" judgment, as opposed to a "thetic" judgment, conforms to the traditional and philosophical structure of a subject and a predicate. The categorical vs. thetic opposition is expected to correlate with the presuppositional nature of the subject of a categorical judgment, as opposed to the existential entailment of the subject, if any, of a thetic judgment. And this is so because, by default, the subject of a categorical judgment is associated with a speaker presupposition of existence, which means that prototypically categorical judgments combine a strong subject with a generic predicate.

We provide below some examples of categorical judgments from Brazilian Portuguese. Notice that the sentences in (31) have a left-dislocated topic, interpreted as the logical subject of the sentence, followed by a predicate that introduces an assertion about this subject. The logical predicate has a sentential structure with a subject pronoun and a generic sentence.

(31) a. [A população neotrentina]$_i$ ela$_i$ é meio flutuante (...).
the population neotrentian it is half floating
'The neotrentian population is relatively unstable (...).'
b. [Esses rapazes]$_i$ eles$_i$ são muito bonitos.
these guys they are very handsome.PL
'These guys are very handsome.'
c. [Um homem comum]$_i$ ele$_i$ tem um conforto compatível com (. . .).
a man common he has a comfort compatible with
'A common man has comfort compatible with (. . .).'
(Britto, 2000: 200, exs. (8a), (1), (9))

This notwithstanding, when we look at the data we very often find examples of categorical judgments with a logical subject–predicate division where the subject is a left-dislocated topic that may be either definite or indefinite.[15]

[15] See Cyrino and Espinal (2015) for an analysis of preverbal bare nominals in Brazilian Portuguese in terms of subjects of categorical judgments. Consider the data in (i), where *ele/eles* may alternate with a null resumptive pronoun, which correspond to their examples in (42).

(i) a. Brasileiro ele é trabalhador.
Brazilian he is hardworking
b. Brasileiro eles são trabalhadores.
Brazilian they are hardworking.PL
'Brazilians are hardworking.'
c. Brasileiro *pro* é trabalhador.
Brazilian is hardworking

According to these authors, in (a) these preverbal bare nominals are instantiations of logical subjects of categorical

The examples in (32) illustrate this claim for French.

(32) a. Les/des enfants, c'est chouette.
the.PL/des children it is fun.M.SG
'Doing something with children (having them, playing with them, raising them, and so on) is cool/fun.'

b. Les/des animaux de compagnie, c'est compliqué.
the.PL/des animal.PL of company it is complicated.M.SG
'Having domestic animals, caring for them, etc. is complicated.'

(Martin et al., 2021: 140, exs. (3), (11b))

Interestingly, when native speakers of French are asked to provide the translations of our NAD constructions, examples similar to those in (32) are provided. These are examples like (8), repeated below for convenience, to which we add the variations in (33).

(8) a. Quatre pizzas, c'est suffisant.
four pizzas PR.N is enough
'Four pizzas is enough.'

b. *Quatre pizzas, ce sont suffisantes.
four pizzas PR.N are enough

c. *Quatre pizzas est suffisant.

d. *Quatre pizzas sont suffisantes.

(33) a. Quatre pizzas, { c'est / *ce sont } suffisamment de nourriture.
four pizzas it is it are enough of food
'Four pizzas is enough food.'

b. Quatre pizzas { ??est / *sont } suffisamment de nourriture.
four pizzas is are enough of food

These examples involve, we believe, a left-dislocated topic, interpreted as the logical subject of a categorical judgment, followed by an assertion about that subject. Syntactically, the left-dislocated topic is followed by a sentence with its own pronominal subject, the demonstrative neuter pronoun *ce* 'that', followed by a copula that must be in singular form. As a consequence, we contend that, although PS have a variant with left-dislocated topics and NAD constructions

judgments; in (b) however, these logical subjects are not syntactic subjects, but are DPs in a left Topic position, necessarily linked by means of a syntactic chain to a resumptive pronoun in subject internal position, in order to comply with argumenthood requirements on DPs; and, finally, (c) in the case where no overt third person pronoun is present (see (ic)), a null pronoun (*pro*) must be postulated in subject position.

Likewise, this pattern has been postulated for definitional generic sentences (Seres and Espinal 2019) in Russian, a language without articles. Definitional generic sentences of the form *NP1 èto NP2* (see (iia)) consist of a presentential NP1 (a kind of aboutness topic merged in Spec,TopP), while the rest of the sentence *èto* 'that' NP2 corresponds to the logical predicate (with *èto* being merged in Spec,PredP, BE being the head of Pred, and its complement NP2). Consider the structure in (iib).

(ii) a. Gippopotam– èto begemot.
gippopotam.NOM.M.SG that hippopotamus.NOM.M.SG
'The/a gippopotam is the/a hippopotamus.'

(Seres and Espinal, 2019: 1, ex. (1a))

b. $[_{\text{TopP}}\ [\text{NP}_1] \ldots [_{\text{PredP}}\ [\text{èto}]\ [_{\text{Pred'}}\ [\ \text{BE}\ ]\ [\text{NP}_2]]]]$

(Seres and Espinal, 2019: 3, ex. (3))

are translated as topic categorical sentences in some languages, NADs, PS and topic categorical sentences are different constructions.

6. Conclusions

In this paper we have explored the semantic consequences of non-standard agreement patterns in copular constructions. Drawing data from a number of languages, we have argued for the need to distinguish at least three kinds of constructions: Pancake Sentences (e.g. Wechsler 2011), Topic Categorical Sentences (e.g. Britto 2000) and Non-Agreeing Degree constructions (Mendia and Espinal 2024). What brings all three constructions together is the fact that, in addition to the non-standard agreement pattern between subject and copula, the observed semantic effects influence subjects especially. In all three constructions subjects must be interpreted non-extensionally, i.e. as referring not to entities in the actual evaluation world but to any one such entity, to an abstract one (such as kinds or nominalized properties) that those entities would realize, or to situations involving such entities (similar to cases of logical metonymy). We leave open for future research a full compositional semantic account of the interpretive isomorphism of the three constructions that nevertheless accounts for their underlying distinct syntactic structures.

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From perfectivity to performativity in conditionals[1]

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Abstract. This paper documents a novel pattern in the expression of conditional statements about future in Farsi. When both p and ¬p are equally plausible future events, the antecedent of conditional statements about future can either be marked with imperfective or perfective. Conditionals whose antecedent is marked with *perfective* necessarily give rise to *performative* interpretations in the consequent. I propose an analysis that derives the differences between the two conditionals from their sole linguistics difference, i.e. the semantics of aspectual heads, and general principles of pragmatic reasoning.

Keywords: Aspect, conditionals, performative utterances

1. Zero tense antecedent and future-oriented conditionals

This research documents a novel pattern in the expression of conditional statements about future in Farsi. When the antecedent proposition *p* is not settled, i.e. *p* and ¬*p* are equally plausible future events, there are two possible ways of marking the verb in the antecedent of Farsi conditionals: the imperfective zero tense (1), and perfective zero tense (2).[2]

(1) **Imperfective zero tense**

Agar jarime **be-š**-i, bayad pool-esh ro be-d-i
If fine **IMPF**-become.∅-2SG should money-its RA IMPF-give.∅-2SG

If you get a ticket, you must pay it. [3]

(2) **Perfective zero tense**

Agar jarime **šod**-i, bayad pool-esh ro be-d-i
If fine become.**PERF**.∅-2SG should money-its RA IMPF-give.∅-2SG

If you get a ticket, you must pay it. →*warning*

Conditionals whose antecedent is marked with *perfective* aspect give rise to a wide variety of *performative* interpretations in their consequent. What I mean by *performative interpretation* is the use of ordinary sentences not to describe the world, but rather to change it. Let me illustrate what I have in mind with an example by Mandelkern (2020). Suppose Mark tells

[1]I would like to thank Rajesh Bhatt, seth Cable, Manfred Krifka, Paul Portner, and Yael Sharvit, the audiences at Commit22, the SynSem at UCLA, and SuB28 for providing valuable feedback in different stages of this project. My special thanks goes to Ana Arregui and Maria Biezma; without their guidance, this project would not have shaped. All errors are mine.

[2]In Farsi, antecedents marked with diectic tenses come with the presupposition that the truth or falsity of the antecedent proposition to presuppositions is settled in the context set relative to which the antecedent is uttered and they yield factual or counterfactual interpretations. When the antecedent proposition is not settled in the context, it is necessarily marked with zero tense, which is traditionally called subjunctive (Mirrazi, 2022). Conditionals with zero tense antecedents are hypotheticals.

[3]Imperfective marker in Farsi has two morphological realizations depending on the deictic property of tense. *be-* is the variant that appears with zero tense.

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John: *This afternoon, you will be cleaning the rabbit cage*. Assume that Mark has the right kind of authority over John to tell him what to do. In such a scenario, this sentence does not just inform John about the future, but also obligates John to bring about that future, i.e. the cleaning of the rabbit cage. By uttering this sentence, Mark communicates his belief that John will clean the rabbit cage later in the day. If John had no prior intention to do so but acknowledges Mark's authority, he will reason that Mark would only believe that John will clean the rabbit cage if Mark is imposing that he do so. Consequently, John is likely to adjust his plans to comply with Mark's beliefs, assuming he recognizes Mark's authority to impose requirements on him.

Now compare this to a descriptive use of the sentence, when Mark reports to Mary, *This afternoon, John will be cleaning the rabbit cage.* There is no obvious reason to think that Mark's sentence to Mary is semantically different from his first sentence. As Mandelkern (2020) argues, it is natural to think that these sentences have the same content in the two contexts. The only difference is that Mark's assertion in the first context serves not just to describe the world, but also to impose an obligation for the hearer to bring about the state of affairs described. By describing what the future will be like in the right normative setting, Mark's assertion functions to change the future. As Mandelkern (2020) argues, it is natural to assume that these two utterances have the same semantic content. In both cases, they are statements with ordinary truth conditions. Their difference is a matter of pragmatics: in their performative uses, utterances function to change the world. Truth conditional approaches to performative utterances have also been taken by Condoravdi and Lauer (2011); Eckardt (2009, 2012), among others. In this chapter, I take a similar approach. I take performative utterances to have the same semantic content as other utterances. They denote propositions, which in situations talks are properties of situations. The performative interpretation is treated as a matter of pragmatics.

My aim in this paper is to derive the pragmatic differences between the two conditionals from their sole linguistic difference, i.e. the semantic properties of aspectual heads, and general principles of pragmatic reasoning.

2. Performative interpretations of consequents

In this section, I will provide data that illustrate the semantic and pragmatic differences between perfective and imperfective zero tense conditionals.

2.1. Imperatives

Conditional imperatives provide a clear case of contrast between perfective and imperfective zero tense conditionals. As shown in (3), conditional imperatives in Farsi are ungrammatical with imperfective zero tense antecedents.

(3) Agar farda {***be-bin-i-sh/** **did-i**-sh}, az-ash be-pors
If tomorrow **IMPF**-see.∅-2SG-him/ see.**PERF**.∅-2SG-him from-him IMPER-ask
If you see him tomorrow, ask him.

2.2. Declaratives

A declarative in the consequent of a zero tense conditional whose antecedent carries a perfective aspect necessarily get a performative interpretation. That is, perfective zero tense conditionals cannot be used to just describe the world. Consider the contrast in (4), where it is shown that a perfective conditional cannot be used by a human right activist to describe the horrible situation Afghan women experience.

(4) *A human right activist describing the terror Afghan women experience:*

agar zan-an-e afghan eteraz {**be-kon-and/ #kar-d-and**}, koš-te
if woman-PL Afghan protest **IMPF**-do-∅-3PL/ do.**PERF**.∅-3PL kill-PP
mi-šav-and
IMPF-become-3PL.

If Afghan women protest, they will get killed.

When the consequent can be interpreted performatively—to change the world so as to include the future situation that it is describing, the perfective antecedent is felicitous. For instance, the perfective conditional is acceptable when uttered by a Talib threatening Afghan women.

(5) *A speaker of Taliban threatening Afghan women:*

agar zan-an-e afghan eteraz {**be-kon-and/ kar-d-and**}, koš-te
if woman-PL Afghan protest **IMPF**-do-∅-3PL/ do.**PERF**.∅-3PL kill-PP
mi-šav-and
IMPF-become-3PL.

If Afghan women protest, they will get killed.

A similar contrast between perfective and imperfective conditionals can be seen in the interpretation of deontic modals in the consequent. Deontic modals in the consequent of perfective zero tense conditionals, necessarily have a *performative* interpretation. The perfective conditional implies that it is the speaker who imposes the obligation, and thus endorses the obligation. That is why the obligation cannot be at odds with the speaker's view of that obligation. As the contrast in (6) shows, only an imperfective conditional is felicitous with the continuation *but I don't want you to pay*.

(6) Agar jarime {**be-š**-i/ **#šod**-i}, bayad pool-esh ro
If fine **IMPF**-become.∅-2SG/ become.**PERF**.∅-2SG should money-its RA
be-d-i
SUBJ-give-2SG
If you get a ticket, you must pay it. **but I don't want you to pay.**

Both perfective and imperfective conditionals in 6 are felicitous in a context where the addressee is borrowing the speaker's car, and the speaker is warning them that in the event of getting a ticket, they're obligated to pay it.

When there is an epistemic modal in the consequent, and a performative interpretation is not possible, the antecedent of a zero tense conditional has to be imperfective. For instance, the contrast in (7) shows that perfective conditionals are not felicitous in an epistemic reasoning scenario.

(7) agar harf-ha-ye shahed-e eini ra jeddi {**be-gir-im/** **#gereft-im**},
if word-PL-EZ witness-EZ visual RA serious **IMPF**-take-∅-1PL/ take-**PERF**-∅-1PL
John ne-mi-tavan-∅-ad ghatel baš-ad.
John NEG-IMPF-can-PRES-3SG murderer be.∅-3SG
If we take what the eyewitness said seriously, John cannot be the murderer.

The contrast in (8) shows that perfective zero tense conditional cannot felicitously be used to take a *wild guess*.

(8) *John is about to flip a fair coin. Mark takes a wild guess about the outcome.*

agar sekke ra {**be-andaz**-i/ **#andaxt**-i}, šir mi-ay-ad
if coin RA **IMPF**-throw-∅-2SG/ throw.**PERF**-∅-2SG heads IMPF-come-3SG

If you flip the coin, it will come up heads.

The perfective conditional is only felicitous when it can be interpreted as an authoritative claim. An example of such a context is given in (9), where the speaker warns the addressee against flipping the coin. The authoritative nature of this claim can be further illustrated with challengeability tests. Since the speaker of the perfective conditional is understood to claim that they *know* that the coin is not fair, the truth of their statement cannot be denied with *That's not true*. The only way a perfective conditional claim can be challenged is to ask the speaker to justify the *source* of their knowledge, with *how do you know?*.

(9) *John is about to flip a fair coin. He has bet on tails. Mark knows that the game is rigged. The coin is not fair, and has heads on both side. Mark is warning John:*

a. gar sekke ra **andaxt**-i, šir mi-ay-ad
if coin RA throw.**PERF**-∅-2SG heads IMPF-come-3SG
If you flip the coin, it will come up heads.
✗John: That's not true. It may come up tails. →*infelicitous as a wild guess*
✓John: How do you know?

b. gar sekke ra **be-andaz**-i, šir mi-ay-ad
if coin RA **IMPF**-throw-∅-2SG heads IMPF-come-3SG
If you flip the coin, it will come up heads.
✓John: That's not true. It may come up tails.
✓John: How do you know?

An interesting contrast between perfective and imperfective conditionals in Farsi can be seen in the interpretation of biscuit conditionals. The choice of the aspect in the antecedent depends on the inference associated with the biscuit conditional.

If the biscuit conditional involves an indirect speech act that requires the speaker's authority over the addressee, the antecedent must carry the perfective aspect. For instance, a biscuit

conditional that is used by the speaker to convey an *order* for the addressee to lie has to have a perfective antecedent. The contrast between perfective and imperfective conditionals in the famous example by Siegel (2006) illustrates this point.

(10) *An adult is traveling by bus with a child. They see a ticket collector who is going around checking that children above four have paid full fare. Parent to the child: (the context is provided by Biezma and Goebel (2023))*

agar {**pors-id**-and/ #**be-pors**-and} čand sal-et-e, čahar sal-et-e
if ask-**PERF**-∅-3PL/ **IMPF**-ask-∅-3PL some year-2SG-3SG, four year-2SG-3SG

If they ask how old you are, you are four. →*offer*

Similarly, the biscuit conditional in (11), which is used by the speaker to *offer* food to the hearer, is only felicitous when the antecedent is marked with perfective morphology.

(11) *The host is leaving the house. She tells her guest that he should feel free to help himself to some food, while she's not home.*

agar gorosne {#**be-sh**-i/ **shod**-i}, ghaza tu yakhchal hast.
if hungry **IMPF**-become-∅-2SG/ become.**PERF**.∅-2SG food in fridge is

If you get hungry, there's food in the fridge. →*offer*

In contrast, in a context where the speaker lacks the required authority to offer the food to the hearer and the biscuit conditional is used to just inform the hearer of available options, the antecedent has to be marked with imperfective morphology. This is shown in (12).

(12) *Amir and Masoud are guests in an Airbnb. Amir to Masoud, who is worried about food:*

agar gorosne {**be-sh**-i/ #**shod**-i}, ghaza tu yakhchal hast.
if hungry **IMPF**-become-∅-2SG/ become.**PERF**.∅-2SG food in fridge is

If you get hungry, there's food in the fridge.
But ask for the host's permission first.

In sum, we have seen that the perfective aspect in the antecedent of future-oriented hypothetical conditionals in Farsi is only felicitous when a performative interpretation of the consequent is plausible in the context.

3. Insights from pragmatics of biscuit conditionals

While perfective and imperfective conditionals can have both biscuit and non-biscuit uses, perfective conditionals share three important properties with biscuit conditionals, even in their non-biscuit uses: (1) the independence of the antecedent and the consequent, (2) incompatibility with reverse mapping to discourse structure, and (3) unembeddability under attitude predicates.

In the remainder of this section, I first discuss these shared properties of biscuit conditionals and Farsi perfective conditionals. Then, I will give an overview of independence-based accounts of biscuit conditionals that provide a crucial insight into understanding the semantic and pragmatic behavior of perfective conditionals in Farsi.

3.1. Shared properties of perfective conditionals and biscuit conditionals

3.1.1. Independence

The main characteristics of biscuit conditionals is that the truth of consequent in a biscuit conditional holds independent of the truth of antecedent (13). Consider the famous examples by Austin (1958).

(13) If you are hungry, there are biscuits on the sideboard. *biscuit*

Unlike hypothetical conditionals that convey that the consequent is true in all of the worlds where the antecedent is true, biscuit conditionals convey that the consequent is true in all the worlds in the context, not just those selected by the antecedent. Explaining this observation, which is referred to as the *consequent entailment*, is the main puzzle in the study of biscuit conditionals. Many pragmatic accounts of biscuit conditionals (Franke 2009; Sano and Hara 2014; Lauer 2015; Francez 2015; Biezma and Goebel 2023) take the consequent entailment to be by-product of the assumed independence between antecedent and consequent. For instance, the consequent entailment associated with the conditional (13) is the result of our assumption that the truth of the consequent proposition *there are biscuits on the sideboard* does not depend on anyone's hunger.

Not all perfective conditionals in Farsi are biscuit conditionals, so the consequent entailment is clearly not a shared properties of perfective conditionals. Nevertheless, these conditional seem to presuppose a certain kind of independence between the antecedent and the consequent. This is evident in the infelicity of perfective conditionals in contexts where it is already assumed that the antecedent and the consequent are dependent.

First, consider the example in 14 where the truth of the consequent necessarily follows from the truth of the antecedent. In such contexts, the perfective conditional is not acceptable.

(14) agar farda došanbe {**baš-ad/ #bud**}, pas farda sešanbe
if tomorrow Monday be.∅.3SG/ be.**PERF**.∅.3SG after tomorrow Tuesday
ast.
be.PRES.3SG
If tomorrow is Monday, the day after is Tuesday.

Furthermore, perfective conditionals cannot be used to describe natural laws and generalizations, as shown in (15). The perfective conditional in (15) is only felicitous when it is used as a warning to the addressee against burning themselves with boiling water.

(15) agar ab dagh {**be-šav**-ad/ **#šod**}, mi-juš-∅-ad.
if water hot **IMPF**-become.∅-3SG/ become.**PERF**.∅.3SG IMPF-boil-PRES-3SG
if water heats up, it boils.

Finally, contexts where a conditional is used to highlight the dependency between antecedent and consequent to argue for or against the antecedent proposition, provides another environment to illustrate the independence between antecedent and consequent of perfective conditionals. That is, perfective conditionals are not felicitous in question and answer pairs like (16).

(16) A: why (not) p?
B: Because if p, q.

The examples in (17) show that only imperfective conditionals are felicitous in such contexts.

(17) A: Why don't you tell her the truth? B:..

agar haghighat ra beh-esh {**be-guy**-am/ **#gof-t**-am}, narahat
if truth RA to-her **IMPF**-tell-∅-1SG/ tell-**PERF**-∅-1SG upset
mi-šav-∅-ad.
IMPF-become-PRES-3SG

If I tell her the truth, she'll get upset.

3.1.2. Default discourse mapping

In the default mapping of conditionals to discourse, the antecedent is understood to set up a question under discussion (QUD), which the consequent provides an answer to (Haiman, 1978; Ebert et al., 2014; Biezma and Goebel, 2023). Thus, it is the consequent that presents at-issue content in a default mapping. The QUD can be characterized as *What is true at the selected p-worlds?/ what if p?*. Let us illustrate this default mapping with the discourse mapping of the biscuit conditional *if you are hungry, there are biscuits on the sideboards.*.

(18) QUD: What if you're hungry?
Answer: There are biscuits on the sideboard.

The reverse of this mapping is also possible. In the reverse mapping, the antecedent is understood as an answer to a question about the consequent. Thus, the at-issue content is presented by the proposition in the antecedent. The QUD for the reverse mapping can be characterized as *What are the propositions p such that for all selected worlds in which p is true, q is true?/ When q?*. The example (19) illustrates the reverse mapping.

(19) If you mow the lawn, I'll give you 5 dollars.
a. QUD: When would you give me 5?
b. Answer: If you mow the lawn, I'll give you 5.

Biezma and Goebel (2023) show that the reverse mapping is not available to biscuit conditionals. When the QUD is a question about the consequent, and the antecedent presents 'at issue' content (provides an answer to QUD), a biscuit conditional is infelicitous.

(20) A: When are there biscuits on the sideboard?
B: # if you are hungry, there are biscuits on the sideboard.

Only the default mapping to discourse is available to perfective conditionals, even in their non-biscuit uses. This is demonstrated by the infelicity of perfective conditionals in contexts where the antecedent provides the answer to QUD (contains the 'at issue' content), as in (21)-(22).

(21) *A: How can I get to the mall? B:..*

agar az samt-e rast {**be-r**-i/ **#raf-t**-i}, ye saxtemun-e boland
if from side-EZ right **IMPF**-go-∅-2SG/ go-**PERF**-∅-2SG a building-EZ tall
mi-bin-∅-i,...
IMPF-see-PRES-2SG,...

if you go right, you will see a tall building,..

(22) *A: I hate Breaking Bad. What will change my opinion? B:...*

agar ghesmat-ha-ye badi-š ro {**be-bin**-i/ **#did**-i} ,
if episode-PL-EZ next-its RA **IMPF**-see-∅-2SG/ see.**PERF**-∅-2SG opinion-your
nazar-et avaz mi-šav-∅-ad.
change IMPF-become-PRES-3SG

If you see its next episodes, your opinion will be changed.

When it is the consequent which provides the answer to QUD, the perfective conditional becomes acceptable. For instance, it is the consequent in (23) that provides a *yes* answer to the QUD. Therefore, both imperfective and perfective conditionals are felicitous.

(23) *A: Will you buy me chocolate? B:..*

agar {**be-rav**-am/ **raf-t**-am} maghaze, bara-t šokolat
if **IMPF**-go-∅-1SG/ go-**PERF**-∅-1SG store for-you chocolate
mi-xar-∅-am
IMPF-buy-PRES-1SG

if I go to the store, I will buy you chocolate.

3.1.3. (Un)embeddability

It has been shown that biscuit conditionals cannot be embedded under attitude verbs unless it is a speech act verb (Iatridou, 1991; Bhatt and Pancheva, 2006; Siegel, 2006; Scheffler, 2008; Rawlins, 2020).

(24) John says/*believes that if you're thirsty there is beer in the fridge.

The examples in (25) show that while perfective conditionals in Farsi cannot be embedded under attitude predicates like *think*, they are embeddable under a speech act verb like *say*.

(25) a. Talib fekr mi-kon-∅-ad ke agar zan-an-e afghan eteraz
Talib think IMPF-do.PRES-3SG that if woman-PL Afghan protest
{**be-kon-and/ #kar-d-and**}, koš-te mi-šav-and
IMPF-do-∅-3PL/ do.**PERF**.∅-3PL kill-PP IMPF-become-3PL
*Talib **thinks** if Afghan women protest, they will get killed.*

b. Talib mi-guy-∅-ad ke agar zan-an-e afghan eteraz {**be-kon-and/**
Talib IMPF-say.PRES-3SG that if woman-PL Afghan protest **IMPF**-do-∅-3PL/
kar-d-and}, koš-te mi-šav-and
do.**PERF**.∅-3PL kill-PP IMPF-become-3PL
*Talib **says** if Afghan women protest, they will get killed.*

Perfective conditionals can also be embedded under imperatives. Interestingly, as the example (26) illustrates, the imperfective conditional is infelicitous here.

(26) čatr be-yar ke agar baran {**amad/ #be-ay-ad**}, xis
umbrella IMPER-bring that if rain come.**PERF**.∅.3SG/ **IMPF**-come.∅.3SG wet
na-šav-i
NEG-become.∅-2SG
Bring an umbrella so that if it rains, you don't get wet.

3.2. Independence-based accounts of biscuit conditionals

The striking similarities between properties of biscuit conditionals and Farsi perfective conditionals raise two important questions: (1) what shared feature of these conditionals is responsible for their similarities? (2) what role does the perfective aspect play in expressing this feature?

Independence-based accounts of biscuit conditionals, as discussed by Franke (2007, 2009); Van Rooij (2007); Sano and Hara (2014); Biezma and Goebel (2018, 2023), provide an insightful perspective for addressing the first question. Assuming a standard semantics for both biscuit and hypothetical conditionals, the key idea of these accounts is that the biscuit interpretation arises from pragmatic reasoning about the relevance of conditionals in face of the independence between antecedent and consequent. These accounts diverge in their characterization of the independence. I will adopt the conceptual framework introduced by Biezma and Goebel (2023), which distinguishes between the two notions of independence: (i) *informational independence* (referred to as *epistemic independence* by Franke (2009)) and (ii) factual independence.

The informational independence, which is formally defined (27), refers to the relationship between two propositions, ϕ and ψ, in a context set *Cs* whereby the context set can be updated with any logically possible conjunction of these propositions and their negations.

(27) **Informational independence**
Let W be a set of possible worlds and ϕ, $\psi \subseteq W$, i.e. ϕ , ψ are propositions, X and Y variables over propositions and σ an information state, a set of possible worlds. Propositions ϕ and ψ are *orthogonal/ informationally independent* iff $\forall X \in \{\phi, \overline{\phi}\}, \forall Y \in \{\psi, \overline{\psi}\}$: if $\Diamond_\sigma X$ and $\Diamond_\sigma Y$, then $\Diamond_\sigma(X \cap Y)$ where $\Diamond_\sigma P$ is shorthand for $P \cap \sigma \neq \emptyset$, i.e., compatibility of P and the information state σ .
Biezma and Goebel (2023) adapted from Franke (2009)

The factual independence between two propositions, in contrast, is determined on the basis of law-like generalizations that hold among facts in the actual world. Such law-like dependencies among facts have been argued to play a crucial role in the interpretation of counterfactual conditionals (Kratzer 1981; Veltman 2005; Arregui 2011, among others). Biezma and Goebel (2023) formalize the notion of the factual independence in the premise semantics of Veltman (2005) and Arregui (2011). The technical details of this formal definition fall outside the scope of our current discussion. The importance of the account of Biezma and Goebel (2023) lies in explaining how the distinction between the factual independence and the information independence, together with assumptions about their interaction can account for the behavior of biscuit conditionals. Here, I present an informal overview of their proposal and discuss how it can be extended to explain properties of perfective conditionals in Farsi.

Biezma and Goebel (2023) take the context set includes participants' assumptions about facts in the actual world and generalization that hold among these facts. They propose that our assumptions about generalizations that hold among facts govern our information state. That is, if our assumptions about law-like generalizations rule out any factual dependencies between two propositions p and q, then updating the context set with the antecedent proposition p, cannot remove all not-q worlds. Consequently, given the definition of the informational independence in (27), the two factually independent propositions will necessarily be informationally independent. They refer to this intuitive constraint that governs the relationship between the two notions of independence as the *Mirror Constraint*, defined below.

(28) **Mirror Constraint (Biezma and Goebel, 2023)**
If two propositions are presupposed to be factually independent in *Cs*, then they cannot be informationally dependent in *Cs*.

Now let us see how this system explains the difference between biscuit and hypothetical conditionals with the help of an example by Biezma and Goebel (2023). Consider the conditional statement *If you like blue, the wedding dress is blue*. Imagine this is uttered in a context where it is presupposed that your color preferences and the color of the wedding dress are factually independent (for instance, because the wedding dress is already bought and its color cannot be changed). Given the the Mirror Constraint, updating the context with this conditional utterance cannot cannot give rise to informational dependence between the antecedent and consequent. (Biezma and Goebel, 2023) propose that the pragmatic strategy to avoid this mismatch between the Mirror Constraint and the update proposed by the if-construction is a strengthened update whereby all worlds in which the consequent is false are removed from the *Cs*. The result of this strengthened update is the consequent entailment. This accounts for the biscuit interpretation of this conditional.

Now assume the conditional *If you like blue, the wedding dress is blue* is uttered before the wedding dress is bought. Since the possibility of a factual dependency between your color preferences and the color of the wedding dress has remained open, the context set is compatible with learning that the antecedent and the consequent are informationally dependent. The conditional is interpreted as a hypothetical, without violating the Mirror Constraint.

Biezma and Goebel (2023) only consider cases where the factual independence between the antecedent and consequent is pragmatically presupposed, and the pragmatic strategy they propose suffices for such cases. This framework opens up two empirical questions: (1) can we find cases where the factual independence between the antecedence and consequent is semantically presupposed? (2) is there any other strategy available to resolve the mismatch between the Mirror Constraint and uttering an if-construction when the factual independence is presupposed?

I believe that perfective conditionals in Farsi provide an affirmative answer to both of these questions. In the next section, I provide denotations of perfective and imperfective aspects that together with a standard Kratzerian semantics of conditionals explains why perfective conditionals presuppose that the antecedent and consequent are *factually* independent. I then propose that *speaker authority* is a conventional implicature that arises from the violation of the Mirror Constraint and the Cooperative Principle (Grice, 1975).

4. Proposal

The overarching goal of this paper is to derive the semantic and pragmatic differences between perfective and imperfective conditionals in Farsi from the semantics of these aspectual heads. This analysis also aims to provide an explanation for the observed similarities between Farsi perfective conditionals and biscuit conditionals. This proposal unfolds in three parts. First, I will provide my assumptions about semantics of conditionals, tense and aspect within Situation Semantics. Then, by characterizing the notion of factual independence within the lumping framework of (Kratzer, 1989), I argue that the factual independence is the semantic contribution of the perfective aspect in the antecedent. Lastly, building on insights from Biezma and Goebel (2023), I derive the performative flavor of perfective conditionals from pragmatic reasoning to maintain relevance in face of factual independence.

4.1. Theoretical assumptions: Situation semantics

I assume a standard Kratzerian view of conditionals, it then follows that the consequent cannot be according *if*-clauses to restrict the quantification domain of modals. Instead of quantifiers over possible worlds, in Situation Semantics modals are quantifiers over possible situations.

(29) $[\![\text{if p, q}]\!]^{c,g} = \forall s'[s' \leq w_s.\ p(s') \rightarrow \exists s''[s' \leq s''\ \&\ q(s'')]]$

In Mirrazi (2022, 2024), I put forth denotations for tense and aspectual heads that effectively capture their distributional patterns in Farsi. This section provides an overview of the proposal, focusing on aspects relevant to the current discussion, namely the semantics of perfective and imperfective aspect, as well as zero tense.

Propositions in the framework of situation semantics (Kratzer, 2023, 2012) are defined as the characteristic function of a set of situations, i.e. properties of situation. Some situations contain nothing that does not contribute to the truth of a given proposition. These are *exemplifying* situations of a proposition (Kratzer, 2023). The notion of *Exemplification* is defined below.

(30) A situation s **exemplifies** a proposition p if whenever there is a part of s in which p is not true, then s is a minimal situation in which p is true. (Kratzer 2023: p.23)

There are two ways for a situation s to exemplify p: (i) Either p is true in all subsituations of s, or (ii) s is a *minimal* situation in which p is true.

(31) A situation s is **a minimal situation** in which a proposition p is true ($p(s) = 1$) iff it has no proper parts in which p is true. This is represented with the notation $\downarrow p(s)$. (Kratzer 2023: p.24)

In line with the widely accepted view that that characterizes aspectual categories in terms of mereological notions like whole and part (e.g. Verkuyl 1972; Krifka 1992; Filip 1999), Mirrazi (2022, 2024) takes aspect to determine the structural properties of the situation under discussion. I follow Cipria and Roberts (2000) in adopting a situation semantic without explicit quantification over events in the object language. Taking events to be exemplifying situations (Kratzer, 2023), aspect will combine with a property of situations expressed by VP and introduces structural constraints on its exemplifying situations. Perfective aspect restricts the set of situations exemplifying the proposition expressed by its embedded VP to quantized minimal situations. Imperfective aspect, on the other hand, specifies that the set of situations exemplifying the proposition expressed by its embedded VP is a homogeneous set. The denotations of perfective and imperfective aspect are given below.[4]

(32) $[\![\text{PERFECTIVE}]\!]^{c,g} = \lambda P_{\langle s,t\rangle}.\ \lambda s.\ P(s) = 1\ \&\ \forall s'[\ s' \leq s\ \&\ P(s') = 1 \rightarrow\ s' = s]$

(33) $[\![\text{IMPERFECTIVE}]\!]^{c,g} = \lambda P_{\langle s,t\rangle}.\ \lambda s.\ \forall s'[s' \leq \text{s}\ \&$
there exists a contextually salient relation R such that $R(s)(s')$. $\rightarrow\ P(s') = 1]$[5]

Translating the presuppositional theory of tense (Heim, 1994) into the situation semantics, Mirrazi (2022, 2024) takes tense to introduce a presupposition about the value of a variable that ranges over situations. Thus, tense operates on an aspectual phrase in its scope which contains some situation variable s, and introduces a presupposition about the value of s. Zero tense does not introduce any deictic constraint on the situation they refer to (Kratzer 1998 and Arregui 2009). As (34) shows, the denotation of zero tense is simply an identity function.

(34) $[\![\emptyset]\!]^{g} = \lambda P_{\langle s,t\rangle}.\ P$

[4] I will summarize the denotation of perfective aspect as given below, where $\downarrow$ represents quantized situations (i.e. $\forall s'[\ s' \leq s\ \&\ P(s') = 1 \rightarrow\ s' = s$).

(1) $[\![\text{PERFECTIVE}]\!]^{c,g} = \lambda P_{\langle s,t\rangle}.\ \lambda s.\ \downarrow P(s) = 1$

[5] This denotation is adapted from the proposal by Cipria and Roberts (2000) and Arregui et al. (2014) who take the imperfective aspect to introduce a universal quantifier over situations.

Given that the zero tense does not introduce a topic situation, the antecedent of these conditionals denote a property of *exemplifying* situations. The absence of deictic tense in the antecedent of perfective conditionals plays a crucial role in my analysis. Deictic tenses introduce a topic situation that contains the exemplifying situation denoted by VP, along with a presupposition about its temporal location with respect to the utterance time. Therefore, tensed clauses do not necessarily denote properties of exemplifying situations.

Denotations of antecedents of imperfective and perfective conditionals are given in (35).

(35) a. $[\![[_{\text{TP}} \emptyset [_{\text{ASPP}} \text{IMPERFECTIVE} [_{\text{VP}} \text{P}]]]]\!]^{c,g} = \lambda s.\forall s'[s' \leq s \;\&\; \underline{\text{there exists a contextually salient relation } R \text{ such that } R(s)(s')} \rightarrow P(s') = 1]$

b. $[\![[_{\text{TP}} \emptyset [_{\text{ASPP}} \text{PERFECTIVE} [_{\text{VP}} \text{P}]]]]\!]^{c,g} = \lambda s. \downarrow P(s) = 1$ where $\downarrow$ represents minimal situations.

It is important to note that the denotation of imperfective in (33) is compatible with cases where the situation exemplifying a given proposition is a quantized one. When $s' = s$, it is true that for all situations s' that has a "part of" relation with s (where $R(s)(s')$ is an identity relation), $P(s')$ holds true. In other words, the denotation of imperfective entails that of perfective but the reverse entailment relation does not hold. Given the Gricean maxim of quantity, which requires participants to be maximally informative, the use of a weaker alternative implies that the speaker believes the stronger alternative does not hold true. In other words, there is at least some $s' \leq s$ such that $s' \neq s$ and $P(s') = 1$. This will be important in explaining the observation that imperfective conditionals are compatible with performative interpretations, and can make a biscuit conditionals.

4.2. Deriving independence from minimality

My goal here is to argue that the minimality constraint that perfective aspect puts on the value of the situation variable denoted by the antecedent is responsible for the factual independence between antecedent and consequent of perfective conditionals.

To characterize the notion of factual independence, I adopt the lumping framework of Kratzer (1989), according to which factual dependencies can be tracked on the basis of lumping relations between propositions. A proposition lumps another proposition in a world w in virtue of certain part-whole relationships holding between situations of w.

(36) For all propositions p and $q \in \mathbf{P}(S)$ and all $w \in W$: p lumps q in w iff (a) and (b):

a. $w \in p$

b. For all $s \leq w$ and $s \in p$, then $s \in q$ (Kratzer, 1989, 2012)[6]

The definition of factual independence within this framework is given in (37).

(37) For all propositions p and $q \in \mathbf{P}(S)$ and all $w \in W$: p is **factually independent** of q in w iff $w \in p$ and $\exists s : s \leq w$ and $s \in p$, and $s \notin q$).[7]

[6]Every situation that makes p true, contains a part that makes q true.

[7]There exists at least one situation that makes p true, but does not contain any part that makes q true.

Against this backdrop, we can see that exemplifying minimal situations, while easily lumped by other situations, are poor lumpers themselves. This is due to two factors: (i) they do not contain any sub-situations irrelevant to the truth of a proposition they exemplify (*exemplification*); (ii) they do not contain any proper sub-situations that make the proposition they exemplify true (*minimal situation*). I have argued that the antecedent of perfective conditionals in Farsi denote a property of exemplifying minimal situations where exemplification arises from the absence of deictic tense, and minimality is contributed by the semantics of the perfective aspect. Therefore, the antecedent cannot lump the consequent. It follows, then, that the they are factually independent. This explains why perfective conditionals are infelicitous in contexts where the consequent logically follows from the truth of the antecedent (see 3.1.1).

4.3. Deriving performativity from independence

Having established that the semantics of the antecedent of perfective conditionals results in factual independence between the antecedent and the consequent, I will now turn to pragmatically deriving the performative flavor of these conditionals. Borrowing the main insight Biezma and Goebel (2023), I argue that the speaker authority inference associated with perfective conditional is the pragmatic strategy to maintain the Cooperative Principle in face of the factual independence.

The perfective conditional semantically encodes the factual dependence between the antecedent and the consequent. After uttering the conditional, however, the antecedent and consequent propositions will not be informationally independent (learning the antecedent will lead to learning the consequent). This violates the Mirror Constraint. Biezma and Goebel (2023) argue that there are two options to overcome this violation: (i) interpreting the speaker as saying they don't indicating that they don't share the independence assumption represented in *Cs*, (ii) applying a strengthened update that does not lead to a problematic informational dependence in *Cs*. We have seen that the second option that is taken for interpreting biscuit conditionals results in consequent entailment. There are two reasons why adopting this option would fail to account for the behavior of perfective conditionals. Firstly, this strategy is not viable for (5) which is a conditional threat. Secondly, this cannot explain the difference between the perfective and imperfective biscuit conditionals (see the contrast in (11) and (12)). How about the option (i)? Note that the use of a perfective conditional, which signals the factual independence indicates that the speaker also share the independence assumption. I believe that there is a third option. We can conclude that the speaker is signaling that they have an authority to *build* a dependency between the two propositions by imposing a new law.

My proposal is that perfective conditionals, which semantically encoded factual independence, are conventionalized as a linguistic clue to signal that they are indirect speech acts. The pragmatic strategy used is similar to bald-face lies. Harris (2020) argues that "some bald-face lies are actually indirect speech acts wherein the speaker makes as if to assert something in order to indirectly accomplish some other conversational goal. By uttering something that is obviously false, and that would be obviously uncooperative if taken literally, the speaker manages to flout the maxim of quality and indirectly communicate something else."

Similarly, a speaker who uses a perfective conditional *lets shine through* that the antecedent and

the consequent are factually independent, and yet claims that they are informationally dependent. This is obviously contradictory and uncooperative if taken literally. Given the Cooperative Principle (Grice, 1975), the major underlying assumption that we make in a conversation is that all discourse participants are acting in a way to accomplish conversational goals. Assuming that the speaker knows that the addressee will not drop the Cooperative Principle in interpreting what they hear, they use a *bald-faced* contradiction to signal that the conditional utterance is actually an indirect speech act, and to produce the pragmatic effect of *speaker authority*.

Before ending this section, let us briefly discuss how this proposal can derive the differences between the imperfective and perfective conditionals in Farsi. Recall that the denotations of aspectual heads proposed by Mirrazi (2022, 2024) characterizes the imperfective as a weaker alternative to the perfective, as the denotation of imperfective asymmetrically entails that of perfective. Therefore, we expect their distribution to be regulated by the pragmatic principle of Maximize Presupposition (Heim, 1991), defined in (38).

(38) **Maximize Presupposition**
If ϕ and ψ are contextually equivalent alternatives, and the presuppositions of ψ are stronger than those of ϕ, and are met in the context of utterance, one must use ψ in c. (Heim, 1991)

Given the Maximize Presupposition, we can explain why in cases where signaling the speaker authority is needed to successfully perform the associated speech act, the use of the imperfective conditional is infelicitous. Examples of such cases include conditional imperatives, as in (3), and the use of biscuit conditionals as a genuine offer, as seen in (11).

5. Conclusion and future directions

In this paper, I have presented a novel pattern in which the presence of the perfective aspect in the antecedent of zero tense conditionals in Farsi results in performative interpretations. I have argued that the antecedent of perfective conditionals in Farsi denotes a property of exemplifying minimal situations, thereby establishing factual independence between the antecedent and the consequent. The performative flavor of perfective conditionals was then derived a pragmatic inference reasoning to maintain the Cooperative Principle in face of the factual independence. A strength of this proposal is that it groups Farsi perfective conditionals with other performative conditionals , i.e. biscuit conditionals, and it offers a principled and unified explanation for their shared properties. Providing evidence that the factual independence in conditionals can be linguistically encoded, this paper also highlights the central role of factual independence in performativity of conditionals.

A question that naturally arises: can we find counterparts of Farsi perfective conditionals in other languages? In exploring, it's crucial to remember that the perfective aspect alone may not be enough to convey factual independence. The absence of deictic tense is key here, as tensed clause do not necessarily denote properties of *exemplifying* situations.

As I conclude this paper, I would like to draw attentions to similarities between Farsi perfective conditionals and conditional conjunctions of the form *Imperative and Declarative (IaD)*

in English. It appears that declaratives in the second conjunct of IaDs, like the consequent proposition in Farsi perfective conditionals, have performative interpretations.

von Fintel and Iatridou (2017) distinguish between two kinds of readings of IaDs: (i) endorsing IaDs (e-Iad) which interpreted as coming with an endorsement from the speaker about the advisability of the imperative proposition in the first conjunct, as in (39a); (ii) non-endorsing IaDs (n-IaD) which do not come with such an endorsement, as (39b) and (39c).

(39) a. Study hard and you will pass the class. (e-IaD)
b. Ignore your homework and you will fail this class.(n-IaD)
c. Open the paper and you will find five mistakes on every page.(n-IaD)

Accounts of IaDs diverge with respect to whether or not they take imperatives to contribute their standard directive force. I will not discuss details of different analyses of IaDs here, I will just assume what is shared among these approach, which is the view that IaDs express conditional propositions (Russell, 2007; Kaufmann, 2012; von Fintel and Iatridou, 2017), and only mention their similarities with Farsi perfective conditionals.

von Fintel and Iatridou (2017) observe that IaDs cannot be embedded, which they take to pose a challenge for the view that take IaD to be conditional propositions. As we have seen, however, Farsi perfective conditionals and biscuit conditionals similarly resist embedding.

(40) a. *He doesn't believe that ignore your homework and you will fail.
b. *He doesn't believe that study and you will succeed.

Moreover, a deontic modal in the second conjunct of IaDs necessarily has a performative interpretation. It cannot be interpreted as a mere description of an obligation. The examples in (41) show that IaDs are infelicitous with continuation in which the speaker conveys that they do not endorse the obligation in the second conjunct.

(41) a. Get a ticket, and you should pay it. #But I really don't want you to pay.
b. Get into a PhD program, and you should study hard. #But I think you'll be fine even without studying hard.

Finally, like Farsi perfective conditionals, IaDs can only be felicitous when it can be interpreted as an authoritative claim. That is, the speaker is understood to claim that they *know* (as opposed to merely believe) that the conditional holds. Thus, the truth of their statement cannot be denied with *That's not true*. Instead, the IaD claims can be challenged by asking the speaker to justify the source of their knowledge, with *How do you know?*.

(42) a. A: Throw that coin, and it will come up heads.
b. B: #That's not true. It may come up tails.
c. B: ✓How do you know?

While further research is needed, it seems to me that IaDs might be the counterpart of Farsi perfective conditionals. Interestingly, as reported by von Fintel and Iatridou (2017), Farsi lack IaD constructions. I will leave this as a topic for future exploration.

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Polar particles in Farsi: Anaphora in the scoreboard model of discourse[1]

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Abstract. Cross-linguistically, polar particles can be used in two readings: *polarity* and *conformity*. In response to positive polar questions/assertions, the two readings of each particle generate the same proposition. However, in response to negative initiatives, they lead to ambiguity (Krifka, 2013; Roelofsen and Farkas, 2015; Geist and Repp, in press). In this paper, we investigate the reading(s) of the particles *âre* 'yes' and *na* 'no' in Farsi for five types of initiatives: (i) positive assertions, (ii) negative assertions, (iii) negative polar questions (NPQs), (iv) biased negative questions with the discourse particle *dige* (*dige*-NPQs) and (v) tag questions (TQs). Based on the distribution of readings, we argue that different readings of polar particles react to propositions placed in different compartments of the Scoreboard Model representation.

Keywords: Polar particles, bias implicature, anaphoricity, discourse model.

1. Introduction

Pope (1976) highlights that across languages, polar particles (PolPrts) can serve two distinct functions. They may signal whether a response is positive or negative, known as the *polarity* reading, observed in Chinese. Alternatively, they can convey agreement or disagreement with an initiative (including both assertions and polar questions), termed the *conformity* reading,[2] as in Japanese. In certain languages, such as English and Farsi, the same particles can exhibit both readings. For example, in English, *Yes* can denote a positive response in the polarity reading or agreement with an initiative in the conformity reading. Similarly, *No* can express a negative response in the polarity reading or disagreement with an initiative in the conformity reading. In reactions to positive initiatives, the two readings of each PolPrts converge in the same proposition, as in example (1); but, in responses to negative initiatives, the two readings come apart and lead to different propositions, as in (2).

(1) A: Did John come to the party?
B1: Yes, he did. Polarity[Positive]/Conformity[Agreement]
B2: No, he didn't. Polarity[Negative]/Conformity[Disagreement]

(2) A: Did John not come to the party?
B1: Yes, he DID. Polarity[Positive]
B2: Yes, he didn't. Conformity[Agreement]
B3: No, he DID. Conformity[Disagreement]
B4: No, he didn't. Polarity[Negative]

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[2]This reading is commonly referred to as the *truth-based* or *(dis)agreement* reading. However, the term "truth-based" might imply that the other reading does not involve truth values, while "(dis)agreement" can be confusing due to the *agreement* and *disagreement* feature values. For the sake of clarity, we call it the *conformity* reading.

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Note that the acceptability of different answers to negative initiatives may vary among speakers (in different languages). However, the presence of prosodic saliency, presented in CAPS in (2.B1, B3), enhances the acceptability of particular answers (see Goodhue and Wagner, 2018).

Moreover, while PolPrts often accompany a short answer, namely the *prejacent* (e.g., *he did* in the above examples), they can also occur in isolation, leading to ambiguity as in (3):

(3) A: Did John not come to the party?
B1: Yes. meaning '*he did*' or '*he didn't*'
B2: No. meaning '*he did*' or '*he didn't*'

Such responses raise a question regarding the source of ambiguity in (bare) PolPrts.[3] While some (syntactic-based) accounts reject the ambiguity in examples like (3) (see §2.1), the possibility of different propositions with the same particle in (2) is explained as a kind of relation between the particle and the polarity projection of the prejacent. Generally, one group claims that the ambiguity lies in the antecedent, suggesting that negative initiatives offer two possible antecedents (Ginzburg, 1997; Krifka, 2013; Holmberg, 2013); while the other group places the burden on the particles, indicating different features (Pope, 1976; Kramer and Rawlins, 2009; Roelofsen and Farkas, 2015).

In this paper, we investigate PolPrts *âre* 'yes' and *na* 'no' in Farsi, which have both polarity and conformity readings. We examine their reading distribution in five environments: as declarative responses (i) to positive assertions, (ii) to negative assertions, (iii) to negative polar questions (NPQs), and (iv) to biased negative polar questions with the discourse particle *dige* (*dige*-NPQs), and (v) as constitutive part of the tag in tag questions (TQs). As we will see, the data from Farsi contribute two noteworthy points to the existing literature. Firstly, for declarative responses to different initiatives, they highlight the significance of bias in the initiative when determining the preferred PolPrts reading. Secondly, we will address the lack of ambiguity – which we refer to as *unambiguity* – and meaning of Farsi PolPrts when used in the tag of TQs. This fifth environment has so far remained largely unexplored in the PolPrts literature (but see e.g. Servidio, 2014).

In a nutshell, the proposed analysis has the following tenets. First, PolPrts in Farsi are lexically ambiguous between the polarity and the conformity readings. Second, initiatives – including here assertions/questions and the declarative part of a TQ – introduce propositional discourse referents (DRs) which, using the Scoreboard Model of discourse (Farkas and Bruce, 2009), are presented as issues to be discussed and/or as speaker (actual or tentative) commitments. Third, PolPrts are anaphoric to these DRs but, crucially, they look for their DR in different "compartments" of the Scoreboard representation depending on the reading.

This paper is organized as follows. In the next section, we will review the literature on PolPrts. Section 3 presents the core data of PolPrts from Farsi both in declarative responses and in TQs. In Section 4, we present our analysis of the data, developing our account in three main steps. We first define basic lexical entries for *âre* 'yes' and *na* 'no' in their two readings, then we minimally extend the Scoreboard Model of discourse, and finally we enrich our lexical

[3]What we (and many researchers) refer to as *ambiguity* is referred to by different terms in the literature, such as *multifunctionality*, *negative neutralization*, or *interchangeability*, all of which roughly describe the ability of PolPrts to precede both positive and negative prejacents as in (2).

entries by making them sensitive to different components of the Scoreboard representation. The account is subsequently applied to the data. Section 5 discusses an open issue relating to PolPrts in Farsi alternative questions. Section 6 concludes.

2. Previous Accounts

A substantial body of literature has been dedicated to the investigation of polar particles, particularly to their usage in declarative statements as reactions to assertions and as responses to polar questions (PQs). Broadly speaking, the existing accounts can be categorized into two main perspectives: syntactic and semantic, each aiming to address the underlying structure and the ambiguity puzzle associated with PolPrts. In this section, we will review three primary studies: one syntactic approach (Kramer and Rawlins, 2009) and two semantic approaches (Krifka, 2013; Roelofsen and Farkas, 2015).

2.1. Polarity Interpreters

Kramer and Rawlins (2009) introduce PolPrts as adverbial response markers, which adjoin to a (higher) polarity projection ΣP of their prejacent with a TP complement, as in (4) (see also Holmberg, 2013). Note that in this model the prejacent always exists but it can be fully or partially elided. Following Merchant (2005), the prejacent is licensed to be elided by the $[E]$ feature, which requires semantic identity between prejacent and antecedent.[4]

(4) $[_{\Sigma P}\ [_{AdvP}\ Yes/No]\ [_{TP}\ [_{\Sigma P}\ ]\ ]\ ]$

According to this approach, PolPrts serve as polarity interpreters of their propositional prejacent. Kramer and Rawlins propose that *Yes* has no polarity feature [∅] to mark, while *No* carries a *Negative* [NEG] feature. Moreover, they argue that the particle *No* establishes a negative concord relation with the remaining polarity projections, where only one of the negations in the chain can be interpretable [iNEG] and the rest are uninterpreted [uNEG]. This explains why *No* can co-occur with sentential negation (e.g., *No, he didn't*) without resulting in double negation in standard English. Moreover, in response to negative initiatives like (5), the authors reject the possibility of a positive answer with bare PolPrts as in (B1)–(B2) due to the identity failure. They present (B3)–(B4) as the only answers, where the prejacents are identical to the antecedent.

(5) A: Did he not come? $[_{TP}$ He $[_{\Sigma P[iNEG]}$ didn't come $]]$

B1: #Yes. (meaning 'he did.')
$[_{\Sigma P}$ Yes $[_{\Sigma P_{[E]}}$ ~~$[_{TP}$ he $[_{\Sigma P}$ came $]]$~~ $]]$ ✗ Identity failure

B2: #No. (meaning 'he did.')
$[_{\Sigma P}$ No $[_{\Sigma P_{[E]}}$ ~~$[_{TP}$ he $[_{\Sigma P}$ came $]]$~~ $]]$ ✗ Identity failure

[4]Note that Kramer and Rawlins (2009) follow the PF-Deletion view of the ellipsis (Chao, 1988; Merchant, 2005).

B3: Yes. (meaning 'he didn't.')
$[_{\Sigma P}$ Yes$_{[\emptyset]}$ $[_{\Sigma P_{[E]}}$ $[_{TP}$ he $[_{\Sigma P_{[iNEG]}}$ didn't come]]]]

B4: No. (meaning 'he didn't.')
$[_{\Sigma P}$ No$_{[uNEG]}$ $[_{\Sigma P_{[E,uNEG]}}$ $[_{TP}$ he $[_{\Sigma P_{[iNEG]}}$ didn't come]]

Kramer and Rawlins argue that *Yes* and *No* can serve as a polarity interpreter of a positive answer to negative questions only when the prejacent is uttered. *Yes*, as a featureless particle, can easily be followed by an explicit prejacent, as shown in (B5) below. However, for *No* followed by an explicit positive prejacent, the authors introduce a lexically different *Reversal-No*, as in in (B6) (for details see Kramer and Rawlins, 2009):

(5) B5: Yes, he DID. $[_{\Sigma P}$ Yes$_{[\emptyset]}$ $[_{TP}$ he did $[_{vP_{[E]}}$ come]]]
B6: No, he DID. $[_{\Sigma P}$ No$_{[REV]}$ $[_{TP}$ he did $[_{vP_{[E]}}$ come]]]

2.2. Salient Discourse Referents

Krifka (2013) defines PolPrts as propositional proforms that are anaphoric to a salient antecedent (cf. *propositional lexemes* in Ginzburg and Sag, 2000). He argues that sentential negation makes available two propositional discourse referents (DRs): a negative DR_1 expressed by *NegP* and a positive DR_2 expressed by TP, as illustrated in (6):

(6) He didn't come.
$[_{ActP}$ [ASS] $[_{NegP_{\rightarrow DR1}}$ He$_1$ didn't$_2$ $[_{TP_{\rightarrow DR2}}$ t_1 t_2 $[_{vP}$ come.]]]]

The author defines the particle *Yes* as an identity function taking a DR as input and returning the same DR as output, while *No* negates its input. Additionally, Krifka claims that, in English, PolPrts include a speech act component in their semantic meaning, leading to the lexical entries in (7)–(8). This explains why they cannot be used in embedded positions. In other languages such as German and French, PolPrts do not include a speech act layer, thus allowing for embedding.

(7) $[\![[_{ActP}$ yes] $]\!]$ = ASSERT(p)

(8) $[\![[_{ActP}$ no] $]\!]$ = ASSERT(¬p)

Krifka proposes that PolPrts can freely refer to propositional DRs made available by the antecedent. Thus, in response to negative initiatives like (6), bare particles in principle result in ambiguity: *Yes* can stand for a positive or a negative response, and so can *No*, as shown in (9):

(9) B1: Yes. $= [\![[_{ActP}$ yes$_{\rightarrow DR_2}$ $]\!]$ = ASSERT(DR$_2$) (meaning 'he did.')
$= [\![[_{ActP}$ yes$_{\rightarrow DR_1}$ $]\!]$ = ASSERT(DR$_1$) (meaning 'he didn't.')
B2: No. $= [\![[_{ActP}$ no$_{\rightarrow DR_2}$ $]\!]$ = ASSERT(¬ DR$_2$) (meaning 'he didn't.')
$= [\![[_{ActP}$ no$_{\rightarrow DR_1}$ $]\!]$ = ASSERT(¬ DR$_1$) (meaning 'he did.')

To derive the optimal particle in ambiguous cases, Krifka proposes two constraints penalizing the selection of **NonSalient* and **DisAgreement* discourse referents, respectively. The first

constraint is a general principle of anaphora resolution, which ensures that the most prominent DR is chosen. According to Krifka (2013), in “typical cases", a negative antecedent occurs in a context where the positive proposition is already salient, making the positive DR the optimal choice. At the same time, he acknowledges the possibility of contexts in which the negative proposition is the most salient one (see Krifka, 2013:p. 14). The second constraint is grounded in the inherent semantic/discourse difficulty associated with the process of disagreement. It suggests that accepting someone's proposal is typically an easier process compared to rejecting it (Farkas and Bruce, 2009). The author suggests that the constraints have different costs, with violating *DISAGR resulting in a higher penalty compared to violating *NONSAL. Speakers are expected to choose the particle with the lesser penalty for the intended meaning (see Krifka, 2013: p. 13, for the optimal particles).

2.3. Feature Markers

Another group of studies focusing on the anaphoric reading of polar particles attribute the ambiguity to the particles themselves rather than to the choice of the antecedent. Pope (1976) introduces two reading systems: the *polarity*-reading in which PolPrts mark the answer as a positive or negative form, and the *conformity*-reading in which PolPrts are in agreement or disagreement with the initiative. She proposes that languages employ either one of these systems or a combination of features. Farkas (2011) extends her proposal to analyze English and Romanian particles within the Scoreboard Model of discourse by Farkas and Bruce (2009).

Roelofsen and Farkas (2015) further develop the account using Inquisitive Semantics (*InqSem*). They capture the most highlighted/salient proposition in various types of initiatives. InqSem has the advantage of treating both declaratives and polar questions similarly as sets of propositions, with declaratives denoting a singleton set and polar questions denoting a binary set consisting of positive and negative propositions. In both types, the uttered proposition is the highlighted one. The authors propose two polarity features: the *Absolute* feature with $[+,-]$ values and the *Relative* feature with [agree, reverse] values. They suggest that PolPrts in English mark disjunctive features, in which the particle *Yes* can mark the answer as positive or as agreeing with the initiative, while the particle *No* can mark the answer as negative or as disagreeing with the initiative. Thus, the ambiguity of PolPrts arises from their dual role in feature marking.

(10) A: Did John not come?
$\{\lambda w.come_w(j), \lambda w.\neg come_w(j)\}$, where $\lambda w.\neg come_w(j)$ is highlighted

B1: Yes.	B2: No.
$\text{Yes}_{[Reverse,+]}$ = he did.	$\text{No}_{[Reverse,+]}$ = he did.
$\text{Yes}_{[Agree,-]}$ = he didn't.	$\text{No}_{[Agree,-]}$ = he didn't.

Furthermore, the account aims to predict the optimal PolPrt for each answer by applying different constraints. Following Pope (1976), polarity features exhibit markedness in terms of semantic difficulty, where positive/agreement features are considered less marked ($<$) compared to negative/reverse ones, as the latter are semantically more challenging. Building on

that, Roelofsen and Farkas (2015) offer the following markedness scale, in which some feature combinations are less marked than others (see *natural classes* in Roelofsen and Farkas, 2015).

(11) **Overall markedness scale:** [Agree, +] < [Reverse, −] < [Agree, −] < [Reverse, +]

Roelofsen and Farkas also propose the *Realization Constraint*, which states the more marked a feature is, the stronger the pressure is to overtly realize it. Consequently, in ambiguous cases, there is a preference for realizing the marked feature over the unmarked one (for more discussions Roelofsen and Farkas, 2015, 2019).

3. Data from Farsi

In this section, we will see examples of *âre* 'yes' and *na* 'no' in Farsi in both polarity and conformity readings. Following Roelofsen and Farkas (2015), we represent the related readings with superscripts ^{Pos} and ^{Neg} for positive and negative features in the polarity reading, and ^{Agr} and ^{DAgr} for agreement and disagreement features in the conformity reading. When both features result in the same meaning, we present them together, separated by "/". When the reading is not clear, no superscription is provided. In the next subsections, we will present examples of PolPrts in responses to assertions (§3.1), in responses to simple polar questions and to biased polar questions with the discourse particle *dige* (§3.2), and in the tag of tag questions (§3.3).

3.1. PolPrts in Response to Assertions

Before providing the data, it is worth mentioning that in Farsi, declarative and interrogative forms share the same word order, with the distinction lying in the final falling (↘) and rising (↗) contour, respectively. In our examples, the intonation symbols will be omitted, and a full-stop (.) and question mark (?) will indicate the corresponding forms. Notably, akin to languages such as Italian and French (Servidio, 2014; Pasquereau, 2020), Farsi PolPrts can be employed in embedded positions. These positions include occurrences under predicates of speech and thought (e.g., *say* and *think*), within antecedent and consequent clauses of conditionals, and within coordination structures. However, the present paper confines its focus to the examination of reading constraints associated with PolPrts, avoiding the exploration of embedding positions. Note also that PolPrts can be used in bare form or followed by a short answer. In Farsi, the short answer consists of the main verb, carrying the polarity of the sentence.

Examples (12) and (13) exemplify canonical positive and negative assertions, respectively. Unambiguous interpretations emerge in responses to positive assertions like (12): *âre* signifies a positive response, while *na* denotes a negative response, irrespectively of the presence or absence of an explicit prejacent. In contrast, in reactions to negative assertions like (13), a certain degree of ambiguity is observed with bare particles (B1 and B4). Furthermore, the inclusion of overt prejacents shows that both positive and negative responses can be expressed with *âre* (B2 and B3) and with *na* (B5 and B6).[5] Additionally, it is crucial to acknowledge the potential

[5]Note that speakers may exhibit variations in their preference for a particular particle over the alternative.

impact of prosody on the acceptability and interpretation of particles, particularly in their bare form. For instance, in (13), both particles often bear focal stress when signaling a positive response, such as *they went*. Consequently, focal stress is expected on *âre* and *na* in (B2) and (B5), as well as in (B1) and (B4) when expressing a rejecting response (Mohammadi, 2023). For the sake of simplicity, focal stress is not explicitly marked here.

(12) A: danešjuhâ mehmuni raftand.
students party went
'The students went to the party.'
B1: *âre*$^{Pos/Agr}$.
yes
'Yes, they did.'
'Yes, they didn't.'
B2: *âre*$^{Pos/Agr}$ raftand.
yes went
'Yes, they did.'
B3: # *âre* na-raftand.
yes NEG-went
'Yes, they didn't.'
B4: *na*$^{Neg/DAgr}$.
no
'No, they didn't.'
'No, they did.'
B5: # *na* raftand.
no went
'No, they did.'
B6: *na*$^{Neg/DAgr}$ na-raftand.
no NEG-went
'No, they didn't.'

(13) A: danešjuhâ mehmuni na-raftand.
students party NEG-went
'The students did not go to the party.'
B1: *âre*.
yes
'Yes, they did.' (*âre*^{Pos})
'Yes, they didn't.' (*âre*^{Agr})
B2: *âre*^{Pos} raftand.
yes went
'Yes, they did.'
B3: *âre*^{Agr} na-raftand.
yes NEG-went
'Yes, they didn't.'
B4: *na*.
no
'No, they didn't.' (*na*^{Neg})
'No, they did.' (*na*^{DAgr})
B5: *na*^{DAgr} raftand.
no went
'No, they did.'
B6: *na*^{Neg} na-raftand.
no NEG-went
'No, they didn't.'

3.2. PolPrts in Response to Questions

Moving on to polar questions, examples (14) and (15) exemplify positive polar questions (PPQs) and (simple) negative polar questions (NPQs), respectively. Similar to assertions, in responses to PPQs the two readings lead to the same interpretation, while in responses to NPQs they lead to ambiguity. However, a closer look at the data reveals an interesting difference in reading preference: While the two readings are equally available in reactions to negative assertions like (13) above, the conformity reading is felt somewhat degraded (indicated by %) in responses to (simple) NPQs like (15):

(14) A: danešjuhâ mehmuni raftand?
students party went
'Did the students go to the party?'
B1: *âre*$^{Pos/Agr}$.
yes
'Yes, they did.'
'Yes, they didn't.'
B2: *âre*$^{Pos/Agr}$ raftand.
yes went
'Yes, they did.'
B3: # *âre* na-raftand.
yes NEG-went
'Yes, they didn't.'
B4: *na*$^{Neg/DAgr}$.
no
'No, they didn't.'
'No, they did.'
B5: # *na* raftand.
no went
'No, they did.'
B6: *na*$^{Neg/DAgr}$ na-raftand.
no NEG-went
'No, they didn't.'

(15) A: danešjuhâ mehmuni na-raftand?
students party NEG-went
'Did the students not go to the party?'
B1: *âre*.
yes
'Yes, they did.' (*âre*^{Pos})
%'Yes, they didn't.' (*âre*^{Agr})
B2: *âre*^{Pos} raftand.
yes went
'Yes, they did.'
B3: % *âre*^{Agr} na-raftand.
yes NEG-went
'Yes, they didn't.'
B4: *na*.
no
'No, they didn't.' (*na*^{Neg})
%'No, they did.' (*na*^{DAgr})
B5: % *na*^{DAgr} raftand.
no went
'No, they did.'
B6: *na*^{Neg} na-raftand.
no NEG-went
'No, they didn't.'

According to Pope (1976), languages exhibit a tendency to favor a specific reading based on the inherent bias embedded in their question forms. For instance, languages like Japanese, where polar questions convey the speaker's bias or anticipate a particular response, are more inclined to employ the conformity reading. Conversely, languages like Chinese with less explicit expectations for an answer tend towards the polarity reading. We argue that the split observed by Pope between languages may re-emerge within one and the same language – in this case, Farsi – when different types of initiatives are compared.

To see this, let us take a closer look at different negative polar question forms asking [$\neg p$?]. Consider the following minimal pair: Example (16) is a simple NPQ and example (17) is the same question with the discourse particle *dige*. Both forms imply speaker bias for the uttered proposition in the question (i.e., for $\neg p$), but the status of this bias differs between the two forms: Simple NPQs optionally exhibit bias, allowing the speaker to cancel it, whereas *dige*-NPQs obligatorily convey this bias due to the presence of the discourse particle *dige*. In response to both questions, (B1s) signify rejecting answers (p), while (B2s) denote accepting answers ($\neg p$), as made clear by the explicit prejacents:[6]

[6]As previously noted, PolPrts in rejecting answers often bear focal stress (Mohammadi, 2023). Notably, in examples (16) and (17), both particles in (B1) are equally expected to carry focal stress.

(16) A: Ali mehmuni na-raft? (simple NPQ)
Ali party NEG-went
'Did Ali not go to the party?'

B1: *âre*^{Pos} $\succ$ *na*^{DAgr} raft.
yes no went
'Yes $\succ$ No, he did.'

B2: *âre*^{Agr} $\prec$ *na*^{Neg}, na-raft.
yes no NEG-went
'Yes $\prec$ No, he didn't.'

(17) A: Ali mehmuni na-raft dige? (*dige*-NPQ)
Ali party NEG-went DIGE
'Did Ali not go to the party?' $\rightsquigarrow$ The speaker expects that Ali didn't go.

B1: *âre*^{Pos} $\approx$ *na*^{DAgr} raft.
yes no went
'Yes $\approx$ No, he did.'

B2: *âre*^{Agr} $\approx$ *na*^{Neg}, na-raft.
yes no NEG-went
'Yes $\approx$ No, he didn't.'

Interestingly, speaker judgments unveil a notable asymmetry. In the case of responses to simple NPQs like (16), the conformity reading of PolPrts, denoted by *na*^{DAgr} in (B1) and *âre*^{Agr} in (B2), exhibits lower acceptability ($\prec$) in comparison to the polarity reading, marked as *âre*^{Pos} and *na*^{Neg} in the examples. In contrast, in reaction to *dige*-NPQs like (17), the acceptability of PolPrts in the conformity reading improves to the extent that both readings are nearly equally acceptable ($\approx$) and register high levels of acceptability. The observed contrast, which has found additional validation through experimental data (Mohammadi, to appear a),[7] is summarized in (18):

(18) **Bias Observation:** The polarity reading of PolPrts consistently receives high acceptability in response to simple and *dige*-NPQs. However, the conformity reading of PolPrts varies from degraded acceptability in response to simple NPQs, which can but need not convey bias, to high acceptability in response to *dige*-NPQs, which mandatorily convey bias.

This observation underscores the influence of bias in the initiatives on the reading preference for response PolPrts, much in the spirit of Pope (1976).

3.3. PolPrts in Tag Questions

PolPrts have been extensively studied in declarative responses to different initiatives. However, their role in building questions remains largely unexplored. Tag questions (TQs), characterized by a declarative anchor followed by an interrogative tag, can be built in Farsi using the bare polar particles *âre* and *na* in the tag. The tag component can follow either a positive anchor, exemplified in (19) and (21), or a negative anchor, as illustrated in (20) and (22). Given that the anchor serves as the highlighted antecedent, PolPrts in (20) and (22) with a negative antecedent

[7] In Mohammadi (to appear a)'s study, *dige*-NPQs are labelled as 'strongly biased' in that the implication of bias is strong and hence cannot be cancelled, and simple NPQs are labelled as 'weakly biased' in that the implication of bias is weak and thus can be cancelled.

are anticipated to yield different propositions in the tag, potentially introducing ambiguity. However, TQs in Farsi are not ambiguous. Instead, the intuition of native speakers is that *âre*-tags like (19) and (20) consistently convey the speaker's higher certainty or confidence in the anchor, whereas *na*-tags like (21) and (22) invariably indicate a lesser degree of certainty.

(19) Ali mehmuni raft, *âre*?
Ali party went yes
'Ali went to the party, didn't he?'

(20) Ali mehmuni na-raft, *âre*?
Ali party NEG-went yes
'Ali didn't go to the party, did he?'

(21) Ali mehmuni raft, *na*?
Ali party went no
'Ali went to the party, didn't he?'

(22) Ali mehmuni na-raft, *na*?
Ali party NEG-went no
'Ali didn't go to the party, did he?'

Note that judgments regarding the degree of confidence for each particle remain consistent irrespective of the polarity of the anchor. In other words, whether the speaker's belief in the anchor pertains to a positive or negative proposition, *âre*-tags consistently convey a higher credence in the anchor proposition while *na*-tags consistently signal lower credence (for *credence*, see Farkas and Roelofsen, 2017). The question is, which reading PolPrts unambiguously have in TQs so that the observed credence effects are derived.

Before addressing this question, we introduce the concept of Relational Attitude in (23). The fundamental idea is that, when the propositions in the assertive anchor and in the question tag share the same polarity, the question reflects the speaker's high confidence, as she is simply seeking confirmation of her original belief in the anchor; when the polarity of the anchor and the tag are reverse, the question reflects lesser confidence, as the speaker is considering an alternative to the anchor proposition (Mohammadi, to appear b):

(23) **Relational Attitude:** Let ϕ be a positive or negative proposition
- The question $[\phi, \phi?]$ indicates that the speaker has high credence in the anchor.
- The question $[\phi, \neg\phi?]$ indicates that the speaker has lesser credence in the anchor.

Equipped with this notion, let us see which of the two readings – polarity or conformity – can derive the degree of credence in examples (19)–(22). We start with the polarity reading. Are^{Pos} and na^{Neg} consistently yield positive and negative propositions, respectively. That is, regardless of the polarity of the antecedent, $\hat{a}re^{Pos}$-tags function as PPQs, marked in grey in (19′)–(20′), while na^{Neg}-tags function as NPQs, marked in grey in (21′)–(22′). Following the Relational Attitude, *âre* is predicted to convey high and lesser credence in (19′) and (20′) respectively, while *na* is predicted to behave conversely in (21′) and (22′). These predictions do not align with the observed behavior of PolPrts.

(19′) Ali raft, *âre*?
Ali went yes
LF: Ali went, $\hat{a}re^{Pos}$ [Ali went]?
✓ Relational Attitude: high credence

(20′) Ali na-raft, *âre*?
Ali NEG-went yes
LF: Ali didn't go, $\hat{a}re^{Pos}$ [Ali went]?
✗ Relational Attitude: low credence

(21′) Ali raft, *na*?
Ali went no
LF: Ali went, na^{Neg} [Ali didn't go]?
✓ Relational Attitude: low credence

(22′) Ali na-raft, *na*?
Ali NEG-went no
LF: Ali didn't go, na^{Neg} [Ali didn't go]?
✗ Relational Attitude: high credence

Let us try now the conformity reading. On the one hand, $\hat{a}re^{Agr}$ consistently forms a question tag over the proposition found in the anchor. Based on the notion of Relation Attitude, this means that, both in (19″) and (20″), *âre*-tags signal high credence on the anchor proposition. On the other hand, na^{Agr} consistently builds a question tag over the negation of the anchor proposition. Hence, following the idea of Relation Attitude, *na*-tags signal lesser credence in the anchor both in (21″) and (22″). This correctly matches the observed behavior of PolPrts.

(19″) Ali raft, *âre*?
Ali went yes
LF: Ali went, $\hat{a}re^{Agr}$ [Ali went]?
✓ Relational Attitude: high credence

(20″) Ali na-raft, *âre*?
Ali NEG-went yes
LF: Ali didn't go, $\hat{a}re^{Agr}$ [Ali didn't go]?
✓ Relational Attitude: high credence

(21″) Ali raft, *na*?
Ali went no
LF: Ali went, na^{DAgr} [Ali didn't go]?
✓ Relational Attitude: low credence

(22″) Ali na-raft, *na*?
Ali NEG-went no
LF: Ali didn't go, na^{DAgr} [Ali went]?
✓ Relational Attitude: low credence

Finally, note that permitting both readings would lead to an ambiguity between high and lower credence interpretations in (20‴) and (22‴) below. Such ambiguity contradicts the attested behavior of the PolPrts.

(19‴) Ali raft, *âre*?
Ali went yes
LF1: Ali went, $\hat{a}re^{Pos}$ [Ali went]?
✓ Relational Attitude: high credence
LF2: Ali went, $\hat{a}re^{Agr}$ [Ali went]?
✓ Relational Attitude: high credence

(20‴) Ali na-raft, *âre*?
Ali NEG-went yes
LF1: Ali didn't go, $\hat{a}re^{Pos}$ [Ali went]?
✗ Relational Attitude: low credence
LF2: Ali didn't go, $\hat{a}re^{Agr}$ [Ali didn't go]?
✓ Relational Attitude: high credence

(21‴) Ali raft, *na*?
Ali went no
LF1: Ali went, na^{Neg} [Ali didn't go]?
✓ Relational Attitude: low credence
LF2: Ali went, na^{DAgr} [Ali didn't go]?
✓ Relational Attitude: low credence

(22‴) Ali na-raft, *na*?
Ali NEG-went no
LF1: Ali didn't go, na^{Neg} [Ali didn't go]?
✓ Relational Attitude: low credence
LF2: Ali didn't go, na^{DAgr} [Ali went]?
✗ Relational Attitude: high credence

To sum up section 3, Farsi polar particles display both polarity and conformity readings. The analysis of PolPrts in response to different initiatives reveals the following key findings: **(a)** PolPrts exhibit ambiguity in response to negative initiatives; **(b)** the polarity reading consistently maintains high acceptability across different types of initiatives; and **(c)** the acceptability

of the conformity reading is influenced by the bias of the initiative, with a higher acceptability observed for mandatorily biased initiatives. On the other hand, the examination of PolPrts in TQs yields the following results: **(d)** PolPrts in questions are unambiguous; **(e)** only the conformity reading accurately predicts the observed degree of credence.

4. The Proposal

Our proposed analysis unfolds in three steps. First, in §4.1, we offer the basic semantic denotations of Farsi PolPrts in both the polarity and conformity readings. These readings are defined within distinct lexical entries, treating PolPrts as propositional anaphoras as in previous approaches (Pope, 1976; Roelofsen and Farkas, 2015). Second, in §4.2, we introduce and minimally extend the Scoreboard model of discourse (Farkas and Bruce, 2009; Malamud and Stephenson, 2015), focusing on four types of initiatives: assertions, unbiased polar questions, biased polar questions, and anchors in TQs. Finally, in §4.3, we enrich the basic lexical entries of PolPrts by making them sensitive to the discourse status of the propositional discourse referents (DRs) introduced by the initiative. The idea is that the two PolPrts readings – the polarity reading and the conformity reading – seek a propositional DR in different "compartments" of the Scoreboard representation of the initiative. We will then show how (**I**) the role of bias in PolPrt reading preference in declarative responses (findings **(b)**-**(c)** above) and (**II**) the unambiguity and degree of credence of PolPrts in TQs (findings **(d)**-**(e)** above) stem from the availability of the right kind of DR in the Scoreboard representation of the initiative.

4.1. Basic Lexical Entries for Farsi PolPrts

In establishing PolPrts as propositional anaphoras, an exploration of their antecedents becomes imperative. Consistent with existing literature, PolPrts, akin to other anaphoric elements, make reference to the most salient or highlighted proposition in the context as their discourse referent. We follow in this respect the approach put forth by Roelofsen and Farkas (2015), who extensively delved into the concept of highlighted propositions across various types of initiatives within Inquisitive Semantics. Among other purposes, highlighting precludes PolPrts from being employed in response to *wh*-questions and alternative questions, as well as in out-of-the-blue contexts.

Couching their approach in the Distributive Morphology framework (Halle and Marantz, 1993), we saw that Roelofsen and Farkas treat PolPrts in English as expressing features disjunctively: *Yes* can mark an answer as a positive proposition or as agreeing with the initiative, while *No* can mark an answer as a negative proposition or as disagreeing with the antecedent. Our analysis of Farsi PolPrts aligns with the feature marker approach in spirit, but it follows Mohammadi (2022) in positing two separate lexical entries for each PolPrt. In other words, we define two lexical entries for *âre* 'yes' – $\hat{a}re^{Pos}$ and $\hat{a}re^{Agr}$ – and two lexical entries for *na* 'no' – na^{Neg} and na^{DAgr} –, hence rendering the PolPrts lexically ambiguous.

The proposed lexical entries are provided in (24). PolPrts function as identity functions with presuppositional conditions. The proposition to saturate the λp-slot is the prejacent following

the PolPrts, which we saw can appear overtly or elided. The anaphoric link is encoded in $g(i)$, which refers to the propositional DR highlighted by the initiative, as per Roelofsen and Farkas (2015). The functions $+$ and $-$ take a proposition p and return a truth value: $+p = 1$ iff p has positive polarity and $-p = 1$ iff p has negative polarity.[8]

(24) Lexical entries of PolPrts in Farsi: [To be revised]

a. $[\![\ \hat{\text{a}}\text{re}_i^{Pos}\ ]\!]^{w,g} = \lambda p : (p = g(i) \vee p = \neg g(i)) \wedge +p\ .\ p$

b. $[\![\ \text{na}_i^{Neg}\ ]\!]^{w,g} = \lambda p : (p = g(i) \vee p = \neg g(i)) \wedge -p\ .\ p$

c. $[\![\ \hat{\text{a}}\text{re}_i^{Agr}\ ]\!]^{w,g} = \lambda p : p = g(i)\ .\ p$

d. $[\![\ \text{na}_i^{DAgr}\ ]\!]^{w,g} = \lambda p : p = \neg g(i)\ .\ p$

In the polarity-reading entries (24a)–(24b), both PolPrts initially verify that the prejacent proposition and the DR $g(i)$ highlighted by the initiative are identical up to their polarity values (i.e., $(p = g(i) \vee p = \neg g(i))$). This is essential to prevent unrelated answers, as exemplified by *A: Did John come? B: #Yes, I am.* (cf. examples (89) and (90) in Farkas and Roelofsen 2017), while still allowing for coupling a prejacent and a DR that align in propositional content except for their polarity, thus enabling responses like *A: John did not come. B: Yes, he did*. Subsequently, $\hat{a}re^{Pos}$ and na^{Neg} require that their prejacent p exhibit positive and negative polarity, respectively. This way, the lexical entries guarantee that the polarity of $\hat{a}re^{Pos}$/na^{Neg} and of the prejacent p align, thereby preventing infelicitous answers such as *A: Did John come? B: #Yes, he didn't.*

In the conformity-reading entries (24c)–(24d), $\hat{a}re^{Agr}$ presupposes that the prejacent proposition p and the DR $g(i)$ are identical ($p = g(i)$), whereas na^{DAgr} presupposes that they are complementary ($p = \neg g(i)$).

All together, with these lexical entries, *âre* can exclusively accompany a positive (over or covert) prejacent in response to a positive initiative while it can escort either a positive or negative prejacent after a negative initiative. Similarly, *na* can only accompany a negative (overt or covert) prejacent in response to positive initiatives, while both positive and negative prejacents are acceptable with *na* in response to negative initiatives. Thus, the analysis so far aligns with the core data from Roelofsen and Farkas (2015).

But recall that, in addition, we need to derive two key aspects of PolPrts in Farsi: **(I)** the varying acceptability of PolPrt readings based on the bias of the initiative and **(II)** the unambiguity and degree of credence of PolPrts in TQs. To achieve this goal, we move to the next step of our proposal.

[8]See Roelofsen and Farkas (2015) p. 378 for a richer way to represent propositional content consisting of a pair $< [\![\phi]\!]^+, [\![\phi]\!]^- >$ which hosts a proposition derived from a positive structure as the first member of the pair and a proposition derived from a negative structure as the second member of the paper. For example, the positive sentence *John arrived* will have the pair representation $< \lambda w.\text{arrive}_w(\text{j}), \emptyset >$ while the negative sentence *John did not arrive* will be represented as $< \emptyset, \lambda w.\neg\text{arrive}_w(\text{j}) >$.

4.2. Discourse Referents of the initiative in the Scoreboard model

The second segment of our proposal capitalizes on the detailed representation of discourse as delineated by the Scoreboard model. Following Farkas and Bruce (2009), any stage of the discourse consists of a tuple including: the common ground, *CG* (Stalnaker, 2002); the *negotiation Table* as a stack of questions under discussion; the discourse commitments of the participants *A* and *B* in the conversation, represented by DC_A and DC_B; and the projected CG^* (they call it *projected set*). Adding the tentative *DC* of each participant, DC^*_A, DC^*_B, from Malamud and Stephenson (2015), we have the following schematic representation:

A	**Table**	**B**
DC_A		DC_B
DC^*_A		DC^*_B
$CG = \{...\}$	$CG^* = \{...\}$	

Table 1: Sample Scoreboard representation

According to Farkas and Bruce, conversational moves, including assertions and questions, denote functions from Scoreboard tuples to Scoreboard tuples. An Assertion $[\neg\phi.]$ by speaker A adds the proposition $\neg\phi$ to DC_A and the issue $\{\neg\phi\}$ to the negotiation *Table*, as in Table 2. An unbiased polar question $[\neg\phi?]$ adds the set containing $\neg\phi$ and its complement ϕ, i.e. $\{\neg\phi, \phi\}$, to the negotiation *Table*, as illustrated in Table 3. The effects on *CG* and CG^* defined by Farkas and Bruce (2009) are indicated in our tables but will not be relevant for our analysis.[9] Note that the uttered proposition, as the salient/highlighted one, is boldfaced in the Scoreboard representations (for saliency/highlighting see Krifka, 2013; Roelofsen and Farkas, 2015).

A	**Table**	**B**
DC_A $\neg\phi$	$\{\neg\boldsymbol{\phi}\}$	DC_B
DC^*_A		DC^*_B
$CG = \{...\}$	$CG^* = CG\overline{\cup}\{\phi\}$	

Table 2: Assertion $[\neg\phi.]$

A	**Table**	**B**
DC_A	$\{\neg\boldsymbol{\phi}, \phi\}$	DC_B
DC^*_A		DC^*_B
$CG = \{...\}$	$CG^* = CG\overline{\cup}\{\neg\phi, \phi\}$	

Table 3: Question $[\neg\phi?]$

Extending Malamud and Stephenson (2015)'s modeling of bias in TQs to bias in polar questions, we propose that $[\neg\phi$ *dige*?] signals that the speaker tentatively commits to $\neg\phi$. Thus, $[\neg\phi$ *dige*?] not only adds the issue $\{\neg\phi, \phi\}$ to the negotiation *Table*, but it also adds the proposition $\neg\phi$ that a speaker A signals a bias for to DC^*_A, as in Table 4:

A	**Table**	**B**
DC_A	$\{\neg\boldsymbol{\phi}, \phi\}$	DC_B
DC^*_A $\neg\phi$		DC^*_B
$CG = \{...\}$	$CG^* = CG\overline{\cup}\{\neg\phi, \phi\}$	

Table 4: *dige*-NPQs $[\neg\phi$ *dige*?]

A	**Table**	**B**
DC_A		DC_B
DC^*_A ϕ		DC^*_B
$CG = \{...\}$	$CG^* = \{...\}$	

Table 5: TQs $[\phi, ...?]$

[9] For the reader interested in CG^*, Farkas and Bruce (2009) argue that assertions, $[\phi.]$, project the confirmation of ϕ, while (default) PQs $[\phi?]$ project accepting and rejecting ϕ, representing as the future moves in CG^*. $CG\overline{\cup}X$ combines *CG* with the elements of set *X* pointwise and collects them into a set. That is, $CG^* = CG\overline{\cup}\{\neg\phi, \phi\}$ on e.g. Table 3 is simply a shorthand for $CG^* = \{CG \cup \{\neg\phi\}, CG \cup \{\phi\}\}$.

Finally, for TQs, we propose that the declarative anchor $[\phi]_{anchor}$ simply adds the proposition ϕ to DC_A^*, as in Table 5. Later, the tag will add the issue $\{\neg\phi, \phi\}$ to the negotiation *Table*. But, crucially, the parsing of the declarative anchor only adds a DR to DC_A^*, not to the *Table*.

4.3. Enriching the PolPrts lexical entries with Scoreboard sensitivity

We posit that the two readings of PolPrts – the polarity reading and the conformity reading – are anaphoric to DRs belonging to different parts of the Scoreboard representation of the initiative: PolPrts in the polarity reading pick up a DR from the negotiation *Table*, while PolPrts in the conformity reading pick up a DR from the $DC^{(*)}$, including current (*DC*) and tentative (DC^*) commitments. The rationale behind this distinction is that the polarity reading directly addresses the issue under negotiation and simply marks the polarity – positive of negative – of the proposition chosen to resolve the issue, while the conformity reading is a reaction to someone's (tentative) belief or commitment and signals agreement or disagreement with that commitment.

To implement this idea, we enrich our basic lexical entries with an additional presuppositional condition. In the polarity readings (25a) and (25b), PolPrts are anaphoric to a DR – *g(i)* in the lexical entries – that is on the negotiation *Table* of the initiative, marked as purple ϕ in our Scoreboard representations above. That is, $\hat{a}re_i^{Pos}$ and na_i^{Neg} presuppose that $g(i) \in Table$. In contrast, in the conformity readings (25c) and (25d), PolPrts are anaphoric to a DR $g(i)$ that is in the (current/tentative) $DC_A^{(*)}$ of the initiative, marked as orange ϕ in our Scoreboard representations. In other words, $\hat{a}re_i^{Agr}$ and na_i^{DAgr} presuppose that $g(i) \in DC^{(*)}$:

(25) Lexical entries of PolPrts in Farsi: [Final version]

a. $[\![\ \hat{a}re_i^{Pos}\ ]\!] = \lambda p : (p = g(i) \vee p = \neg g(i)) \ \wedge\ g(i) \in Table \ \wedge\ +p\ .\ p$

b. $[\![\ na_i^{Neg}\ ]\!] = \lambda p : (p = g(i) \vee p = \neg g(i)) \ \wedge\ g(i) \in Table \ \wedge\ -p\ .\ p$

c. $[\![\ \hat{a}re_i^{Agr}\ ]\!] = \lambda p : p = g(i) \ \wedge\ g(i) \in DC^{(*)}\ .\ p$

d. $[\![\ na_i^{DAgr}\ ]\!] = \lambda p : p = \neg g(i) \ \wedge\ g(i) \in DC^{(*)}\ .\ p$

Equipped with these enriched lexical entries, we are ready to derive the two main empirical facts from Farsi: **(I)** the effect of bias on reading preference, whereby the conformity reading exhibits high acceptability with mandatorily biased initiatives but lower acceptability when the bias is optional, while the polarity reading consistently remains highly acceptable, and **(II)** the unambiguity and degree of credence in TQs.

We start with the bias effect. First, with Assertions, both polarity and conformity readings are acceptable, given the presence of the required DRs on the *Table* and in the *DC*, respectively:

A	Table	B
$DC_A \quad \neg p$	$\{\neg p\}$	DC_B
DC_A^*		DC_B^*
$CG = \{...\}$	$CG^* = CG \cup \{\neg p\}$	

Table 6: Assertion $[\neg p.]$

(26) A: Ali didn't come.

B1: $\hat{a}re_i^{Pos} \approx na_i^{DAgr}$ he did.
yes no

B2: $\hat{a}re_i^{Agr} \approx na_i^{Neg}$ he didn't.
yes no

Second, *dige*-NPQs, characterized by obligatory bias towards a negative proposition, exhibit high acceptability for both readings, akin to assertions. The polarity reading is allowed because the intended DR is found on the *Table*, while the conformity reading is acceptable because, given that the initiative conveyed a bias, the desired DR is found in the DC^* as well:

A	Table	B
DC_A	$\{p, \neg p\}$	DC_B
DC_A^* $\neg p$		DC_B^*
$CG = \{...\}$	$CG^* = CG \cup \{p, \neg p\}$	

Table 7: *dige*-NPQs [$\neg p$ *dige*?]

(27) A: Did Ali not go *dige*?
B1: $\hat{a}re_i^{Pos} \approx na_i^{DAgr}$ he did.
yes no
B2: $\hat{a}re_i^{Agr} \approx na_i^{Neg}$ he didn't.
yes no

Finally, for simple NPQs [$\neg p$?], which optionally express bias for $\neg p$, the polarity reading is acceptable but the conformity reading is significantly degraded. We contend that this is due to the unclear status of the bias implication. On one hand, simple NPQs can convey bias for $\neg p$, expressing the speaker's tentative belief. This establishes the presence of a DR in DC_A^* and consequently permits the conformity reading in the PolPrts, much as in Table 7. On the other hand, there exists a more viable competitor, namely *dige*-NPQs, which is designed to convey this bias explicitly via *dige*. Therefore, the bias in simple NPQs is easily cancelable, leaving no DR in $DC^{(*)}$ in Table 8 and thus rendering the conformity reading unavailable. The unclear status of this bias in simple NPQs makes the conformity reading precarious and more variable among speakers, as some bias-sensitive speakers may accept conformity PolPrts in this situation while bias-insensitive speakers reject them.

A	Table	B
DC_A	$\{p, \neg p\}$	DC_B
DC_A^*		DC_B^*
$CG = \{...\}$	$CG^* = CG \cup \{p, \neg p\}$	

Table 8: NPQs [$\neg p$?]

(28) A: Did Ali not go?
B1: $\hat{a}re_i^{Pos} \succ na_i^{DAgr}$ he did.
yes no
B2: $\hat{a}re_i^{Agr} \prec na_i^{Neg}$ he didn't.
yes no

Taken together, the consistent acceptability of the polarity reading is attributed to the presence of the required propositional DR on the *Table* in all cases, whereas the variable acceptability of the conformity reading stems from the presence or absence of a DR in $DC^{(*)}$.

We come now to the unambiguity of PolPrts in TQs. We have argued that the negative anchor [$\neg\phi$] simply adds the proposition $\neg\phi$ to DC_A^*. This means that, when *âre* or *na* in the tag seeks a salient DR as antecedent, it finds one in DC^* but not on the *Table*, as in Tables 9 and 10. Thus, PolPrts in the tag can be used in the conformity reading as in (29.b)–(30.b) but not in the polarity reading as in (29.a)-(30.a). This derives the lack of ambiguity for PolPrts in TQs.

A	Table	B
DC_A		DC_B
DC^*_A $\neg p$		DC^*_B
$CG = \{...\}$	$CG^* = \{...\}$	

Table 9: TQs [$\neg p$, *âre*?]

(29) Ali didn't go, *âre*?

a. $[\![\ \text{âre}_i^{Pos}\ ]\!]$ ✗ No Referent
$= \lambda p : (p = g(i) \vee p = \neg g(i)) \wedge g(i) \in Table \wedge +p\ .\ p$

b. $[\![\ \text{âre}_i^{Agr}\ ]\!]$ ✓ Referent
$= \lambda p : p = g(i)\ \wedge\ g(i) \in DC^{(*)}\ .\ p$

c. $[\![$ Ali didn't go, âre_i^{DAgr}?$]\!]$ =
'Ali didn't go, did Ali not go?' ✓ High Credence

A	Table	B
DC_A		DC_B
DC^*_A $\neg p$		DC^*_B
$CG = \{...\}$	$CG^* = \{...\}$	

Table 10: TQs [$\neg p$, *na*?]

(30) Ali didn't go, *na*?

a. $[\![\ \text{na}_i^{Neg}\ ]\!]$ ✗ No Referent
$= \lambda p : (p = g(i) \vee p = \neg g(i)) \wedge g(i) \in Table \wedge -p\ .\ p$

b. $[\![\ \text{na}_i^{DAgr}\ ]\!]$ ✓ Referent
$= \lambda p : p = \neg g(i)\ \wedge\ g(i) \in DC^{(*)}\ .\ p$

c. $[\![$ Ali didn't go, na_i^{DAgr}?$]\!]$ =
'Ali didn't go, did Ali go?' ✓ Lower Credence

Additionally, we argued for the notion of Relational Attitude, which calculates the degree of credence in the anchor proposition based on the matching polarity of anchor and tag (high credence) vs. reverse polarity between anchor and tag (lower credence). Once we have secured the conformity reading for the PolPrts in the tag, the degree of confidence intuited by native speakers is automatically derived via the Relational Attitude: With $\hat{a}re^{Agr}$ the polarities of the anchor and tag match, leading to high credence as in (29.c); with na^{DAgr} the polarities of the anchor and tag are misaligned, resulting in lower credence as in (30.c).

To sum up section 4, after extending the Scoreboard model to reflect bias in polar questions and declarative anchors of TQs, we have defined the polarity and conformity readings of *âre* and *na* as sensitive to the Scoreboard representation of the initiative. The proposal correctly derives (**I**) the effect of bias on reading preference and (**I**) the unambiguity and credence of TQs.

5. Open Issue: Alternative Questions

Before concluding the paper, it is worth noting an unresolved puzzle regarding alternative questions (AltQs). In Farsi, *or-not*-AltQs like *Do you want coffee or not?* can be built by placing a PolPrts after the disjunction (PolPrts-AltQs). While *âre* is deemed unacceptable in such AltQs, as in (31) and (33), *na* is acceptable, albeit the formulation starting with a negative clause in (34) is slightly degraded compared to the formulation starting with a positive clause in (32):[10]

[10]The lower acceptability of (34) may be due to a ordering convention in *or-not*-AltQs/PolPrt-AltQs by which the positive structure tends to precede disjunction, as mentioned by Van Rooy and Šafářová (2003). Still, (34) becomes felicitous in a context where the speaker is challenged regarding whether Ali did not go, prompting the speaker to seek clarification. Importantly, *âre*-AltQs in the same context still lead to infelicity.

(31) # Ali raft yâ *âre*?
Ali went or yes

(32) Ali raft yâ *na*?
Ali went or no
'Did Ali go or not?'

(33) # Ali na-raft yâ *âre*?
Ali NEG-went or yes

(34) ? Ali na-raft yâ *na*?
Ali NEG-went or no
'Did Ali not go or did he?

The two readings of *na* in (34) with a negative antecedent (namely, the first disjunct) are expected to lead to two distinct propositions. However, (34) is not ambiguous. Let us try each reading in turn to see which one derives the correct results. In the polarity reading, $\hat{a}re^{Pos}$ in (31′.LF1) correctly produces a logically ill-formed question [p or p?], but $\hat{a}re^{Pos}$ in (33′.LF1) incorrectly derives the congruent form [$\neg p$ or p?]. Similarly, na^{Neg} in (32′.LF1) correctly yields the congruent form [p or $\neg p$?], yet in (34′.LF1) it wrongly leads to the illogical form [$\neg p$ or $\neg p$?]. In contrast, the conformity reading of both PolPrts accurately predicts the felicitous forms and identifies the infelicitous ones. Particle $\hat{a}re^{Agr}$ in (31′.LF2) and (33′.LF2) correctly yields illogical forms, while na^{DAgr} in (32′.LF2) and (34′.LF2) returns proper readings:

(31′) # Ali raft yâ *âre*?
Ali went or yes

LF1: Ali went or $\hat{a}re^{Pos}$ [Ali went] ✓
LF2: Ali went or $\hat{a}re^{Agr}$ [Ali went]? ✓

(33′) # Ali na-raft yâ *âre*?
Ali NEG-went or yes

LF1: Ali didn't go or $\hat{a}re^{Pos}$ [Ali went]?✗
LF2: Ali didn't go or $\hat{a}re^{Agr}$[Ali didn't go]?✓

(32′) Ali raft yâ *na*?
Ali went or no

LF1: Ali went or na^{Neg} [Ali didn't go]?✓
LF2: Ali went or na^{DAgr} [Ali didn't go]?✓

(34′) Ali na-raft yâ *na*?
Ali NEG-went or no

LF1: Ali didn't go or na^{Neg}[Ali didn't go]?✗
LF2: Ali didn't go or na^{DAgr} [Ali went]?✓

The unsolved puzzle concerns the justification of the conformity reading. In the case of TQs, PolPrts in the question tag could only have the conformity reading because the declarative anchor introduces a tentative commitment but not yet an issue. However, it is not clear how a tentative commitment to the first disjunct in an AltQ could be motivated, since AltQs typically signal a balanced belief and interest in the two disjuncts (Van Rooy and Šafářová, 2003). While we cannot offer a solution at this time, we would like to point out that there is a second way to form *or-not*-AltQs in Farsi, namely Verbal-AltQs, in which the predicate of the first disjunct is repeated in the reverse polarity in the second disjunct, as illustrated in (35)–(36):

(35) Ali raft yâ na-raft?
Ali went or NEG-went
Did Ali go or not?

(36) Ali na-raft yâ raft?
Ali NEG-went or went
Did Ali not go or did he go?

Notably, the disjuncts in Verbal-AltQs are parallel to what $\hat{a}re^{Pos}$ and na^{Neg} in the polarity reading would produce. This may have driven PolPrts-AltQs to specialize in the opposite reading,

i.e., in the conformity reading. We leave the investigation of the pragmatic properties of Verbal-AltQs vs. PolPrts-AltQs and their potential impact on PolPrts readings for future research.

6. Conclusion

This paper has examined polar particles in Farsi, *âre* 'yes' and *na* 'no', in their polarity and conformity readings. Our investigation includes their use in declarative responses to assertions and polar questions and in the formation of tag questions. The data from Farsi make a double contribution to the existing scholarship by shedding light on (**I**) the impact of bias on reading preferences in declarative responses and (**II**) the unambiguity and degree of credence in TQs. Our proposal is built in three steps. First, for each PolPrt, we define distinct basic lexical entries for each reading. Second, we minimally extend the discourse Scoreboard model by representing bias in polar questions and in the the declarative anchor of tag questions as tentative discourse commitments (DC^{*}). Finally, we argue that the two readings of PolPrts are anaphoric to discourse referents from different components of the Scoreboard representation of the initiative: The polarity reading requires an antecedent on the negotiation *Table* whereas the conformity reading seeks an antecedent in $DC^{(*)}$. The proposed sensitivity of PolPrts to the discourse status of the antecedent may inform further cross-linguistic explorations of PolPrts.

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Dynamics and alternatives of unconditionals[1]

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Abstract. The *indistinguishable participants* configuration, typically observed within conditional sentences, has motivated dynamic analyses of anaphora resolution. This study points out that the configuration is attested in *unconditionals* as well. We analyze these instances of indistinguishable participants by augmenting dynamic semantics to Rawlins' (2013) proposal for unconditionals, which utilizes Hamblinian alternative semantics. The result is a combination of dynamic semantics and update semantics. The success of the analysis provides further support for the combinatory system, which is independently motivated by Li (2021).

Keywords: alternative semantics, update semantics, unconditionals, Japanese.

1. Introduction and summary

Anaphora resolution in the so-called *bishop sentence* or *indistinguishable participants*, exemplified in (1), has been taken as a motivation to prefer dynamic analyses (Heim 1982; Kamp 1981; Groenendijk and Stokhof 1991; a.m.o.) over their major competitor, the *d*/*E*-type analysis (Cooper 1979; Heim 1990; Elbourne 2001, 2005; a.m.o.).

(1) If a bishop meets another bishop, he greets him.

The latter analysis claims, with some auxiliary assumptions with which we are not concerned with here,[2] that the pronouns *he*/*him* denotes *a unique bishop* in a (minimal) situation where the antecedent proposition is true. The analysis fails for no such uniqueness is established.[3] At least two bishops exist in the antecedent situation. The former, dynamic analysis, takes the pronoun as anaphoric to a *discourse referent* introduced by the indefinites in the antecedent. Since the two indefinites introduce distinct discourse referents, the pronouns can pick up one of them without any further assumptions.

This study concerns a variant of the indistinguishable participants, an instance observed within *unconditionals*. The Japanese sentence in (2) exemplifies it. Throughout this paper, anaphoric relation is explicated with superscript indices (for antecedents) and subscript indices (for anaphoric elements).

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[2]For example, Elbourne 2001 claims that *he* is decomposed into *he bishop* at an LF-syntax level, where *he* has the same denotation as *the* (requiring uniqueness) and the description *bishop* is deleted via NP-deletion.

[3]See, however, Elbourne (2016) for an attempt to overcome the problem outlined here. Evaluation of the attempt is beyond the scope of this paper.

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(2) ***Dare***^{x}*-ga hokano* ***dare***^{y}*-ni atte-mo,* ***soitu***$_{x}$*-wa* ***soitu***$_{y}$*-ni aisatu-suru.*
who-NOM other who-DAT meet-MO, s/he-TOP s/he-DAT greet-do.
Lit. 'whoever meets anyone else, s/he greets him/her.'

Rawlins (2013) proposes to analyze unconditionals with Hamblinian alternative semantics. The indistinguishable participants motivate to *dynamicize* the alternative-semantic analysis. The aim of this paper is to implement such dynamicization.

We propose that each propositional Hamblinian alternative is a *Context Change Potential* (CCP) (Heim 1982). The antecedent of an unconditional forms a set of CCPs. Each member of the set restricts the quantificational domain of the modal in the consequent (Kratzer 1986) via Pointwise Functional Application (PFA). The composition results in a set of conditionals. This set is universally quantified by a designated quantificational particle, realized as *mo* in Japanese. It requires every conditional in the set to be true, resulting in the meaning of unconditional. The resulting system is a version of alternative dynamic semantics independently motivated by Li (2021).

The rest of this paper is organized as follows. Section 2 sets up necessary backgrounds. Section 2.1 describes the static analysis of English unconditionals proposed by Rawlins (2013) and demonstrates that the analysis is applicable to the unconditionals in Japanese. Section 2.2 lays out an analysis of conditionals in update semantics, built on Groenendijk et al. (1996). Section 3 is the core of the paper. It illustrates how anaphora in (2) is resolved. Predictions, consequences, and remaining issues of the proposal are discussed in Section 4.

2. Background

2.1. Unconditionals in static semantics (Rawlins 2013)

In *alternative semantics* (Hamblin 1973 *et seq*), natural language expressions are translated into a *set* of the canonical denotation(s). A sentence *John is tall* is translated into a singleton set of a proposition (3a); a verb phrase *is tall* is into a singleton set of a predicate (3b); a noun phrase *John* is into a singleton set of an individual (3c). (3a) is obtained by composing (3b) and (3c) via PFA, defined as (4).[4]

(3) a. $[\![John\ is\ tall]\!] = \{\lambda w.T(\mathtt{j})(w)\}$
b. $[\![tall]\!] = \{\lambda x.\lambda w.T(x)(w)\}$
c. $[\![John]\!] = \{\mathtt{j}\}$

(4) *Point Wise Functional Application (PFA)*
if α and β are daughters of γ and $[\![\alpha]\!] \subseteq D_{AB}$ and $[\![\beta]\!] \subseteq D_A$ for some type A and B, then
$[\![\gamma]\!] = \mathrm{PFA}([\![\alpha]\!], [\![\beta]\!]) = \{Y \in D_B \mid \exists f \in [\![\alpha]\!] : \exists X \in [\![\beta]\!] : f(X) = Y\}$

Some expressions denote a non-singleton set. Wh-expressions are primary examples. *Who*, for example, denotes a set of (relevant) individuals. PFA lets *who is tall* be the set of propositions in (5b).

[4]Below, when no confusion arises, we omit the brackets in $T(\mathtt{j})(w)$ and simply notate as $T\mathtt{j}w$.

(5) a. $[\![\textit{who}]\!] = \{\mathsf{a}, \mathsf{b}, \mathsf{c}, \ldots\}$

b. $[\![\textit{who is tall(?)}]\!] = \{\lambda w.T\mathsf{a}w, \lambda w.T\mathsf{b}w, \lambda w.T\mathsf{c}w, \ldots\}$

Rawlins (2013) proposes to analyze unconditional with Hamblinian alternative semantics. There, an antecedent of unconditional denotes a set of propositions. Each member of the set restricts the quantificational domain of the modal in the consequent (Kratzer 1986). The result is a set of conditionals. This set is universally quantified, resulting in the intended meaning of unconditional.

Consider (6) for illustration. The antecedent α in (6a) denotes a set of alternative propositions. The set is non-singleton due to *whatever*: just like *who*, *whoever* also denotes a set of relevant individuals. The consequent β in (6b) denotes a singleton set whose sole member is the canonical denotation for conditional consequents. The function f is a *modal base* that takes a world and returns a set of propositions. The contents of the returned set vary depending on the flavor of the modality. Here we suppose *must* is epistemic, and $f(w)$ returns a set of propositions that the speaker believes. The intersection of the set, $\bigcap\big(f(w)\big)$, returns the set of worlds where every proposition believed by the speaker is true. This set is further intersected by p, which is saturated by the antecedent of the conditional. The quantification requires in every world w' where all the propositions that the speaker believes and p are true, the consequent is also true. α and β are composed by PFA as (6c), resulting in a set of conditionals. Informally, the set is equivalent to (6d). The set is universally quantified by a Hamblinian universal operator, defined as (7). The quantification results in an unconditional statement: for every individual x, if x tries to convince him, John argues harshly.

(6) [$_\alpha$ Whoever tries to convince him], [$_\beta$ John must argue harshly].

a. $[\![\alpha]\!] = \left\{ \begin{array}{l} \lambda w.\, \texttt{Alex\_tries\_to\_convince\_him}(w) \\ \lambda w.\, \texttt{Beth\_tries\_to\_convince\_him}(w) \\ \lambda w.\, \texttt{Chris\_tries\_to\_convince\_him}(w) \\ \qquad\qquad \vdots \end{array} \right\}$

b. $[\![\beta]\!] = \{\lambda p.\lambda w.\forall w' \in \bigcap\big(f(w)\big) \cap p\ [\texttt{John\_argues\_harshly}(w')]\}$

c. $\mathrm{PFA}([\![\alpha]\!], [\![\beta]\!]) =$

$$\left\{ \begin{array}{l} \lambda w.\, \forall w' \in \bigcap\big(f(w)\big) \cap [\lambda w''\texttt{Alex\_tries\_to\_convince\_him}(w'')] \\ \qquad\qquad [\texttt{John\_argues\_harshly}(w')] \\ \lambda w.\, \forall w' \in \bigcap\big(f(w)\big) \cap [\lambda w''\texttt{Beth\_tries\_to\_convince\_him}(w'')] \\ \qquad\qquad [\texttt{John\_argues\_harshly}(w')] \\ \lambda w.\, \forall w' \in \bigcap\big(f(w)\big) \cap [\lambda w''\texttt{Chrsi\_tries\_to\_convince\_him}(w'')] \\ \qquad\qquad [\texttt{John\_argues\_harshly}(w')] \\ \qquad\qquad\qquad \vdots \end{array} \right\}$$

d. $\mathrm{PFA}([\![\alpha]\!],[\![\beta]\!]) =$

$$\left\{\begin{array}{c} \textit{If Alex tries to convince him, John argues harshly} \\ \textit{If Beth tries to convince him, John argues harshly} \\ \textit{If Chris tries to convince him, John argues harshly} \\ \vdots \end{array}\right\}$$

e. $[\![\forall]\!]([\![(6a)]\!]) = \{\lambda w.\forall p \in [\![(6a)]\!]\ [p(w) = 1]\}$

(7) Hamblinian Universal Operator (Kratzer and Shimoyama 2002)
Where $[\![\alpha]\!]$ is a set of propositions,
$[\![\forall\alpha]\!] = \{\lambda w.\forall p \in [\![\alpha]\!]\ [p(w) = 1]\}$

Unconditionals in Japanese are constructed in the same way. Consider (8). The antecedent α contains a wh-indeterminate *dare* '*who*', which denotes a set of individuals (Shimoyama 2006). The particle ***mo*** is a morphological realization of the Hamblinian universal operator. The composition proceeds in the same way as in English. α denotes a set of propositions, each member of which is taken as an argument by the consequent via PFA. The result is a set of conditionals. *Mo* universally quantifies the set, resulting in an unconditional.

(8) [$_\alpha$ ***Dare***-*ga* *paati-ni* *kite*] -***mo*** [$_\beta$ *John-wa* *yorokobu*] .
who-NOM party-DAT come -∀ John-TOP happy
'Whoever comes to the party, John will be happy.'

2.2. Conditionals in update semantics

Resolving the indistinguishable participants in (2) calls for dynamicizing the analysis by Rawlins (2013). To pave the way for such dynamicization, this subsection describes the analysis of conditionals in update semantics (Groenendijk et al. 1996).

The primitive notions in update semantics are *possibilities* and *states*.

- A *possibility* i is a pair (g, w), g an assignment function, w a possible world.
- A *state* s is a set of possibilities.

Possible worlds are functions that assign each expression its extension in the worlds. Assignment functions g are partial functions from variables to individuals. The denotation of α in i, $i(\alpha)$, is defined as

- $i(\alpha) = w(\alpha)$ if α is a constant.[5]
  - $w(\alpha) \in D$ if α is an individual constant.
  - $w(\alpha) \in D^n$ is α is an n-place predicate.

[5] w in update semantics is information of, or a model of, the corresponding possible world. The worlds in the information state only project and describe the corresponding possible worlds and do not denote the possible worlds themselves. However, the possible worlds in static alternative semantics denote the worlds themselves just as a constant denotes an individual. That is, the ontological levels of these two "possible worlds" are different: The possible worlds in alternative semantics are entities in the object language, while w in update semantics is a symbol in the meta language. As far as no confusion arises, we use the same symbol for both (cf. Section 4.2).

- $i(\alpha) = g(\alpha)$ if α is a variable and is in the domain of g. Otherwise, $g(\alpha)$ is undefined.

Sentences are interpreted as *Context Change Potentials* (CCPs; Heim 1982). For any sentence S, we notate $[\![S]\!]$ for the canonical proposition denoted by S, and $[S]$ for the CCP specified by S. When no indefinites are involved, a CCP takes a state s and returns the maximal subset $s' \subseteq s$ such that $[\![S]\!]^i$ is true for every $i \in s'$. Below, we notate $s[\phi]$ for update of s by CCP $[\phi]$. $s[\phi][\psi]$ a shorthand form of $(s[\phi])[\psi]$.

Consider s_0 in (9) for some predicate P, for example. Each cell in the table represents a possibility. In the top left i_1, g_1 assigns a to x and only a is P in w_1. x is not in the domain of g_4, and the undefinedness of $g_4(x)$ is represented as $\uparrow$. Updating s_0 by CCP $[Px]$, $s_0[Px]$, results in s_1, where the grayed cell indicates that the possibility is excluded: $s_1 = \{i_1\}$. $i_2 - i_4$ are excluded because $[\![P(x)]\!]$ is not true w.r.t. these possibilities. Formally, $[Px]$ is translated as (10).[6]

(9)

s_0

$i_1 = (g_1, w_1)$ $g_1(x) = \mathsf{a}$ $w_1(P) = \{\mathsf{a}\}$	$i_2 = (g_2, w_2)$ $g_2(x) = \mathsf{a}$ $w_2(P) = \{\mathsf{b}\}$
$i_3 = (g_3, w_3)$ $g_3(x) = b$ $w_3(P) = \{\mathsf{a}\}$	$i_4 = (g_4, w_4)$ $g_4(x) = \uparrow$ $w_4(P) = \{\mathsf{b}\}$

$\xRightarrow{s_0[P(x)]}$

s_1

$i_1 = (g_1, w_1)$ $g_1(x) = \mathsf{a}$ $w_1(P) = \{\mathsf{a}\}$	$i_2 = (g_2, w_2)$ $g_2(x) = \mathsf{a}$ $w_2(P) = \{\mathsf{b}\}$
$i_3 = (g_3, w_3)$ $g_3(x) = \mathsf{b}$ $w_3(P) = \{\mathsf{a}\}$	$i_4 = (g_4, w_4)$ $g_4(x) \uparrow$ $w_4(P) = \{\mathsf{b}\}$

(10) $[Px] \rightsquigarrow \lambda s_s.\{i \mid i \in s \;\&\; [\![Px]\!]^i = 1\}$

Updates are not always eliminative. For any variable x and individual d, $[x/\mathsf{d}]$ is a CCP that updates the domain and the range of an assignment function. Consider s_0 again in (11). Updating s_0 by $[x/\mathsf{d}]$ returns s_2. For all $(g, w) \in s_2$, $g(x)$ is defined and returns d.

- $(g, w)[x/\mathsf{d}] \coloneqq (g', w')$ such that $w = w'$ and g' agrees with g except that $\mathtt{Domain}(g') = \mathtt{Domain}(g) \cup \{x\}$ and $g'(x) = \mathsf{d}$
- $[x/\mathsf{d}] \coloneqq \lambda s_s.\{(g, w)[x/\mathsf{d}] \mid (g, w) \in s\}$

(11)

s_0

$i_1 = (g_1, w_1)$ $g_1(x) = \mathsf{a}$ $w_1(P) = \{\mathsf{a}\}$	$i_2 = (g_2, w_2)$ $g_2(x) = \mathsf{a}$ $w_2(P) = \{\mathsf{b}\}$
$i_3 = (g_3, w_3)$ $g_3(x) = b$ $w_3(P) = \{\mathsf{a}\}$	$i_4 = (g_4, w_4)$ $g_4(x) = \uparrow$ $w_4(P) = \{\mathsf{b}\}$

$\xRightarrow{[x/\mathsf{d}]}$

s_2

$i_1 = (g_1, w_1)$ $g'_1(x) = \mathsf{d}$ $w_1(P) = \{\mathsf{a}\}$	$i_2 = (g_2, w_2)$ $g'_2(x) = \mathsf{d}$ $w_2(P) = \{\mathsf{b}\}$
$i_3 = (g_3, w_3)$ $g'_3(x) = \mathsf{d}$ $w_3(P) = \{\mathsf{a}\}$	$i_4 = (g_4, w_4)$ $g'_4(x) = \mathsf{d}$ $w_4(P) = \{\mathsf{b}\}$

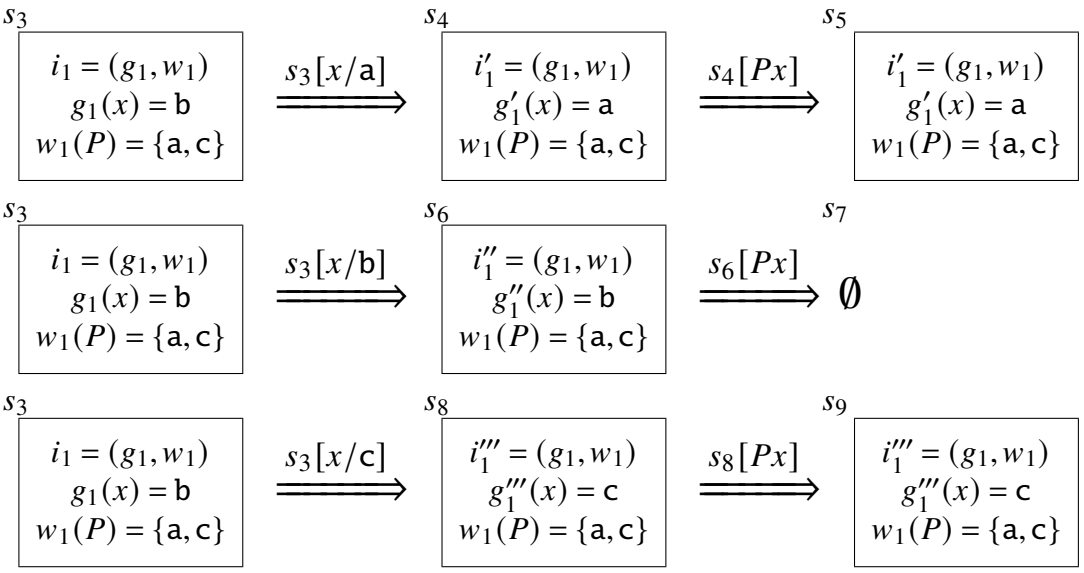
[6] We use s, s',... for variables over states, and use s for the type of states. Since $[Px]$ is a function from states to states, the update should more accurately be notated as $[Px](s)$. Following Groenendijk et al. (1996), however, we keep using the infix notation.

Indefinites in natural language are translated into existential quantification, defined as follows in update semantics.[7] $[\exists x\phi]$ induces random (re)assignment for the variable x.

- $[\exists x\phi] \coloneqq \lambda s_s.\bigcup_{\mathtt{d}\in D}(s[x/\mathtt{d}][\phi])$

Consider s_3 in (12) updated by $[\exists xPx]$. s_3 is a singleton set that only contains $i_1 = (g_1, w_1)$. Suppose $D = \{\mathtt{a},\mathtt{b},\mathtt{c}\}$, and $w_1(P) = \{\mathtt{a},\mathtt{c}\}$. s_3 is updated as $s_3[x/\mathtt{d}][Px]$ for all $\mathtt{d} \in D$, as illustrated in (12). The resultant state is the union of s_5, s_7, and s_9, i.e., $\{i'_1, i'''_1\}$.

(12)



It is helpful to have the notions *descendants* and *subsistence* defined as follows.

- i *subsists* in s iff i has one or more descendant(s) in s.
- (g', w') is a *descendant* of (g, w) iff $w = w'$ and $\mathtt{Domain}(g) \subseteq \mathtt{Domain}(g')$.

In (12), for example, i_1 has a descendant in s_5, namely i'_1, for $w_1 = w_1$ and $\mathtt{Domain}(g_1) \subseteq \mathtt{Domain}(g')$. Accordingly, i_1 *subsists* in $s_3[x/\mathtt{a}][Px] (= s_5)$. On the other hand, i_1 does not subsist in s_7 because there is no descendant of i_1 in there (for s_7 being empty). Therefore, i_1 does not subsist in $s_3[x/\mathtt{b}][Px]$. In other words, i subsists in $\{i\}[\phi]$ if ϕ can be classically true at i. We say $[\![x/\mathtt{d}\ \phi]\!]^i$ is classically true at i if and only if $[\![\phi]\!]^{i_{x/\mathtt{d}}}$ is classically true, where $i_{x/d}$ agrees with i except that $\mathtt{Domain}(i_{x/\mathtt{d}}) = \mathtt{Domain}(i) \cup \{x\}$ and $i(x) = \mathtt{d}$. Then i_1 does not subsist in $\{i_1\}[x/\mathtt{b}][Px]$ in (12) because $[\![P\mathtt{b}]\!]^i$ is not classically true.

Now, conditionals are defined as follows in Groenendijk et al. (1996).

- $s[\phi \to \psi] =$
  $\{i \in s :$ if i subsists in $s[\phi]$, then all descendants of i in $s[\phi]$ subsist in $s[\phi][\psi]\}$

Under this definition, i subsists in $\{i\}[\phi \to \psi]$ if and only if (a) $[\![\phi]\!]^i$ is classically true and $[\![\phi \wedge \psi]\!]^i$ is classically true (where $s[\phi \wedge \psi] \equiv s[\phi][\psi]$), or (b) $[\![\phi]\!]^i$ is classically false. The definition replicates the semantics of material implication.

For illustration, consider (13a), which we suppose is translated as $\exists xHx \to Fx$, H for being a horse, and F for being well-fed. Suppose that the domain of individual contains $\{\mathtt{a},\mathtt{b},\mathtt{c}\}$.

[7] D is the domain of individuals.

Consider s_{10} in (13b). When s_{10} is updated by $[\exists xHx \rightarrow Fx]$, first each $i \in s_{10}$ is checked if i subsists in $s_{10}[\exists xHx]$. It is illustrated in the first updates in (13c-e). i_1 and i_3 but not i_2 subsist in $s_{10}[\exists xHx]$. At this point, i_2 is guaranteed to subsist in $s[\exists xHx \rightarrow Fx]$ (for $[\![\exists xHx]\!]^{i_2}$ is classically false). In (13c, e), i_1 and i_3 are further checked if all of their descendants in $s_{10}[\exists xHx]$ subsist in $s_{10}[\exists xHx][Fx]$. Not all descendants of i_1 do, because i_1'' does not have any descendant in $s_{10}[\exists xHx][Fx]$ (for $i_1'(x) \neq i_1''(x)$ and $i_1''(x) \notin w_1(F)$). On the other hand, i_3', which is the only descendant of i_3 in $s_{10}[\exists xHx]$, does subsist in $s_{10}[\exists xHx][Fx]$. Therefore, $s_{10}[\exists xHx \rightarrow Fx] = \{i_2, i_3\}$. Notice that $[\![\exists xHx \wedge Fx]\!]^{i_3}$ is classically true.

(13) a. If there is [a horse]^x, [the horse]$_x$ is well-fed $\rightsquigarrow \exists xHx \rightarrow Fx$

b. s_{10}

$i_1 = (g_1, w_1)$ $g_1(x) = \uparrow$ $w_1(H) = \{\mathsf{a}, \mathsf{b}\}$ $w_1(F) = \{\mathsf{a}\}$	$i_2 = (g_2, w_2)$ $g_2(x) = \uparrow$ $w_2(H) = \emptyset$ $w_2(F) = \emptyset$
$i_3 = (g_3, w_3)$ $g_3(x) = \uparrow$ $w_3(H) = \{\mathsf{c}\}$ $w_3(F) = \{\mathsf{c}\}$	

c. $\boxed{\begin{array}{c} i_1 = (g_1, w_1) \\ g_1(x) = \uparrow \\ w_1(H) = \{\mathsf{a}, \mathsf{b}\} \\ w_1(F) = \{\mathsf{a}\} \end{array}} \xRightarrow{[\exists xDx]} \boxed{\begin{array}{c} i_1' = (g_1', w_1) \\ g_1'(x) = \mathsf{a} \\ w_1(H) = \{\mathsf{a}, \mathsf{b}\} \\ w_1(F) = \{\mathsf{a}\} \end{array}} \\ \boxed{\begin{array}{c} i_1'' = (g_1'', w_1) \\ g_1''(x) = \mathsf{b} \\ w_1(H) = \{\mathsf{a}, \mathsf{b}\} \\ w_1(F) = \{\mathsf{a}\} \end{array}} \xRightarrow{[Fx]} \boxed{\begin{array}{c} i_1' = (g_1', w_1) \\ g_1'(x) = \mathsf{a} \\ w_1(H) = \{\mathsf{a}, \mathsf{b}\} \\ w_1(F) = \{\mathsf{a}\} \end{array}}$

d. $\boxed{\begin{array}{c} i_2 = (g_2, w_2) \\ g_2(x) = \uparrow \\ w_2(H) = \emptyset \\ w_2(F) = \emptyset \end{array}} \xRightarrow{[\exists xDx]} \emptyset$

e. $\boxed{\begin{array}{c} i_3 = (g_3, w_3) \\ g_3(x) = \uparrow \\ w_3(H) = \{\mathsf{c}\} \\ w_3(F) = \{\mathsf{c}\} \end{array}} \xRightarrow{[\exists xDx]} \boxed{\begin{array}{c} i_3' = (g_3', w_3) \\ g_3'(x) = \mathsf{c} \\ w_3(H) = \{\mathsf{c}\} \\ w_3(F) = \{\mathsf{c}\} \end{array}} \xRightarrow{[Fx]} \boxed{\begin{array}{c} i_3' = (g_3', w_3) \\ g_3'(x) = \mathsf{c} \\ w_3(H) = \{\mathsf{c}\} \\ w_3(F) = \{\mathsf{c}\} \end{array}}$

Below, we partially adopt the restrictor analysis of conditionals (Kratzer 1986) for compositionality, ignoring a modal base and an ordering source (see Section 4.2 for an extension of the proposal with a modal base, though). We suppose that the consequent of (un)conditionals

always contain an overt or cover modality, represented as $\Box$. $\Box$ is the source of conditionality. $\Box\psi$ waits for an antecedent to come to form a conditional. $[\Box\psi]$ is defined as (14).

(14) $[\Box\psi] \rightsquigarrow \lambda p_{ss}.\lambda s_s.\left\{ i \in s : \begin{array}{l}\text{if } i \text{ subsists in } p(s), \text{ then all descendants}\\ \text{of } i \text{ in } p(s) \text{ subsist in } (p(s))[\psi]\end{array} \right\}$

3. Unconditinoals in alternative update semantics

We adopt the analysis of unconditionals by Rawlins (2013), but propose to extend it so that *each alternative is a CCP*. The idea is illustrated as follows. Consider (15). The wh-indeterminate ***dare*** creates alternatives (suppose again the domain contains a, b, and c), percolating up to the entire conditional antecedent via PFA. The antecedent denotes a *set* of CCPs. The consequent is also a (singleton) set of CCPs. The antecedent and the consequent are composed to form a set of conditionals (15b) (where C is for *comes to the party* and E is for *enjoy*). The particle ***mo*** universally quantifies over the set, resulting in the meaning of unconditionals. Since each alternative is a CCP, the anaphora in the consequent is resolved.

(15) [$_\alpha$ ***Dare***^{x}*-ga paati-ni kite*] *-**mo*** [$_\beta$ ***soitu***$_x$*-wa tanosimu*] .
who-NOM party-DAT come -∀ the.person-TOP enjoy
'Whoever comes to the party, s/he will enjoy.'

a. $\left\{\lambda p_{ss}.\lambda s_s.\left\{ i \in s : \begin{array}{l}\text{if } i \text{ subsists in } p(s), \text{ then all descendants}\\ \text{of } i \text{ in } p(s) \text{ subsist in } (p(s))[Ex]\end{array} \right\}\right\}\left(\left\{ \begin{array}{l}\lambda s.s[x/\mathsf{a}][Cx],\\ \lambda s.s[x/\mathsf{b}][Cx],\\ \lambda s.s[x/\mathsf{c}][Cx]\end{array} \right\}\right)$

b. $\left\{ \begin{array}{l} \lambda s.\left\{ i \in s : \begin{array}{l}\text{if } i \text{ subsists in } s[x/\mathsf{a}][Cx], \text{ then all descendants}\\ \text{of } i \text{ in } s[x/\mathsf{a}][Cx] \text{ subsist in } s[x/\mathsf{a}][Cx][Ex]\end{array} \right\},\\ \lambda s.\left\{ i \in s : \begin{array}{l}\text{if } i \text{ subsists in } s[x/\mathsf{b}][Cx], \text{ then all descendants}\\ \text{of } i \text{ in } s[x/\mathsf{b}][Cx] \text{ subsist in } s[x/\mathsf{b}][Cx][Ex]\end{array} \right\},\\ \lambda s.\left\{ i \in s : \begin{array}{l}\text{if } i \text{ subsists in } s[x/\mathsf{c}][Cx], \text{ then all descendants}\\ \text{of } i \text{ in } s[x/\mathsf{c}][Cx] \text{ subsist in } s[x/\mathsf{c}][Cx][Ex]\end{array} \right\} \end{array} \right\}$

The rest of this section is devoted to formalizing the idea. Alternative semantics laid out in Section 2 is modified to conform to update semantics. The antecedent α of (15) is composed with the translations in (16).

(16) a. *dare*^{x}*(-NOM)* $\rightsquigarrow \left\{ \lambda P_{e,ss}.\lambda s.P(x)(s[x/\mathsf{d}]) : \mathsf{d} \in D \right\}$
b. *comes to the party* $\rightsquigarrow \{\lambda x_e.\lambda s.s[Cx]\}$
c. *dare*^{x}*-NOM comes to the party* $\rightsquigarrow \{\lambda s.s[x/\mathsf{d}][C(x)] : \mathsf{d} \in D\}$

The consequent β, which we suppose contains a covert modal $\Box$, is translated as:

(17) a. *soitu*$_x$ $\rightsquigarrow \left\{ \lambda P_{e,ss}.\lambda s.P(x)(s) \right\}$
b. *enjoy* $\rightsquigarrow \{\lambda x_e.\lambda s.s[Ex]\}$

c. $\Box \rightsquigarrow \left\{\lambda q.\lambda p.\lambda s.\left\{i \in s : \begin{array}{l}\text{if } i \text{ subsists in } p(s), \text{ then all descendants}\\ \text{of } i \text{ in } p(s) \text{ subsist in } q(p(s))\end{array}\right\}\right\}$

d. $\Box\ soitu_x\text{-}\textsc{nom}\ enjoy \rightsquigarrow \left\{\lambda p.\lambda s.\left\{i \in s : \begin{array}{l}\text{if } i \text{ subsists in } p(s), \text{ then all descendants}\\ \text{of } i \text{ in } p(s) \text{ subsist in } (p(s))[Ex]\end{array}\right\}\right\}$

Morpho-syntactically, the particle *mo* is attached to the antecedent. We define the particle so that it is first composed with the antecedent and then the consequent. Following Shimoyama (2006), the definition is type-general so that it appears outside unconditionals as well (see Section 4.4).

(18) $mo \rightsquigarrow \left\{\lambda\alpha.\lambda\beta.\lambda s_s.\{i \in s : \forall a \in \alpha\,[\,i \text{ subsists in } \beta(a)(s)\,]\}\right\}$

Combining the antecedent and *mo* results in:

(19) $dare^x\text{-}\textsc{nom}$ *comes to the party mo* $\rightsquigarrow$
$\left\{\lambda\beta.\lambda s_s.\{i \in s : \forall a \in \{\lambda s.s[x/\mathsf{d}][C(x)] : \mathsf{d} \in D\}\,[\,i \text{ subsists in } \beta(a)(s)\,]\}\right\}$

Suppose again $D = \{\mathsf{a}, \mathsf{b}, \mathsf{c}\}$. Then (19) is equivalent to:

(20) $\left\{\lambda\beta.\lambda s_s.\left\{i \in s : \forall a \in \left\{\begin{array}{l}\lambda s.s[x/\mathsf{a}][C(x)],\\ \lambda s.s[x/\mathsf{b}][C(x)],\\ \lambda s.s[x/\mathsf{c}][C(x)]\end{array}\right\}\,[\,i \text{ subsists in } \beta(a)(s)\,]\right\}\right\}$

(20) takes the consequent. Decomposing the universal quantification, the composition results in (21). The anaphora in the consequent of the unconditional is resolved in the usual fashion: the anaphora is interpreted as a variable.

(21) $dare^x\text{-}\textsc{nom}$ *comes to the party mo* $soitu_x\text{-}\textsc{top}$ *enjoys* $\rightsquigarrow$

$$\left\{\lambda s_s.\left\{i \in s : i \text{ subsists in } \left\{\begin{array}{l}\left\{j \in s : \begin{array}{l}\text{if } j \text{ subsists in } s[x/\mathsf{a}][Cx], \text{ then all descendants}\\ \text{of } j \text{ in } s[x/\mathsf{a}][Cx] \text{ subsist in } s[x/\mathsf{a}][Cx][Ex]\end{array}\right\},\\ \left\{j \in s : \begin{array}{l}\text{if } j \text{ subsists in } s[x/\mathsf{b}][Cx], \text{ then all descendants}\\ \text{of } j \text{ in } s[x/\mathsf{b}][Cx] \text{ subsist in } s[x/\mathsf{b}][Cx][Ex]\end{array}\right\},\\ \left\{j \in s : \begin{array}{l}\text{if } j \text{ subsists in } s[x/\mathsf{c}][Cx], \text{ then all descendants}\\ \text{of } j \text{ in } s[x/\mathsf{c}][Cx] \text{ subsist in } s[x/\mathsf{c}][Cx][Ex]\end{array}\right\}\end{array}\right.\right\}\right\}$$

(21) is a singleton set of CCPs. The CCP takes a state s and collects the possibilities $i \in s$ such that i subsists in all of $s[x/\mathsf{a}][Cx \rightarrow Ex]$, $s[x/\mathsf{b}][Cx \rightarrow Ex]$, and $s[x/\mathsf{c}][Cx \rightarrow Ex]$. More intuitively and informally, (21) is equivalent to (22).

(22) $\left\{\lambda s_s.\left\{i \in s : i \text{ subsists in } \begin{array}{l}s[\textit{if } \mathsf{a} \textit{ comes to the party } \mathsf{a} \textit{ enjoys}], \text{ and}\\ s[\textit{if } \mathsf{b} \textit{ comes to the party } \mathsf{b} \textit{ enjoys}], \text{ and}\\ s[\textit{if } \mathsf{c} \textit{ comes to the party } \mathsf{c} \textit{ enjoys}]\end{array}\right\}\right\}$

Consider s_{11} in (23), updated by the unconditional in (21). i_2 and i_3 subsist in the update by all the three alternative conditionals, but i_1 does not: i_1 does not subsist in $s_{11}[\textit{if } \mathsf{b} \textit{ comes to the party } \mathsf{b}$ *enjoys*]. Therefore, the result of the update is $\{i_2, i_3\}$.

(23) s_{11}

$i_1 = (g_1, w_1)$ $g_1(x) = \uparrow$ $w_1(C) = \{\mathsf{a}, \mathsf{b}\}$ $w_1(F) = \{\mathsf{a}\}$	$i_2 = (g_2, w_2)$ $g_2(x) = \uparrow$ $w_2(C) = \{\mathsf{a}\}$ $w_2(F) = \{\mathsf{a}, \mathsf{b}\}$
$i_3 = (g_3, w_3)$ $g_3(x) = \uparrow$ $w_3(C) = \{\mathsf{c}\}$ $w_3(F) = \{\mathsf{c}\}$	

Now that the semantics for unconditionals is dynamicized, the indistinguishable participants in (2) are dynamically resolved with the following indexation.

(2) ***Dare***^{x}*-ga hokano* ***dare***^{y}*-ni atte-mo,* ***soitu***$_x$*-wa* ***soitu***$_y$*-ni aisatu-suru.*
who-NOM other who-DAT meet-MO, s/he-TOP s/he-DAT greet-do.
Lit. 'whoever meets whoever, s/he greets him/her.'

(24) shows how the anaphora in (2) are resolved under the assumption that $D = \{\mathsf{a}, \mathsf{b}, \mathsf{c}\}$. (24a) is the result of composition. The self-meeting event (e.g., *a meets a*) is excluded from the antecedent because *hokano* (other) factors out the possibility that the second *dare* denotes the individual same as the one denoted by the first *dare*. Consider the initial state s_{12} in (24b), where M is for meeting and G for greeting. i_2 and i_3 subsist in all six states. But i_1 doesn't, for b and c do not greet each other although they meet in i_1. Thus, the update by (2) results in $\{i_2, i_3\}$ as in (24c), which identifies with the intuitive interpretation of (2).

(24) a. *dare-NOM other dare-DAT meet mo, s/he-NOM s/he-DAT greet*

$$\rightsquigarrow \left\{ \lambda s_s \left\{ i \in s : i \text{ subsists in } \begin{array}{l} s[\textit{if a meets b, a greets b}], \\ s[\textit{if a meets c, a greets c}], \\ s[\textit{if b meets a, b greets c}], \\ s[\textit{if b meets c, b greets c}], \\ s[\textit{if c meets a, c greets a}], \\ s[\textit{if c meets b, c greets b}] \end{array} \right\} \right\}$$

b. s_{12}

$i_1 = (g_1, w_1)$ $g_1(x) = \uparrow$ $w_1(M) = \{\langle \mathsf{a}, \mathsf{b}\rangle, \langle \mathsf{b}, \mathsf{a}\rangle, \langle \mathsf{b}, \mathsf{c}\rangle, \langle \mathsf{c}, \mathsf{b}\rangle\}$ $w_1(G) = \{\langle \mathsf{a}, \mathsf{b}\rangle, \langle \mathsf{b}, \mathsf{a}\rangle\}$	$i_2 = (g_2, w_2)$ $g_2(x) = \uparrow$ $w_2(M) = \{\langle \mathsf{a}, \mathsf{b}\rangle, \langle \mathsf{b}, \mathsf{a}\rangle\}$ $w_2(G) = \{\langle \mathsf{a}, \mathsf{b}\rangle, \langle \mathsf{b}, \mathsf{a}\rangle, \langle \mathsf{b}, \mathsf{c}\rangle, \langle \mathsf{c}, \mathsf{b}\rangle\}$
$i_3 = (g_3, w_3)$ $g_3(x) = \uparrow$ $w_3(M) = \{\langle \mathsf{b}, \mathsf{c}\rangle, \langle \mathsf{c}, \mathsf{b}\rangle\}$ $w_3(G) = \{\langle \mathsf{b}, \mathsf{c}\rangle, \langle \mathsf{c}, \mathsf{b}\rangle\}$	

c. $s_{12}[(2)] = \{i_2, i_3\}$

The proposal can be extended to an instance of the *sage-plant* configuration, exemplified in (25). The update is illustrated in (26). Here, we suppose the domain of human individuals D_H is $\{\mathsf{a}, \mathsf{b}\}$ and the domain of non-human individuals D_I is $\{\mathsf{p}_i : i \in \mathbb{N}\}$. The composition of (25) converges to the update potential in (26). Applying this to the initial state s_{13} in (26b), the updated state includes only i_2 and i_3. i_1 is eliminated because both a and b do not buy nine items. Note that i_2 subsists in $s[$*if* b *buys* p_{n_1}, b *buys* $\mathsf{p}_{n_2}, \ldots, \mathsf{p}_{n_9}]$ because b does not buy anything in i_3.

(25) ***Dare***-*ga* ***dore***-*o* *katte-mo* *soitu-wa* *sore-to* *issyoni* *8-tu* *betuno-o* *kau*
who-NOM which-ACC buy-MO s/he-TOP it-with together 8-CLS other-ACC buy
Lit. 'whoever buys whichever, s/he buys eight others along with it. '

(26) a. *dare-NOM dore-ACC buy mo, s/he-NOM it-DAT together 8 others buy* $\rightsquigarrow$

$$\left\{ \lambda s_s \left\{ i \in s : i \text{ subsists in } \begin{array}{l} s[\textit{if } \mathsf{a} \textit{ buys } \mathsf{p}_{n_1}, \mathsf{a} \textit{ buys } \mathsf{p}_{n_2}, \mathsf{p}_{n_3}, \ldots, \textit{and, } \mathsf{p}_{n_9}], \textit{and} \\ s[\textit{if } \mathsf{b} \textit{ buys } \mathsf{p}_{n_1}, \mathsf{b} \textit{ buys } \mathsf{p}_{n_2}, \mathsf{p}_{n_3}, \ldots, \textit{and, } \mathsf{p}_{n_9}], \\ \text{for each } n_1, \ldots, n_9 \in \mathbb{N} \text{ where } n_k \neq n_{k'} \text{ if } k \neq k'. \end{array} \right\} \right\}$$

b. s_{13}

$i_1 = (g_1, w_1)$ $g_1(x) = \uparrow$ $w_1(B) = \{\langle \mathsf{a}, \mathsf{p}_m \rangle, \langle \mathsf{b}, \mathsf{p}_n \rangle : m \in \mathbb{N}_{\leq 7}, n \in \mathbb{N}_{\leq 5}\}$
$i_2 = (g_2, w_2)$ $g_2(x) = \uparrow$ $w_2(B) = \{\langle \mathsf{a}, \mathsf{p}_m \rangle, \langle \mathsf{b}, \mathsf{p}_n \rangle : m \in \mathbb{N}_{\leq 10}, n \in \mathbb{N}_{\leq 10}\}$
$i_3 = (g_3, w_3)$ $g_3(x) = \uparrow$ $w_2(B) = \{\langle \mathsf{a}, \mathsf{p}_m \rangle : m \in \mathbb{N}_{\leq 9}\}$

c. $s_{13}[(25)] = \{i_2, i_3\}$

4. Consequences, predictions, and remaining issues

4.1. Conditionals and unconditionals

Recall the updates of s_{10} by the conditional in (13) and the parallel update of s_{11} by the unconditional in (15) illustrated above. The updates result in $\{i_2, i_3\}$. The results are equivalent due to the validity of Egli's theorem in update semantics.

(27) $\exists x Px \rightarrow Qx \equiv \forall x[Px \rightarrow Qy]$ (Egli's theorem)

Could unconditionals be more simply analyzed as dynamic conditionals? More specifically, could we take wh-indeterminates in unconditionals as indefinites rather than sources of alternatives?

This is not the case. If wh-indeterminates were indefinites and unconditional were a sort of conditionals, it would be predicted that unconditionals in Japanese are well-formed even without *mo*, which, in our proposal, 'flattens' a non-singleton set of alternatives to a singleton set via quantification. The quantification is pivotal for the well-formedness of unconditionals as declarative sentences. Under alternative semantics, declarative sentences should denote a singleton set. If the cardinality of a set is more than one, the sentence is understood as a question. If wh-indeterminates do not induce alternatives, unconditional sentences will denote a singleton set of (dynamic) propositions even without *mo*, and they should be interpreted as well-formed declarative sentences. This prediction is not borne out. (28), which is a variant of (8) without *mo*, is only interpreted as a question (as far as the sentence is acceptable – it is not fully natural). Our proposal straightforwardly predicts this fact. The wh-indeterminates *dare* creates alternatives, which must be fattened by *mo* for the sentence to be declarative; otherwise the sentence is interpreted as a question, which is indeed the case in (28).[8]

(28) ? [$_\alpha$ ***Dare***-*ga* *paati-ni* *kite*][$_\beta$ ***soitu***-*wa* *tanosimu*] *?*
who-NOM party-DAT come the.person-TOP enjoy
'Who will come to the party and enjoy?'

Conditionals and unconditionals also differ in presuppositions. The conditional sentence in (29) reflects the form of the left-hand side of Egli's equation in (27). The truth condition of this sentence is identical to that of a corresponding unconditional (30), just as Egli's theorem predicts. Nevertheless, the presupposition behind these two sentences are different: (30) presupposes that at least one person comes to the party, while the speaker of (29) would not deny the possibility that no one will come to the party. We assume, with Rawlins (2013), that the presupposition comes from the *exhaustivity* requirement of unconditionals: antecedents in the alternative set must exhaustify the logical space. When $D = \{\mathtt{a}, \mathtt{b}, \mathtt{c}\}$, the three propositions `a_comes_to_the_party`, `b_comes_to_the_party`, and `c_comes_to_the_party` together exhaust the logical space. It excludes the possibility that no one will come, hence the presupposition. The difference in presuppositions would not be predicted if we equate unconditionals with dynamic conditionals.

(29) *Dare-ka-ga* *ki-tara* *paati-wa* *tanosii.*
who-∃-NOM come-COND party-TOP fun
'If someone comes to the party, it will be fun.'

(30) *Dare-ga* *kite-mo* *paati-wa* *tanosii.*
who-NOM come-MO party-TOP fun
'If someone comes to the party, it will be fun.'

The above discussion reveals the combinatory system, alternative update semantics, is still motivated.

[8]The CCP of (28) obtained within our analysis amounts to the set of conditionals. On the other hand, (28) is a conjunctive question. However, unconditionals are exhaustive (Rawlins 2013), and thus the possible world in the information state that is to be updated by (28) necessarily assigns at least one individual to the predicate in the first conjunct. Hence, the conditionals in the alternative set become equivalent to conjunctions.

4.2. Adding Modal Base

Following Kratzer's analysis, we assumed in 2.2 that conditionality comes from an overt or covert modal operator. In the standard Kratzerian framework, the quantificational domain of the modal operator is further restricted by a modal base. This subsection demonstrates that the modal base can be incorporated into our proposal. The modal base is represented as a function f, which takes a world and returns a set of propositions. For the clear distinction between a symbol for a possible world (i.e., possible worlds in the sense of alternative semantics) and the model of a possible world (i.e., possible worlds in the sense of dynamic semantics), we notate a possible world in boldface (see also footnote 5).

(31) $f(\mathbf{w}) = \{p_1, \ldots, p_n\}$

The extended modal operator $\Box$ in (32) takes a consequent and adds the modal base as the restriction.

(32) $[\Box\psi] \rightsquigarrow \left\{\lambda\phi.\lambda s.\left\{i \in s : \begin{array}{l}\text{if } i \text{ subsists in } s[f(\mathbf{w})][\phi], \text{ then all descendants}\\ \text{of } i \text{ in } s[f(\mathbf{w})][\phi] \text{ subsist in } s[f(\mathbf{w})][\phi][\psi]\end{array}\right\}\right\}$

By this implementation, all possibilities that are not consistent with propositions specified by $f(\mathbf{w})$ are not evaluated. For example, consider (15), repeated below.

(15) [$_\alpha$ ***Dare**-ga paati-ni kite*] ***-mo*** [$_\beta$ ***soitu**-wa tanosimu*] .
who-NOM party-DAT come -∀ the.person-TOP enjoy
'Whoever comes to the party, s/he will enjoy.'

Suppose there is a party today, and Alex, Beth, Cathy, and Mary (for short, a, b, c, and m) are invited to the party. Mary does not like a party; hence, she will not enjoy it if Mary comes to the party. However, the speaker knows she will not attend the party because Mary is sick today. In this context, one of the propositions in the set $f(\mathbf{w})$ is $\neg C(\mathtt{m})$ (we use the same abbreviation as Section 3. C is for *comes to the party*, E is for *enjoy*). For simplicity, we assume $f(\mathbf{w}) = \{\neg C(\mathtt{m})\}$ and $D_e = \{\mathtt{a}, \mathtt{b}, \mathtt{c}, \mathtt{m}\}$. The translations for the sentence (17) is below.

(33) *dare^x-NOM comes to the party mo soitsu$_x$-TOP enjoys* $\rightsquigarrow$
$\{\lambda s_s.\{i \in s : \forall\alpha \in S,\ i \text{ subsists in } \alpha\}\}$, where

$$\mathrm{S} = \left\{ \begin{array}{l} \left\{j \in s : \begin{array}{l}\text{if } j \text{ subsists in } s[\neg C\mathtt{m}][x/\mathtt{a}][Cx], \text{ then all descendants}\\ \text{of } j \text{ in } s[\neg C\mathtt{m}][x/\mathtt{a}][Cx] \text{ subsist in } s[\neg C\mathtt{m}][x/\mathtt{a}][Cx][Ex]\end{array}\right\}, \\ \left\{j \in s : \begin{array}{l}\text{if } j \text{ subsists in } s[\neg C\mathtt{m}][x/\mathtt{b}][Cx], \text{ then all descendants}\\ \text{of } j \text{ in } s[\neg C\mathtt{m}][x/\mathtt{b}][Cx] \text{ subsist in } s[\neg C\mathtt{m}][x/\mathtt{b}][Cx][Ex]\end{array}\right\}, \\ \left\{j \in s : \begin{array}{l}\text{if } j \text{ subsists in } s[\neg C\mathtt{m}][x/\mathtt{c}][Cx], \text{ then all descendants}\\ \text{of } j \text{ in } s[\neg C\mathtt{m}][x/\mathtt{c}][Cx] \text{ subsist in } s[\neg C\mathtt{m}][x/\mathtt{c}][Cx][Ex]\end{array}\right\}, \\ \left\{j \in s : \begin{array}{l}\text{if } j \text{ subsists in } s[\neg C\mathtt{m}][x/\mathtt{m}][Cx], \text{ then all descendants}\\ \text{of } j \text{ in } s[\neg C\mathtt{m}][x/\mathtt{m}][Cx] \text{ subsist in } s[\neg C\mathtt{m}][x/\mathtt{c}][Cx][Ex]\end{array}\right\} \end{array} \right\}$$

Roughly speaking, we have to consider four conditionals to determine the truth condition of (15). $\neg C\mathtt{m} \wedge C\mathtt{a} \rightarrow E\mathtt{a}$, $\neg C\mathtt{m} \wedge C\mathtt{b} \rightarrow E\mathtt{b}$, $\neg C\mathtt{m} \wedge C\mathtt{c} \rightarrow E\mathtt{c}$ and $\neg C\mathtt{m} \wedge C\mathtt{m} \rightarrow E\mathtt{m}$. The last conditional is vacuously true because the antecedent is logically false. Therefore, we only have

to consider three conditionals associated with Alex, Beth, and Cathy. In this way, the current analysis correctly captures the domain restriction by the speaker's epistemicity.

4.3. Interaction with Quantificational Adverbs

Gawron (2001) points out that the domain of quantification is different between conditionals and unconditionals. In his analysis, the conditional in (34) is true if, in most situations where John cooks, Mary is pleased. That is, the conditional quantifies over situations. On the other hand, unconditionals quantify over individual dishes. The truth condition of (35) is that Mary is pleased with most dishes John cooks.

(34) If John cooks, Mary is usually pleased.

(35) Whatever John cooks, Mary is usually pleased.

The two readings are teased apart by scenario (36). (34) is false in (36) while (35) is true. The falsity of (34) is due to the portion of situations where Mary is pleased: she was pleased in only one situation out of nine. On the other hand, (35) is true because Mary was pleased with 20 dishes out of 28.

(36) John cooked 20 dishes in one situation and only one dish in eight situations. In the first situation, where John cooks 20 dishes, Mary is pleased. But in the other eight situations, she wasn't.

Japanese unconditionals are interpreted as a combination of quantification over individuals and situations.[9] (37) is an unconditional corresponding to (35). An intuitive paraphrase of this sentence is as follows: for each kind of food (e.g., salad, dumpling, tom yum soup), in most situations where John cooks it, Mary is pleased.

(37) *Nani-o* *John-ga* *ryoorisite-mo* *Mary-wa* *taitei* *yorokobu*
what-ACC John-NOM cook-MO Mary-TOP usually pleased
'Whatever John cooks, Mary is usually pleased.'

The difference in the truth conditions between (35) and (37) comes into sharp relief under scenario (38). (35) is true because Mary was pleased with 32 dishes out of 36. By contrast, (37) is false because Mary was not pleased with all the dishes of tom yum soup John cooked, even though she usually was with salad and dumplings.[10]

[9] We owe Muyi Yang (p.c.) for this observation.

[10] One might argue that this contrast is caused by the ambiguity of the word *ryoorisuru* (cook). The internal argument of the verb *ryoorisuru* can be both a kind of food and a dish. Thus, the alternative set raised by *nani* (what) in (37) can be the set of kinds of food. However, (38), where the argument of the verb is specified as an individual human, also has a different truth condition from the corresponding English unconditional. It is true if, for each individual, Mary is usually pleased with their coming to the party.

(i) *Dare-ga* *paati-ni* *kite-mo* *Mary-wa* *taitei* *yorokobu.*
who-NOM party-DAT come-MO Mary-TOP usually pleased
'Whoever comes to the party, Mary is usually pleased.'

(38) John cooked ten dishes of salad in three situations, one dish of dumplings in three other situations, and one dish of tom yum soup in three other situations. Mary was pleased in three salad situations and two dumpling situations.

The analysis of Japanese unconditionals in this paper captures this intuition. (39) is the CCP specified by (37) in our analysis (when the kinds of food are only salad, dumpling, and tom yum soup). In each alternative of the set, the quantification by the antecedent of conditionals is over situations. Thus, the possibilities eliminated in the update are the ones where there is even one kind of food that Mary is not pleased with in most situations where John cooks it.[11]

(39) $\left\{ \lambda s_s. \left\{ i \in s : i \text{ subsists in } \begin{array}{l} s[\textit{if John cooks salad, Mary is usually pleased}], \\ s[\textit{if John cooks dumplings, Mary is usually pleased}], \\ s[\textit{if John cooks tom yum soup, Mary is usually pleased}] \end{array} \right\} \right\}$

4.4. Generality of *Mo*

As extensively discussed by Shimoyama (2006), *mo* also appears as a part of individual quantification, as exemplified in (40). Intuitively the instance of *mo* there quantifies over the set of individuals.

(40) ***Dare****-mo-ga waratta.*
who-∀-NOM laughed.
'Everyone laughed.'

The definition of *mo* proposed above is general enough to derive the individual quantification compositionally. Recall our definition of an indeterminate phrase *dare*, repeated in (41a), and a quantificational particle *mo*, repeated in (41b). Shifting the type of predicate as in (41c), the CCP of the sentence (40) is obtained compositionally as in (42).[12]

(41) a. $\textit{dare} \rightsquigarrow \left\{ \lambda P_{e,ss}.\lambda s.\, P(x)(s[x/\mathsf{d}]) : \mathsf{d} \in D \right\}$
b. $\textit{mo} \rightsquigarrow \left\{ \lambda\alpha.\lambda\beta.\lambda s_s.\, \{ i \in s : \forall a \in \alpha\, [\, i \text{ subsists in } \beta(a)(s)\,] \} \right\}$
c. $\textit{waratta} \rightsquigarrow \left\{ \lambda\xi_{\langle\langle\langle e,ss\rangle,s\rangle,s\rangle}.\lambda s.\, \xi(\lambda x_e.\lambda s.\, s[\mathit{laugh}(x)])(s) \right\}$

(42) *dare-mo-*NOM *laugh*

$$\rightsquigarrow \left\{ \lambda s_s. \left\{ i \in s : \begin{array}{l} \forall a \in \left\{ \lambda P_{e,ss}.\lambda s.\, P(x)(s[x/\mathsf{d}]) : \mathsf{d} \in D \right\} \\ \left[i \text{ subsists in } \lambda\xi_{\langle\langle\langle e,ss\rangle,s\rangle,s\rangle}.\lambda s.\, \xi(\lambda x_e.\lambda s.\, s[\mathit{laugh}(x)])(s) \right] \end{array} \right\} \right\}$$

$$= \left\{ \lambda s_s. \left\{ i \in s : \forall \mathsf{d} \in D : [\, i \text{ subsists in } s[x/\mathsf{d}][\mathit{laugh}(x)]] \right\} \right\}$$

[11] Note that Japanese conditionals quantify over situations similarly to English counterparts. For instance, (39) is true if Mary is pleased in most situations where John cooks. In particular, it is false under the condition (36).

(i) *John-ga ryoorisi-tara Mary-wa taitei yorokobu*
John-NOM cook-COND Mary-TOP usually pleased.
'If John cooks, Mary is usually pleased.'

[12] The type shift occurs to prevent the type mismatch between the predicate and the indefinite. This type shift parallels the type shift discussed in Partee and Rooth (1983), which prevents the mismatch between a quantifier phrase and a predicate.

(42) is a singleton set of CCP that consists of possibilities that subsist in $\lambda s_s.laugh(\mathsf{a})$, $\lambda s_s.laugh(\mathsf{b})$, and $\lambda s_s.laugh(\mathsf{c})$ if $D = \{\mathsf{a}, \mathsf{b}, \mathsf{c}\}$. This is roughly a universal quantification over the set of propositions $\{laugh(\mathsf{d}) \mid \mathsf{d} \in D\}$. Beyond the context of *unconditionals*, Our definition of the indeterminate phrase *dare* and the quantificational particle *mo* correctly derives the truth condition of (40).

Nevertheless, we must leave the analysis of other use of *mo*: *mo* also marks additivity as in (43) and concessivity as in (44). (44) is concessive in that John's coming to the party is relatively less likely to lead to Mary's being happy than other alternative possibilities. Our analysis cannot easily account for these uses of *mo*.

(43) *John-mo kita*
John-MO come
'Also John came.'

(44) *John-ga paati-ni kite-mo Mary-wa yorokobu*
John-NOM party-DAT come-MO Mary-TOP happy
'Even if John comes to the party, Mary is happy.'

Another work left for a future occasion is the analysis of (45). (45) is an unconditional with only two alternatives. Rawlins (2013) dubs it an *alternative unconditional* and analyzes it parallelly to *wh-unconditional*. The corresponding Japanese counterpart includes two *mo* particles, to which we have nothing to offer as an analysis. See Yagi (2022) for an attempt to unify unconditionals and concessive conditionals in Japanese, and Yagi and Yuan (2022) for an attempt to derive concessivity from additivity.

(45) Whether John comes to the party or not, Mary is happy.

(46) *John-ga paati-ni kite-mo ko-nakute-mo Mary-wa yorokobu.*
John-NOM party-DAT come-MO come-NEG-MO Mary-TOP happy
'Whether John comes to the party or not, Mary is happy.'

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Future and the composition of modal meaning: the view from Igbo[1]

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Abstract. In many languages, overt 'future markers' play a role in the expression of modal meaning, but their exact semantic contributions vary depending on the particular language and analysis. In some prominent existing accounts, future markers i) contribute prospective time shifting and combine with modal operators or ii) they are part of the functional modal paradigm of a language, on a par with *must*-type necessity modals. The Igbo future marker *ga* presents an interesting variation on ii). On its own, *ga* expresses necessity relative to a stereotypical conversational background (similar to other future modals). Interestingly, however, *ga* also contributes to the composition of other necessity meanings (≈ MUST) as well as circumstantial possibility (≈ ability CAN). We explore this empirical pattern in more detail, sketch an analysis of the relevant modal constructions involving *ga*, and discuss potential theoretical implications from a cross-linguistic perspective.

Keywords: future, modality, ability, Igbo.

1. Introduction

Morphological markers that are used to express predictive future meaning show interesting cross-linguistic variation in their distribution as well as in their specific meaning contributions. Some natural language future markers have been argued to encode purely modal meaning (see e.g. Giannakidou and Mari 2018b on Greek and Italian), while others have been analyzed as prospective aspect operators (Matthewson 2013 on Gitksan) or as encoding a combination of these two meaning components (e.g. Tonhauser 2011 on Paraguayan Guaraní). Depending on their exact semantics, the forms that canonically express futurity in a language play different part in the language's overall modal paradigm. A future marker with purely modal semantics might be used to express modal meanings other than prediction, such as epistemic necessity. Such a future marker can often be argued to be part of the overall modal paradigm of the language (see Enç 1996, among others, on *will* in English). Prospective aspect markers, by contrast, might co-occur with modal expressions and overtly contribute future orientation to the composition of both necessity and possibility meanings. In this paper, we discuss the future marker *ga* in Igbo, which is interesting in that it can be argued to belong to the class of modal future markers, while also contributing to the composition of various modal meanings beyond prediction.

Igbo is a Benue-Congo language spoken in southern Nigeria. There are various geographical dialects, but the standard variety is largely based on the Owerri, Umuahia and Onitsha dialects (Emenanjo, 1978). The data presented in this paper are based on the standard variety. Igbo is a tone language with three level tones: high (á), low (à) and downstep (ꜜá). Vowels are distinguished based on the advanced tongue root (+/−ATR) feature, and vowels in a phonological

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word come from the same ATR set. Verbs often bear inflectional and derivational affixes to express grammatical categories such as TAM and changes in argument structure. Most of the verbal affixes take on the ATR value and tone of the verbal stem (Green and Igwe, 1963; Manfredi, 1991; Emenanjo, 2015). The basic word order in Igbo is SVO and there is no agreement morphology. The exact meaning of the *-rV* (where *V* is a vowel that assimilates in quality and tone to the vowel of the verb stem) suffix that surfaces in some of the data below is debated (Déchaine, 1993; Manfredi, 1997; Uwalaka, 1988; Emenanjo, 2015). With eventive verbs, the temporal interpretation of *-rV* is past, but present with stative verbs. And because the suffix is in complementary distribution with the negative suffix *-ghi*, Déchaine (1993) argues that the *-rV* suffix indicates affirmative polarity; see (1) to (3).[2]

(1) Paul bù-rù òkú!té
Paul carry-rV stone
"Paul carried a stone."

(2) Paul mà-rà ḿ!má
Paul be.beautiful-rV beauty
"Paul is beautiful."

(3) Paul é!bú-ghí òkú!té
Paul carry-NEG stone
"Paul did not carry a stone."

The basic data pattern that we are concerned with in this paper is the following. In Igbo, future meaning, i.e. prediction, is canonically expressed with the pre-verbal morpheme *ga*, as illustrated in (4).

(4) Paul **gà**-èbú òkú!té áhụ̀
Paul GA-carry stone DEF
"Paul will carry the stone."

When *ga* combines with the verbal suffix *ṛịrị*, the sentence obtains a meaning that corresponds to modal necessity (≈ MUST), see (5). Moreover, *ga* combined with the suffix *ni* appears to obtain a possibility reading (≈ CAN), as shown in (6).

(5) Paul **gà**-èbú-**ṛírí** òkú!té áhụ̀
Paul GA-carry-RIRI stone DEF
"Paul must carry the stone."

(6) Paul **gà**-èbú-**ní** òkú!té áhụ̀
Paul GA-carry-NI stone DEF
"Paul can carry the stone."

In the following sections, we take a closer look at the constructions exemplified in (4), (5) and (6), and investigate the empirical behavior and meaning contributions of *ga*, *ṛịrị* and *ni*. We will show that *ga*, *ga ... ṛịrị* and *ga ... ni* display interesting differences not only in modal

[2]Besides *rV*, the following abbreviations are used in our glosses of Igbo sentences: COP = copular, DEF = definite, IMPF = imperfective, INF = infinitive, LOC = locative, NEG = negation, PRED = predicative, PREP = preposition, SFX = suffix, SG = singular.

force/strength, but also in their respective restrictions on modal flavor, and we will propose an account that aims to capture these force-flavor interactions.

Most of the examples presented in this paper make use of contexts adapted from Vander Klok's (2021) revised modal questionnaire for cross-linguistic use. The Igbo sentences and judgments on their felicity stem from the second author's native speaker intuitions. We do not aim at an exhaustive description of the modal system of Igbo in this paper, but instead focus on the constructions in (4)–(6). For the sake of transparency, however, let us mention two additional forms that can be used in Igbo to express necessity and possibility, respectively. As will be discussed in more detail in the next section, strong necessity in all modal flavors is canonically expressed by the construction involving *ga ... ṛịrị* that is illustrated in (5). Weak necessity, by contrast, can be expressed with the dedicated modal *kwesi(ri)*, as illustrated in (7) for the case of deontic weak necessity.

(7) *Context (deontic weak necessity):* In England, it is recommended that face coverings be worn in stores, but it is not a legal requirement. You plan on going shopping, and you think to yourself ...

Ḿ **kwèsìrì** í-yì íhé kpòchíé íhú ꜜḿ
1SG OUGHT INF-wear thing cover face 1SG
"I ought to wear a face covering."

Another ubiquitous construction in the Igbo modal system involves the expression *nwere ike* (lit. 'have strength'), which can be used to convey possibility meaning in all modal flavors we investigated,[3] including deontic flavor as in (8).

(8) *Context (deontic possibility):* The ferris wheel ride is only for children under 12 years of age. Martin is 10 years of age. It is not obligatory for Martin to go on the ride if he doesn't want to, but ...

Martin **nwèrè íké** í-nyà úgbó
Martin have strength INF-ride vehicle
"Martin may ride the ferris wheel."

The rest of the paper is structured as follows. In Section 2, we investigate in more detail the distribution and interpretation of the constructions shown in (4)–(6). A proposal for an analysis of these data is developed in Section 3. Section 4 provides some discussion of potential theoretical implications of our findings as well as concluding remarks.

2. Data

2.1. The interpretation of sentences with *ga*

To start, let us take a closer look at possible interpretations of sentences with the pre-verbal morpheme *ga*. *Ga* is the canonical future marker in Igbo, see example (4). As stated in the introduction, morphological 'future markers' in some languages semantically encode prospective

[3]Specifically, we have constructed examples showing that *nwere ike* can express epistemic, deontic, teleological and circumstantial possibility.

aspectual meaning. This has been argued explicitly for the morpheme *dim* in the Gitksan language: Matthewson (2013) shows that marking with *dim* is necessary and sufficient for future reference, see (9).

(9) ***(dim)** limx=t James t'aahlakw
*(**FUT**) sing=DM James tomorrow
"James will sing tomorrow." (Gitksan, Matthewson 2013: 357)

What is more, *dim* in Gitksan contributes future orientation (in the sense of Condoravdi 2002) to modal utterances. Therefore, *dim* is obligatory in modal constructions that require future-orientation, as illustrated for the case of circumstantial possibility in (10).

(10) *Context:* We are at a party and people are wanting rides home. I ask you if my friend Sally can ride in your car. The answer is yes, because your car is big enough, it holds five.
ee'e, **da'akxw**-i-t #(dim) makxw-t loo-'y
yes **CIRC.POSS**-TRA-3SG.II #(FUT) catch.a.ride-3SG.II OBL-1SG.II
"Yes, she can come with me." (Gitksan, Matthewson 2013: 371)

Starting from the basic data pattern in (4)–(6), it looks like *ga* in Igbo could be the same kind of 'future marker' as Gitksan *dim*. In other words, it is conceivable that *ga* is a prospective aspect semantically, and that *rịrị* and *ni* denote modal necessity and possibility, respectively. If this were the case, the meaning contribution of *ga* in constructions such as (5) and (6) would be purely temporal, and modal quantification over worlds or situations would come from other operators in the sentence. However, this does not seem to be the right analysis for the case of Igbo. Crucially, and in contrast to Gitksan *dim* according to Matthewson (2013), *ga* does not entail future orientation. This is illustrated in (11) and (12) below. In (11), *ga* combines with a past-shifting aspectual operator encoded by the morpheme *álá*, and the sentence receives a past-oriented epistemic necessity reading.

(11) *Context (epistemic, past-oriented):* Ben goes swimming every day. Ben is not obliged or required to go swimming; it is just a habit of his. It is now time for Ben to be swimming, and when you arrive at his house, he is not there. You conclude:
Ọ́ **gà**-álá ị́-ǃgá ùgbúà
3SG GA-ALA INF-go now
"He must have gone now."

In (12), where *ga* combines with a stative predicate, the resulting interpretation parallels the present-oriented epistemic readings that are also available with the English future modal *will* and other 'future markers' in Indo-European languages.

(12) *Context question (epistemic, present-oriented):* John is not at home, where can he be?
John **gà**-ánọ̀ n'ụ́lọ̀ákwụ́kwọ́
John GA-be PREP.school
"John will be at school."

From data such as (11) and (12), we conclude that *ga* is not a prospective aspect. Moreover, these examples suggest that *ga* itself encodes modal meaning, leading to the observed epistemic interpretations.

Assuming that *ga* itself encodes modality, an obvious question regards its restrictions with respect to modal force and modal flavor. As for modal force, we observe that *ga* is not compatible with possibility readings. This is illustrated in (13) for the case of epistemic possibility.

(13) *Context (epistemic possibility):* The teacher is not consistent. The students never know if he's going to come or not to teach class. Today, it's time to start class and the students are waiting again.

Ọ́ **gà**-àbịá ụ́lọ́ákwụ́kwọ́ táà
3SG GA-come school today
Intended: "He might be coming to school today."

Weak necessity readings as triggered by the context in (14) seem to be available with *ga* (although the dedicated weak necessity modal *kwesi(ri)*, shown in (7), would be more natural in such a context).

(14) *Context (epistemic weak necessity):* When the light is on at John's house, it usually means that he is home. You want to visit John. You walk past John's house and notice that the light is on. You think to yourself:

John **gà**-ánọ̀ n'ụ́lọ̀ ùgbúà
John GA-be.LOC PREP.house now
"John will / should be at home."

Let us now consider modal flavor. As shown in (4), (11) and (12), *ga* can have predictive and epistemic readings. However, *ga* alone is not readily compatible with root (e.g. deontic or teleological) modal flavors. Since intuitions on the flavor restrictions of *ga* are quite subtle, a first comparison with the more complex form *ga ... rịrị* is instructive at this point. Consider the examples below. Both *ga* in (15a) and *ga ... rịrị* in (15b) are felicitous as answers to the simple future question in (15). However, the forms are felicitous in different types of background situations. The background described in (15a) clearly relates to assumptions about normality and stereotypical developments of events. By contrast, the background situation given in (15b) that licenses *ga ... rịrị* can be described as teleological in that it refers to John's goal not to fail his class.

(15) *Context question:* Where will John be tomorrow at noon?

a. *Background situation:* John is a student and tomorrow is a school day, so it's normal for him to be at school (so ...)

John **gà**-ánọ̀ n'ụ́lọ̀ákwụ́kwọ́
John GA-be PREP.school
"John will be at school."

b. *Background situation:* There is an exam tomorrow and you know that John wouldn't miss it because then he would fail (so ...)

John **gà**-ánọ̀-**rịrị́** n'ụ́lọ̀ákwụ́kwọ́
John GA-be-RIRI PREP.school
"John will / must be at school."

Additional evidence that the quantificational domain of *ga* relates to assumptions about normal or stereotypical courses of events comes from the observation that *ga* can express 'pseudo-epistemic' meaning (in the sense of Yalcin 2016). A relevant example is given in (16).

(16) *Context (from Yalcin 2016: 231):* Jones is in a crowded office building when a severe earthquake hits. The building topples. By sheer accident, nothing falls upon Jones; the building just happens to crumble in such a way as not to touch the place where he is standing. He emerges from the rubble as the only survivor. Talking to the media, Jones says in wonderment:

Ḿ **gà**-à-rà àbṵ́ ónyé ꜜnwṵ́-ꜜrṵ́ ànwṵ́ ùgbúà
I GA-SFX-rV COP person die-rV dead now
"I should be dead now."

Yalcin (2016) notes that truly epistemic modal expressions (such as English *might* or *probably*) are not felicitous in situations like (16). Note that in this context, the truth of the prejacent (i.e. the speaker being dead) is not compatible with their knowledge in the actual world. Rather, the speaker seems to be making a claim about what their situation would be had it unfolded normally: they would have died like all the other poor people in the office building. Yalcin concludes that English *should* and *ought* under their pseudo-epistemic readings are quantifiers over 'normal' worlds. In Section 3, we will implement a similar idea to account for the behavior of *ga* and its interaction with the suffix *ṛịrị̀*, to which we now turn.

2.2. The interpretation of sentences with *(ga ...) ṛịrị̀*

Let us first look at how the combined form *ga ... ṛịrị̀* differs from *ga* alone in terms of modal flavor. While the predictive and normality-related readings illustrated above are more naturally expressed by *ga* alone, *ga ... ṛịrị̀* is used to convey necessity in all other modal flavors. A teleological use of *ga ... ṛịrị̀* has already been shown in (15b). In (17) we illustrate the deontic use of *ga ... ṛịrị̀*:

(17) *Context (deontic necessity):* In Indonesia, the law states that when you ride a motorbike . . .

Ị́ **gà**-ékpù **ṛị́rị́** helmet
2SG GA-wear RIRI helmet
"You must wear a helmet."

While *ga* alone can be used in some epistemic or pseudo-epistemic contexts as shown in the previous subsection, *ga ... ṛịrị̀* is often preferred for expressing epistemic necessity. What is more, *ṛịrị̀* is obligatory in epistemic necessity contexts with full certainty, i.e when the speaker is entirely sure that the prejacent follows from the facts (for discussion of such cases see e.g. Mihoc et al. 2019).

(18) *Context (epistemic necessity with full certainty):* The teacher says: There are 3 boxes. The ball is in box A or in box B or in box C. It is not in A. It is not in B. So . . .

Ọ́ **gà**-àdị́ ***(ṛị́rị́)** n'ákpàtì C
3SG GA-be.PRED RIRI PREP.box C
"It must be in C."

Crucially, not only *ṛịrị̀* but also *ga* is obligatory in (18). Marking the sentence with *ṛịrị̀* without *ga* is in fact not well-formed, as shown in (19). This observation generalizes to all instances of *ga ... ṛịrị̀*, i.e. *ṛịrị̀* cannot occur on its own.

(19) ?? Ọ́ dị̀-**rị̀rị̀** n'ákpàtì C.
3SG be.PRED-RIRI PREP.box C
Intended: "It must be in C."

However, *rị̀rị̀* can also combine with the weak necessity modal. Interestingly, the resulting meaning is strong necessity in this case, as illustrated in (20).

(20) *Context (teleological necessity):* The best pizza in town is sold at Gino's. You have invited your sister for dinner, and you decide to order pizza. You tell your sister:
Ányị́ **kwèsì-rị̀rị̀** ị́-$^{!}$zú nà ǹké Gino
1PL OUGHT-RIRI INF-buy PREP one.of Gino
"We have to order from Gino's."

More generally, *rị̀rị̀* seems to manipulate modal strength in that it always forces a strong necessity reading.[4] Recall that, while *kwesi(ri)* is the dedicated weak necessity modal in Igbo, *ga* is also somewhat compatible with weak epistemic necessity readings, as illustrated in (14). By contrast, the use of *ga ... rị̀rị̀* is not felicitous in a weak necessity context:

(21) *Context (epistemic weak necessity):* When the light is on at Mary's house, it usually means that she is home. You want to visit Mary. You walk past Mary's house and notice that the light is on. You think to yourself:
Mary **gà**-ánọ̀ **rị́rí** n'úlọ̀ ùgbúà
Mary GA-be.LOC RIRI PREP.house now
Intended: "Mary will / should be at home."

Next, we conclude this data section by considering the properties of *(ga ...) ni*.

2.3. The interpretation of sentences with *(ga ...) ni*

As noted at the beginning of our discussion (see ex. (6)), when *ga* is combined with the post-verbal marker *ni*, this combination results in a possibility meaning. It is important to note, however, that this construction is mainly associated with circumstantial possibility / ability readings. Some representative examples of the use of *ga ... ni* are provided in (22)–(24).

(22) *Context:* Ben was in a motorbike accident and he sprained his ankle. Ben is able to walk now. However, the doctor told Ben that he is not allowed to walk until 5 weeks after the accident.
Ben **gà**-àgá-**ní** íjè ùgbúà
Ben GA-go-NI walk now
"Ben can walk now."

(23) *Context:* The travel vans have a limit of 13 people by law. But the drivers don't care, and stop for more than 13 people. Also, the vans are bigger than you think ...

[4]This observation has been documented before in a small case study on Igbo modality by Zimmermann (2019), which, in accordance with our arguments in this paper, arrives at the conclusion that *ga* is a modal operator rather than a semantic future shifter. Many thanks to Malte Zimmermann for sharing this study with us. The idea that *ga* is a necessity modal that is strengthened by *rị̀rị̀* also seems in line with a brief overview of Igbo modality presented by Emenanjo (2015: ch.18).

Úgbó **gà**-èbú-**ní** ḿmádù 20
vehicle GA-carry-NI people 20
"Travel vans can fit 20 people."

(24) *Context:* Ani came to visit a small island in the Philippines. She noticed that the climate and many of the plants are similar to some places she visited in Indonesia, where duku trees grow. The temperature is the same, the rainfall is the same, the types of rocks and the soil are the same. But when she looked around, she didn't find any duku trees anywhere. But because the temperature, rainfall, and soil are the same, she thinks that ...

Ósísí duku **gà**-ètó-**ní** ébè à
tree duku GA-grow-NI place this
"Duku trees can grow here."

The use of *ga ... ni* to express other modal flavors is highly restricted. It is particularly interesting to note that *ga ... ni* cannot be used with epistemic flavor, in contrast to *ga* and *ga ... ṛiṛị*. In other words, although *ga* is in principle compatible with epistemic readings (see (11), (12) and (14)), and although adding *ni* seems to weaken the modal force to possibility (see (22)–(24)), the combination of *ga* and *ni* cannot be used to express epistemic possibility, as shown in (25).[5]

(25) *Context (epistemic possibility):* The teacher is not consistent. The students never know if he's going to come or not to teach class. Today, it's time to start class and the students are waiting again.

Ọ́ **gà** bị́á-**ní** ụ́lọ̀ákwụ́kwọ́ táà
3SG GA come-NI school today
Intended: "He might be coming to school today."

Another interesting observation is that *ni*, unlike *ṛiṛị*, can occur without *ga* or another modal operator in the sentence. Moreover, like ability expressions in many other languages (see e.g. Bhatt 2006; Hacquard 2009, among many others) sentences with *ni* give rise to an actuality entailment when the aspectual interpretation of the sentence is perfective, as in (26): the sentence in (26a) (with *ni* but without *ga*) triggers the inference that Paul carried the stone in the actual world, and it is infelicitous to cancel that inference, as shown in (26b).

(26) a. Paul bùrù**-nì** òkú$^{!}$té áhụ̀ ...
Paul carry.RV-NI stone DEF
"Paul was able to carry the stone ..."

b. **# ... mànà ò bú-bè-ghì òkú$^{!}$té áhụ̀**
... but 3SG carry-yet-NEG stone DEF
"... but he never carried the stone."

By contrast, no such actuality inference arises when *ga* combines with *ni*. This is shown for a simple sentence with *ga ... ni* in (27), which receives a non-past interpretation by default. Note, however, that the same *ga ... ni* construction can receive a past interpretation if the context sets a past reference time, as in (28). In this case too, *ga ... ni* does not give rise to an actuality entailment.

[5]In (13), we showed that *ga* alone is likewise incompatible with this same context. To express epistemic possibility, the *nwere ike*-construction, illustrated in (8), is used.

(27) Paul **gà**-èbú-**ní** òkú!té áhụ̀ mànà ò bú-bè-ghì òkú!té áhụ̀
Paul GA-carry-NI stone DEF but 3SG carry-yet-NEG stone DEF
"Paul can carry that stone, but he never carried the stone."

(28) *Context:* Last year, you worked in the field and asked Paul to carry a heavy stone for you. Paul had the ability to do it, but he still declined your request. You tell your friend:
Paul **gà**-èbú-**ní** òkú!té áhụ̀ mànà ọ́ jụ̀-rụ̀ í-!bú !yá
Paul GA-carry-NI stone DEF but 3SG refuse-rV INF-carry it
"Paul was able to carry the stone, but he refused to do it."

3. Towards an analysis

3.1. The semantics of *ga*

Before we move on to proposing an analysis of the future marker *ga*, let us briefly summarize its main empirical properties as laid out in the data section:

(29) Sentences with *ga*
a. are compatible not only with future, but also with past and present temporal orientation;
b. are compatible with (weak and strong) necessity readings, but not with possibility readings;
c. are compatible with predictive (= future), epistemic and pseudo-epistemic readings, but not (or only marginally) with other modal flavors.

From the observation in (29a), we conclude that the semantic contribution of *ga* is not that of a prospective future shifter. The examples we presented as (11) and (12) display a present temporal perspective as well as past and present temporal orientation, respectively. In other words, there is no future shift of the reference time or the event time in these examples. However, the sentences are modalized; they receive an epistemic-like interpretation. It therefore seems reasonable to generalize that the meaning of *ga* is modal, and that the predictive reading of the 'future marker' *ga* is just one specific instance of its modal meaning.[6] From (29b), we derive the assumption that *ga* encodes universal modal force, i.e. it is a marker of modal necessity. Recall from Section 2 that, intuitively, sentences with *ga* are weaker than sentences with *ga ... ṛịrị*. As will become clear in the next subsection, we will analyze this observation as a difference in modal strength, by positing different quantificational domains for *ga* with and without *ṛịrị*. Hence, based on the observations in (29a) and (29b), we propose the basic semantics in (30) for *ga*. According to (30), *ga* takes as its arguments a quantificational domain *D* and a proposition *p*, and asserts that all possible worlds in *D* are worlds in which *p* is true.

[6] This leaves open the question of how exactly the future orientation of (4) and, in fact, any future orientation in modal sentences in Igbo is derived. Although some further investigation of temporal interpretation in Igbo is required, from a cross-linguistic point of view it seems plausible to hypothesize that future orientation is contributed by prospective aspect, which can be covert in some languages. This argument has been made by Kratzer (2012b) for circumstantial modals in English, by Matthewson (2012); Rullmann and Matthewson (2018) for modals cross-linguistically and by Mucha (2015, 2016) for modal future markers. We conjecture that Igbo is one of the languages that encodes prospectivity covertly.

(30) $[\![ga]\!]^{w,c} = \lambda D_{\langle s,t\rangle}.\lambda p_{\langle s,t\rangle}.\ \lambda w.\ \forall w'\ [w' \in D(w) \rightarrow p(w') = 1]$

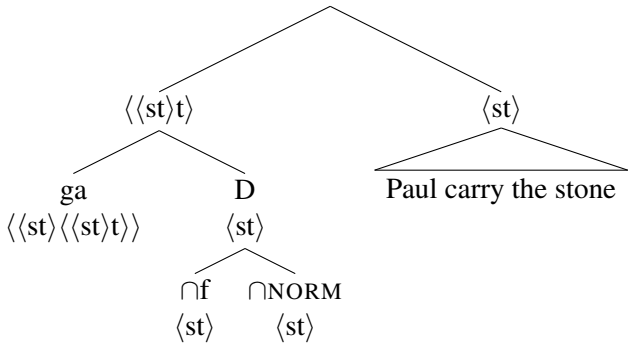
Our observation in (29c) becomes relevant for the definition of *ga*'s quantificational domain. We propose that what unifies the observed modal flavors of *ga* as listed in (29c) is that they are associated with quantification over normal or stereotypical worlds, i.e. possible worlds consistent with how situations normally develop. That normality assumptions play a role in epistemic modality has already been proposed by Kratzer (1981, 2012a), where they function as a stereotypical ordering source restricting an epistemic modal base. The proposal that predictive readings of modal future markers can be analyzed in parallel to their epistemic readings figures prominently in the works of Giannakidou and Mari (2018b, 2023) on Greek and Italian. Finally, as already noted in Section 2, Yalcin (2016) analyzes pseudo-epistemic *should* and *ought* in English as quantifiers over 'normal' worlds.[7] Since all and only these flavors seems to be readily available for sentences with *ga* alone, we propose that its quantificational domain is constructed from the following two components. The first, which we call ∩NORM, is the set of worlds consistent with the normality assumptions in the actual world, see (31). The second component is a generalized modal base as shown in (32), i.e. the set of worlds accessible from the actual world in the context of utterance. This ∩f should be thought of as the intersection of the propositions that make up an under-specified conversational background.

(31) $[\![\cap\text{NORM}]\!]^{w,c} = \lambda u_s.$ u is compatible with the normality assumptions in w

(32) $[\![\cap f]\!]^{w,c} = \lambda v_s.$ v is contextually accessible from w in c

The quantificational domain of *ga*, we propose, is the intersection of these two sets of possible worlds, both represented (covertly) in the syntax.[8] In (33), we sketch the LF structure of our original future sentence in (4) (*Paul* ***gà****-èbú òkú*^{l}*té áhù*), and in (34) we make explicit the denotation of the quantificational domain *D*. The truth conditions of (4) are provided in (35).

(33) LF structure of (4):



(34) $[\![D]\!]^{w,c} = [\![\cap f]\!]^{w,c} \cap [\![\cap\text{NORM}]\!]^{w,c}$
$= \lambda z_s.$ z is accessible from w in c & z is compatible with normality assumptions in w
shorthand: $\lambda z_s.\ z \in \text{ACC}_c(w, z)\ \&\ z \in \cap\text{NORM}$

[7] We should note that Yalcin (2016) proposes a clear distinction between epistemic and pseudo-epistemic modality, and assumes that only the latter is sensitive to stereotypicality.

[8] This aspect of our proposal is similar to the analysis of epistemic modality and future marking proposed by Giannakidou and Mari (2018a, 2023), where a modal base is narrowed down by a set of worlds that is ideal with respect to stereotypicality assumptions (rather than restricted *and* ordered by a stereotypical conservational background as in Kratzer (1981, 2012a)'s original framework). We thank Alda Mari for drawing our attention to the similarities between their observations on Italian and ours on Igbo.

(35) $[\![(4)]\!]^{w,c} = [\![ga]\!]^{w,c}([\![D]\!]^{w,c})(\lambda w.\exists e$ [Paul carry the stone (e,w)])
= $\forall w'$ [w' $\in$ ACC$_c$(w,w') & w' $\in \cap$NORM $\rightarrow \exists e$ [Paul carry the stone (e,w')]]

In effect, *ga* quantifies over only those worlds that are compatible with normality assumption in the actual world. The subtle differences between the modal flavors listed in (29c) depend on the contextual information represented in $\cap$f, and temporal orientation depends on the aspectual properties of the embedded proposition (see also footnote 6).

3.2. The semantics of *(ga) ... ṛịrị*

Again, we first summarize the main empirical properties of the morpheme *ṛịrị* and its interpretation in combination with *ga*, before we extend our account to sentences like (5) (repeated below).

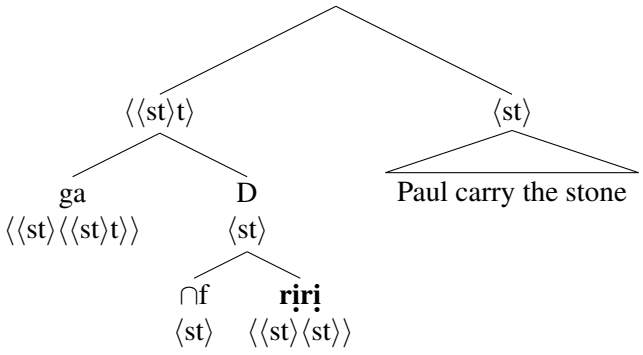
(36) a. Sentences with *ga ... ṛịrị* are compatible with a variety of modal flavors, including epistemic, deontic, teleological and pure circumstantial flavor;
b. Sentences with *ga ... ṛịrị* are intuitively stronger than sentences with *ga* alone. *Ga ... ṛịrị* always expresses strong necessity;
c. It seems that *ṛịrị* always occurs in combination with a modal operator. When *ṛịrị* combines with a weak necessity modal, the resulting interpretation is strong necessity.

(5) Paul **gà**-èbú-**ṛ́ịrí́** òkú!té áhụ̀
Paul GA-carry-RIRI stone DEF
"Paul must carry the stone."

We propose to account for these observations by analyzing *ṛịrị* as a domain widener for (necessity) modals. More specifically, we take *ṛịrị* to denote an identity function over sets of possible worlds, as shown in (37). In the composition of modal sentences with *ga*, *ṛịrị* 'replaces' the normality set $\cap$NORM, and takes the modal base $\cap$f as its argument, as shown in (38). The resulting truth conditions in (39) are identical to the truth conditions of the future sentence without *ṛịrị*, except that *ga* quantifies over the entire modal base.

(37) $[\![ṛịrị]\!] = \lambda W_{\langle s,t\rangle}.\ W$

(38) LF structure of (5):



(39) $[\![(5)]\!]^{w,c} = [\![ga]\!]^{w,c}([\![D]\!]^{w,c})(\lambda w.\exists e$ [Paul carry the stone (e,w)])
= $\forall w'$ [w' $\in$ ACC$_c$(w,w') $\rightarrow \exists e$ [Paul carry the stone (e,w')]]

Thus, *ṛiṛị* removes the restriction to 'normal' worlds in the quantificational domain of *ga*. In contrast to sentences with *ga* alone, the modal flavor of sentences with *ga ... ṛiṛị* is provided only by the modal base (∩f). Given the underspecified definition of ∩f, the flavor of *ga ... ṛiṛị* thus solely depends on the context of utterance, which accounts for our observation in (36a). By removing the inbuilt normality restriction of *ga*,[9] *ṛiṛị* also has the effect of widening the domain of the universal quantifier. This, we propose, accounts for the intuition that sentences with *ga ... ṛiṛị* are intuitively stronger than sentences with *ga* alone, see (36b). Finally, the assumption that *ṛiṛị* is a modifier of modal bases helps us make sense of the observation that it seems to need a modal 'host', such as *ga* or the weak necessity modal *kwesi(ri)*. In the analysis sketched here, *ṛiṛị* does not itself encode modality, but merely manipulates a modal's domain of quantification.

3.3. The semantics of *(ga) ... ni*

Finally, in (40) we summarize some relevant properties of sentences with *(ga) ... ni*.

(40) a. In contrast to *ga* alone and *ga ... ṛiṛị*, sentences with *ga ... ni* express possibility;
b. Sentences with *ga ... ni* always come with non-epistemic flavor. Specifically, *ga ... ni* expresses circumstantial possibility / ability meaning;
c. In contrast to *ṛiṛị*, *ni* can occur on its own, and in this case also expresses circumstantial possibility / ability.
d. Actuality entailments arise with *ni* alone, but not with *ga ... ni*.

We propose that, taken together, the observations in (40a)–(40c) point to the conclusion that *ni* comes with its own modal meaning. More specifically, we adopt a version of Hacquard's (2009) lexical entry for circumstantial possibility to model the meaning of *ni*, which is event-relative and assumes that the modal attaches low in the LF structure, taking the vP as its argument:

(41) $[\![ni]\!]^{w,c} = \lambda P_{\langle s,\varepsilon t\rangle}.\lambda e_{\varepsilon}.\ \exists w'$ [w' is compatible with circumstances in w so that P(w',e)]

Adopting this event-relative modal meaning for *ni* potentially allows us to capture all of the observations listed in (40). Most straightforwardly, assuming that *ni* itself is a modal marker accounts for its independent status in contrast to *ṛiṛị*, as stated in (40c). Moreover, Hacquard's analysis of modals in French explicitly aims to explain the distribution of actuality entailments with modal sentences. As a reminder, we repeat our example (26a) of an actuality entailment arising with *ni*:

(26a) Paul bùrù**-nì** òkú$^{!}$té áhù̩ ...
Paul carry.RV-NI stone DEF
"Paul was able to carry the stone ..."
(...**# mànà ò bú-bè-ghì òkú$^{!}$té áhù̩**)
but 3SG carry-yet-NEG stone DEF
"but he never carried the stone."

[9]This inbuilt restriction is essentially a stipulation. However, following Kratzer (2012a), we hypothesize that it might have some conceptual grounding in that stereotypical ordering has a privileged role in the domain of modal flavors, as briefly discussed in Section 4.

According to Hacquard (2009), actuality entailments arise only with root modals (including circumstantial modals) when they co-occur with perfective aspect, due to their specific compositional interaction. Root modals occupy a lower syntactic position than aspect at LF, and perfective aspect anchors the modalized event to the actual world. In the lexical entry for perfective in (42) (adapted from Hacquard 2009: 295), this world anchoring is represented in the underlined meaning component.

(42) $[\![\text{PERFECTIVE}]\!]^{w,c} = \lambda P_{\langle \varepsilon t \rangle}.\lambda t_i.\ \exists e\ [\underline{e \text{ in } w} \ \&\ \tau(e) \subseteq t \ \&\ P(e)]$

By contrast, with imperfective aspect or an epistemically interpreted modal, no actuality entailment arises. Epistemic modals, unlike root modals, are assumed to occupy a higher syntactic position than aspect. In this configuration, even if an epistemic modal co-occurs with perfective aspect, the perfective anchors the event to the possible worlds introduced by the modal, not to the actual world. Actuality entailments are also suspended with imperfective aspect, which is assumed to come with its own modal meaning component, and therefore does not anchor the event to the actual world. An example of the relevant aspectual contrast in French is reproduced in (43): (43a) shows a circumstantial possibility sentence with perfective aspect, and gives rise to an actuality entailment. In the imperfective circumstantial possibility sentence in (43b), no actuality entailment arises.

(43) a. Jane a pu soulever cette table, # mais elle ne l'a pas soulevée.
Jane can-past-pfv lift this table, # but she didn't lift it

b. Jane pouvait soulever cette table, mais elle ne l'a pas soulevée.
Jane can-past-impf lift this table, but she didn't lift it
"Jane was able to lift this table, but she didn't do it." (Hacquard, 2009: 288)

Returning to Igbo, a crucial step towards modeling the semantics of sentences with *ni* such as (26a) therefore consists in identifying their aspectual properties. This is by no means an easy task, and a detailed analysis of aspect semantics in Igbo is well outside the scope of this paper. However, preliminary evidence suggests that sentences that give rise to actuality entailments with *ni* are in fact semantically perfective. In (45)–(47), we examine possible aspectual interpretations of the sentence in (26a) without *ni*, i.e., its unmodalized version shown in (44). (We consider versions of the sentence with definite or indefinite object NPs, since definiteness is well-known to influence aspectual interpretation in some languages.)

(44) Paul bù-rù òkú!té (áhụ̀)
Paul carry-rV stone (DEF)
"Paul carried the / a stone."

Like (26a), the sentence receives a past interpretation by default. As illustrated in (45), (44) is felicitous as an answer to a question that triggers a perfective interpretation. It cannot be used, however, to answer questions triggering an imperfective interpretation. We tested this for two common interpretations of imperfective sentences: an ongoing event interpretation, see (46), and habitual interpretation, (47). While these meanings are expressed by distinct progressive and habitual markers in some languages, both are associated with imperfective aspect meaning, and compatible with imperfective markers in languages that encode a binary perfective / imperfective aspectual distinction. Crucially, both of these interpretations seem to be incompatible with the verb form that triggers an actuality entailment with *ni*.

(45) *Context question (past perfective):* Paul's back is sore. What did he do yesterday?

Paul bù-rù òkú!té (áhụ̀)
Paul carry-rV stone (DEF)
"Paul carried the / a stone."

(46) *Context question (past imperfective / ongoing):* What was Paul doing this morning when you saw him here in the field?

Paul bù-rù òkú!té (áhụ̀)
Paul carry-rV stone (DEF)
Intended: "Paul was carrying the / a stone."

(47) *Context question (past imperfective / habitual):* What did Paul usually do when we used to work in the field?

Paul bù-rù òkú!té (áhụ̀)
Paul lift-rV stone (DEF)
Intended: "Paul used to carry the / a stone."

From these data, we tentatively conclude that sentences such as (45)–(47), as well as (26a), indeed involve perfective aspectual semantics (possibly encoded by the *-rV* morpheme, but see our remarks on this in Section 1). If this assumption is correct, and if *ni* is accurately analyzed as a circumstantial possibility modal as we propose above, Igbo presents yet another example of a language where the compositional interaction of perfective aspect and circumstantial modality results in actuality entailments despite modal meaning being encoded in the sentence. Among a range of available analyses of this and related phenomena (see Hacquard 2020 for an overview and Nadathur 2023 for recent discussion), we adopt Hacquard's (2009) analysis for the sake of concreteness. With *ni* scoping between the vP and a perfective aspect operator as sketched in (48), and the reference time provided by contextual variable assignment (by assumption),[10] the truth conditions come out as in (49).

(48) Structure of (26a): [λw [$_{TP}$ t_1 [$_{AspP}$ PFV [$_{ModP}$ ni [$_{vP}$ Paul carry the stone]]]]]

(49) $[\![(26a)]\!]^{g,c}$ = $[\![\text{PERFECTIVE}]\!]^{g,c}([\![\text{NI}]\!]^{g,c}([\lambda w.\lambda e.\text{Paul carry the stone (e,w)}]))([\![t_1]\!]^{g,c})$
= λw. $\exists$e [e in w & τ(e) $\subseteq$ g(1) & $\exists$w' [w' is compatible with circumstances in w so that e is an event of Paul carrying the stone in w']]

If we adopt from Hacquard (2009) the assumption of "Preservation of Event Description Across Worlds" (PED), i.e., in a nutshell, assuming that the event *e* in (49) can be taken to be same event in the actual world *w* and in the worlds quantified over by *ni*, (49) asserts that Paul carried the stone in the actual world. Hence, negating the existence of such an event is infelicitous, as in (26a). Furthermore, the circumstances in the actual world include Paul's abilities and dispositions, leading to the salient ability interpretation.

[10]We do not currently have sufficient insight into the temporal system of Igbo to decide whether or not the past temporal interpretation of (26a) is semantically encoded. The analysis proposed here assumes that it is not, in which case the past interpretation might be a pragmatic default arising from perfective semantics of the sentence (detailed discussion of how such defaults arise is provided in Smith et al. 2007; Mucha 2015, among others). This is a simplification. Moreover, we diverge from Hacquard's analysis in representing the evaluation world as a bound pronoun in the object language, in order to derive a suitable argument for the modal operator *ga*. In matrix clauses, the evaluation world is identified with the actual world.

Finally, let us spell out the semantics of sentences with *ga* and *ni*, by example of (6), which again we repeat here for convenience.

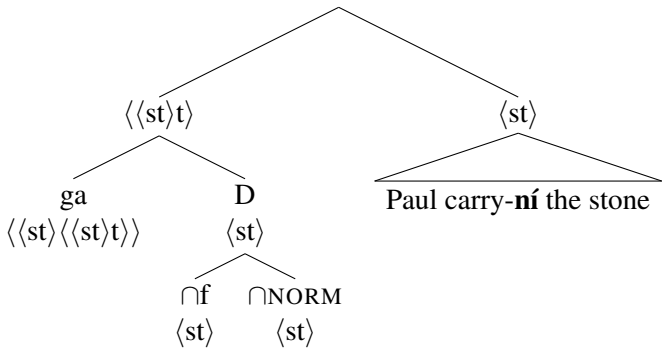
(6) Paul **gà**-èbú-**ní** òkú!té áhụ̀
Paul GA-carry-NI stone DEF
"Paul can carry the stone."

Firstly, recall that this sentence does not give rise to an actuality entailment, irrespective of whether it is interpreted with present or past reference, as shown in examples (27) and (28). Our hypothesis is that *ga* plays a similar role in suspending actuality entailments as imperfective aspect does in languages like French.[11] In existing accounts along the lines of Hacquard (2009) and Bhatt (2006), it is the modal meaning component, broadly in terms of normality, inertia or genericity, that turns the assertion of an actual event into an assertion about a hypothetical ability to realize an event, without any requirement of actual instantiation. We adopt from these works the assumption that the additional layer of modality contributed by *ga* can explain the contrast in actuality entailments between *ga ... ni* and *ni* alone. However, the overall picture is more intricate. It is interesting to note that *ga* cannot occur with the verb form that, by our hypothesis, is associated with perfective aspect. In other words, simply adding *ga* to the sentence in (26a) results in ungrammaticality:

(50) *Paul **gà**-bù-rù-**nì** òkú!té áhụ̀
Paul GA-carry-rV-NI stone DEF
Intended: "Paul was / is able to carry the stone."

While we have to leave a comprehensive analysis of actuality entailments in Igbo for future research, we are now in a position to propose an analysis of sentences with *ga ... ni*. In the LF structure sketched in (51), *ga* composes first with its quantificational domain in the same way as shown in Section 3.1, and then with a proposition modalized by *ni*, which, we assume, involves an aspectually neutral base form of the verb (as we also did in the derivations in Sections 3.1 and 3.2).[12] Simplifying over tense information, we derive the truth conditions in (52).

(51) LF structure of (6):



[11] Although our own data and analysis do not really reflect this, examples cited in Emenanjo (2015: 420/1) suggest that *ga* actually has imperfective uses for some speakers (or at least did so in the past).

[12] This assumption is partly motivated by the fact that Igbo has a dedicated imperfective marker which also combines with this basic verb form, as shown in (i).

(i) Paul **nà**-èbú òkú!té áhụ̀
Paul IMPF-carry stone DEF
"Paul is carrying / carries the stone."

(52) $[\![(6)]\!]^{w,c} = [\![ga]\!]^{w,c}([\![D]\!]^{w,c})([\lambda$w.$\exists$e $\exists$w' [w' is compatible with circumstances in w so that e is an event of Paul carrying the stone in w']])
= $\forall$w' [w' $\in$ ACC$_c$(w,w') & w' $\in \cap$NORM $\rightarrow$ $\exists$e $\exists$w" [w" is compatible with circumstances in w' so that e is an event of Paul carrying the stone in w"]]

The truth conditions in (52) state that for all the 'normal' worlds in the relevant context, an event of Paul carrying the stone is possible given the circumstances (including Paul's abilities) in that world. *Ni* itself contributes existential modal force and the circumstantial flavor, and *ga* adds an extra layer of modality relativizing the circumstantial background to a set of worlds that conform to what is normally the case in the actual world. This implementation is very similar to Hacquard's (2009) analysis of imperfective-marked circumstantial possibility. The idea that a modal operator quantifying over normal worlds is involved in the composition of ability attributions is based on ideas presented by Bhatt (1999, 2006). This operator (a GENericity operator in Bhatt's account), is realized as imperfective aspect in many languages, and covert in others such as English. According to Bhatt, it is this modal operator that distinguishes (modal) ability attributions from a basic implicative meaning of *able*. The data from Igbo that we have presented here support this idea in as much as *ga*, which we propose to analyze as a 'normality' modal, systematically occurs in sentences that express ability (and circumstantial possibility more generally). The ability construction that gives rise to an actuality inference, by contrast, does not involve *ga*. One way of phrasing our analysis is that Igbo conventionalizes the implicative meaning of *able* ($\approx$ 'manage') as the combination of *ni* and perfective aspect, and hypothetical ability attribution ($\approx$ 'have the ability') as the combination of *ni* and *ga*. To illustrate this more clearly, we repeat in (53) a condensed version of examples (26) and (28) for comparison.

(53) a. Paul bùrù-**nì** òkú!té áhụ̀ **#** mànà ò bú-bè-ghì òkú!té áhụ̀
Paul carry.RV-NI stone DEF # but 3SG carry-yet-NEG stone DEF
Intended: "Paul was able to carry the stone but he never carried the stone."

b. Paul **gà**-èbú-**ní** òkú!té áhụ̀ mànà ọ́ jụ̀-rụ̀ í-!bú !yá
Paul GA-carry-NI stone DEF but 3SG refuse-rV INF-carry it
"Paul was able to carry the stone, but he refused to do it."

In the final section, we provide some overall conclusions and possible implications of our findings.

4. Conclusions

In this paper, we discussed the interpretation of the Igbo future marker *ga* as well as the compound forms *ga ... ṛịrị* and *ga ... ni*, which express necessity and possibility meanings, respectively. We argued that *ga* denotes a necessity modal whose quantificational domain is inherently restricted by assumptions about normality. Necessity interpretations in a more general sense, including deontic, teleological and epistemic (strong) necessity are conveyed when *ga* is combined with the morpheme *ṛịrị*. Indeed, the combination of *ga* and *ṛịrị* is the canonical form in the functional modal paradigm of Igbo to express strong necessity, i.e. Igbo does not have a dedicated necessity modal akin to 'must' in English. In Igbo, the modality conveyed by English 'must' is compositionally derived from future modality, which we model as universal

quantification over normal worlds. This architecture of modal necessity in Igbo has potential implications for modal semantics more generally. As reflected (more or less explicitly) in works like Yalcin (2010); Kratzer (2012a) and Giannakidou and Mari (2018a), assumptions about normality and stereotypicality might have a privileged role among conversational backgrounds that restrict modal quantification. If so, this special status of stereotypicality is reflected in the way necessity meaning is construed in Igbo (whether or not our particular implementation is the best way to model this). Besides widening the range of possible modal flavors, adding *rịrị* also has the effect of strengthening the force of *ga*, leading to strength differences that are somewhat comparable to the case of epistemic 'will' and 'must' in English (see e.g. Mihoc et al. 2019, Giannakidou and Mari 2023). What is more, *rịrị* has a similar strengthening effect on the weak necessity modal, changing its interpretation to strong necessity. This observation seems to align with recent research suggesting that, at least in some languages, strong necessity meaning is derived from weak necessity. Weingartz and Hohaus (to appear) develop such a proposal to account for the weak and strong necessity readings of individual modals with variable strength in Afrikaans and Samoan. In Igbo, interestingly, strong necessity is explicitly marked with the morpheme *rịrị*, while weaker necessity expressions are morphologically simpler.

Finally, when the 'future marker' *ga* combines with the morpheme *ni*, which we analyzed as a low-scoping modal operator encoding circumstantial possibility, *ga* seems to contribute the normality-related meaning component associated with ability attributions in some analyses (e.g. Bhatt 2006). Recent accounts of circumstantial possibility / ability modals and their actuality entailments (e.g. Louie 2015; Nadathur 2023) are of considerable complexity, involving several layers of modal quantification. Although we could only provide a rough sketch of an analysis of *ga ... ni* in this paper, the fact that ability meaning is encoded in this compositional modal form in Igbo may reflect the semantic complexity of this particular modal meaning.

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Modifying the ordering source – unstressed *überhaupt* in German purpose clauses[1]

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Abstract. My goal is to reconcile the seemingly unrelated meanings of the two variants of the German particle *überhaupt*, stressed *überhaupt* (≈ 'at all', 'in general') and unstressed *überhaupt* (≈ 'even') in one specific embedded case: purpose clauses[2] with the complementizer *um*. I propose an account of *überhaupt* in purpose clauses that does justice to its focus-sensitive scalar meaning but keeps intact the domain widening meaning, as argued for by Anderssen 2006 for the stressed variant. I claim that unstressed *überhaupt* modifies the bouletic ordering source in purpose clauses by excluding all higher ranked focus alternatives of the embedded proposition *q* in *p in order to q*. The result is a wider domain which is quantified over by a bouletic modal included in the purpose clause with *um*.

Keywords: purpose clauses, modality, *überhaupt*, focus, domain widening

1. Introduction

The German particle *überhaupt* has two variants with seemingly distinct meanings: stressed (*überhaupt*$_s$) and unstressed (*überhaupt*$_u$). Depending on the logical context, the stressed variant has a meaning paraphrasable by 'in general' as in (1) or 'at all' as in (2). (1) involves an upward-entailing (UE) context, whereas (2) involves the verb *verhindern* 'prevent', which gives rise to a downward-entailing (DE) context.

(1) Paul ist sehr frech zu seinen Lehrern. Er ist ÜBERHAUPT sehr frech.
Paul is very sassy to his teachers he is ÜBERHAUPT very sassy
'Paul is sassy with his teachers. He is sassy in general.' König (1983: 161)

(2) Wir müssen verhindern, dass er sich ÜBERHAUPT einmischt.
we must stop that he himself ÜBERHAUPT involves
'We have to stop him from getting involved at all.' König (1983: 161)

The unstressed variant exhibits NPI-distribution König (1983) and has a scalar effect, sensitive to focus. Its meaning is in most cases paraphrasable by English *even* (in its most-likely reading). (3) shows the corresponding example to (2) with the unstressed variant.

(3) Wir müssen verhindern, dass er sich überhaupt EINMISCHT.
we must stop that he himself ÜBERHAUPT involves
'We have to stop him from even getting INVOLVED.'

The contrast between (4a) and (4b) illustrates the NPI distribution of the unstressed variant. Whereas its use is fine in the *before*-clause (with *bevor*), the corresponding *after*-clause with

[1]I would like to thank Berit Gehrke, Malte Zimmermann, Sarah Zobel as well as everybody from Berlin who helped me!

[2]Also sometimes called final clauses or rationale clauses.

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nachdem in does not license its use. As *before*-, but not *after*-clauses license NPIs (Krifka, 1991; Condoravdi and Beaver, 2003).

(4) a. Bevor Su überhaupt die EINLEITUNG gelesen hatte, war sie begeistert.
before Su ÜBERHAUPT the introduction read had was she thrilled.
'Before Su had even read the INTRODUCTION, she was thrilled.'

b. # Nachdem Su überhaupt die EINLEITUNG gelesen hatte, war sie begeistert.
after Su ÜBERHAUPT the introduction read had was she thrilled.
'After Su had even read the INTRODUCTION, she was thrilled.'

The goal of this paper is to account for the meaning of both variants in one specific case: German purpose clauses headed by the complementizer *um* (≈ 'in order'), as in (5).

(5) a. Bo hat eine Tablette genommen, um ÜBERHAUPT zu schlafen.
Bo has a pill taken in-order ÜBERHAUPT to sleep
'Bo took a pill in order to sleep at all.'

b. Bo hat eine Tablette genommen, um überhaupt zu SCHLAFEN.
Bo has a pill taken in-order ÜBERHAUPT to sleep
'Bo takes a pill in order to even sleep.'

In (5a) a desire is expressed in the embedded clause: the agent's desire to sleep, the use of *überhaupt*$_u$ leads to an interpretation with respect to a wider domain of interpretation. The wish to sleep is understood to be more general, than without *überhaupt*$_u$. In use of *überhaupt*$_u$ (5b) leads to an interpretation where sleeping is considered a desire which is ranked lowest on a scale of amount of work.

My proposal in a nutshell: For the stressed variant in (5a), I follow the account of Anderssen (2006): *überhaupt*$_s$ widens the relevant domain of interpretation, similar to English *any* (cf. Kadmon and Landman 1993). I argue that the effect of *überhaupt*$_u$ in (5b) is also one of domain widening. In the unstressed case however, the widened domain is the set of possible worlds quantified over universally by a bouletic modal. This bouletic modal part of the meaning of the purpose clause, allowing a paraphrase *p because the agent wants q* for *p in order to p* Sæbø (1991). This is done via a modification of the ordering source in the bouletic modal. The account preserves the intuition that *überhaupt* has a domain widening meaning in the stressed case, and extends it to the unstressed case.

The paper is structured as follows: In section 2, I present four accounts of *überhaupt* and review the predictions they make for the case of unstressed *überhaupt* in purpose clauses headed by *um*. In section 3, I argue that *überhaupt*$_u$ is a focus-sensitive scalar particle. In section 4, I give a semantics for purpose clauses, based on a paraphrase by Sæbø (1991) for *p in order to q* which is *p because the agent wants that q*. In section 5, I make my proposal for the case of unstressed *überhaupt* in *um*-clauses and address the difference between the two variants, in the examples in (5). In section 6, I show how my account predicts the licensing of *überhaupt*$_u$ as an NPI in purpose clauses. Section is concludes and Section 8 is dedicated to open issues.

2. Previous work on *überhaupt*

Previous work on *überhaupt* has either focused on the meaning of one variant (Anderssen 2006; Csipak and Zobel 2016 for *überhaupt*$_s$, Zobel 2020 for *überhaupt*$_u$) or treated the two variants as having distinct meanings (König, 1983). An exception is Rojas-Esponda (2014), who gives a unified account in a QUD framework, but excludes embedded cases. Embedded cases have received little attention in the literature on the whole. I review four accounts in regards to the predictions they make with respect to the use of unstressed variant in purpose clauses headed by *um* ($\approx$ 'in order to').

2.1. König (1983)

König identifies three main uses of *überhaupt* depending on phonological stress and grammatical context. He notes that in UE contexts, the stressed variant has an effect of widening the perspective. In (6) the speaker expresses that Paul is not only sassy with his teachers but in general.[3]

(6) Paul ist sehr frech zu seinen Lehrern. Er ist ÜBERHAUPT sehr frech.
Paul is very sassy to his teachers he is ÜBERHAUPT very sassy
'Paul is sassy with his teachers. He is very sassy in general.' König (1983: 161)

The sentence in (7) containing the superlative *schnellste* 'fastest' says that the race in question was not only the fastest race with respect to some restrictions provided by the context, but in general.

(7) Dieses war der schnellste 400m Lauf ÜBERHAUPT.
this was the fastest 400m race ÜBERHAUPT
'This was the fastest 400m race of all.' König (1983: 161)

Formally, König analyses this use of *überhaupt*$_s$ in affirmative contexts as a universal quantifier of viewpoint adjuncts, paraphrasable by "in jeder Hinsicht" 'in every regard' (i.e. *Paul is sassy in every regard, This was the fastest race in every regard.*)
König notes that in DE contexts the effect of stressed *überhaupt* changes to an existential one, paraphrasable by English *at all*. In (8), *überhaupt*$_s$ appears in the antecedent of a conditional. In (9) it is embedded under the verb *verhindern* 'prevent'. Both give rise to a DE environment.

(8) Wenn er ÜBERHAUPT kommt, dann (kommt er) spät.
if he ÜBERHAUPT comes then (comes he) late
'If he comes at all, he will be late.' König (1983: 161)

(9) Wir müssen verhindern, dass er sich ÜBERHAUPT einmischt.
we must stop that he himself ÜBERHAUPT involves
'We have to stop him from getting involved at all.' König (1983: 161)

[3] All translations and glosses of König's example are by me, all errors as well.

Note that (9) does not mean that we have to stop him from getting involved in a general way, but that we have to stop him from getting involved in any way at all. König attributes this flip in meaning of the stressed variant (universal to existential) to the monotonicity of the context.[4]

For the unstressed variant, König describes its meaning as expressing a precondition to a contextually given issue. In (10) participating is a precondition to winning a medal, which is expressed by the use of *überhaupt*$_u$. The English paraphrase has *even* in its likeliest reading.

(10) (Hast du eine Medaille gewonnen?) – Ich bin froh, dass ich überhaupt TEILnehmen
have you a medal won – I am glad that I ÜB. participate
durfte.
was-allowed
'(Did you win a medal?)' – 'I am glad I was even allowed to PARTICIPATE.'
(König, 1983: 161)

This notion of precondition however is too strict. In cases like (11b) in the context of (11a), the ordering must be of a different nature, as beer is not a precondition to champagne.

(11) a. Context: *Your friend was tasked with the shopping for a fancy dinner party. Champagne is the preferred drink. However, due to an unusual high demand for alcoholic drinks most stores were sold out. Your friend comes back.*

b. Hast du Champagner dabei? – Ich bin froh, dass ich überhaupt BIER
(Have you Champagne with-you) – I am glad that I ÜBERHAUPT beer
bekommen habe.
got have
'(Did you bring Champagne?)' – 'I'm glad I even got BEER.'

Rather than a ranking according to precondition, the ordering in (11) is based on how much the alcohol is desired. As beer is less desired for a fancy dinner party the use of *überhaupt*$_u$ is licensed. Turning to the use of unstressed *überhaupt* in purpose clauses with *um*, we can see that the notion of precondition is applicable in (12), but not in (13).

(12) (Hast du eine Medaille gewonnen?) – Um überhaupt TEILzunehmen, hab'
Have you a medal won – in-order ÜBERHAUPT participate have
ich die letzten fünf Jahre trainiert.
I the last five years trained.
('Did you win a medal?') – 'In order to even PARTICIPATE, I trained for the last five years.'

(13) (Hast du Champagner dabei?) – Um überhaupt BIER zu bekommen, hab'
Have you champagne with-you – in-order ÜBERHAUPT beer to get have
ich die ganze Stadt abgesucht.
I the whole city searched.
('Did you get champagne?') – 'In order to even get BEER, I searched the whole city.'

[4] Another polarity sensitivity particle with a very similar meaning is Hebrew *bixlal* (cf. Greenberg and Khrizman 2012; Greenberg 2019, 2020)

In short, following König (1983), the stressed variant can be seen as a polarity sensitive viewpoint quantifier with universal force in UE contexts and existential force in DE context. He claims, the unstressed variant marks the focused element as a precondition to a contextually given issue. I have provided evidence that suggests that the notion of precondition is too strict. Crucially, König (1983: 160) claims that the meanings of *überhaupt* are too different to be unified.

2.2. Anderssen (2006)

Anderssen proposes a domain widening account for the stressed variant. He shows that, similar to English *any*, *überhaupt*$_s$ results in a widening of the relevant domain of interpretation (cf. Kadmon and Landman 1993). His account builds on the parallels between the two expressions.[5]

(14) a. Ich habe keine Kartoffeln.
I have no potatoes
'I don't have potatoes.'

b. Ich habe ÜBERHAUPT keine Kartoffeln.
I have ÜBERHAUPT no potatoes
'I don't have any potatoes at all.'[6] Anderssen (2006: 60)

Whereas the domain of negation in (14a) is subject to implicit contextual restrictions (potatoes considered under normal circumstances), *überhaupt*$_s$ in (14b) widens this domain and includes also marginal cases (e.g. plastic potatoes) in the domain. Restrictions from the context are removed. The result is a stronger statement.

Anderssen shows that *überhaupt*$_s$ removes restrictions not only on quantifiers like *keine* 'no'. The example in (15) involves the manner adverb *politisch* 'politically'.

(15) A: Politisch war die Entscheidung eine Dummheit.
politically was the decision a stupidity
'The decision was stupid under a political perspective.'

B: Die Entscheidung war ÜBERHAUPT eine Dummheit.
the decision was ÜBERHAUPT a stupidity
'The decision was stupid under any perspective.' Anderssen (2006: 63)

In short, Anderssen analyzes the meaning of *überhaupt*$_s$ widening the domain of interpretation of its scope. Implicit or explicit restrictions on this domain are removed, in consequence, an 'in general'-reading arises. Anderssen (2006)'s account is limited to the meaning of the stressed variant and thus makes no predictions for the unstressed variant.

[5]Following (Anderssen, 2006: 61), the difference between *any* and *überhaupt*$_s$ is that *any* is morphologically complex and combines an existential and a domain widening component. *überhaupt*$_s$ corresponds only to the domain widening component and has no existential meaning. This is how he explains that *any*, but not *überhaupt*$_u$ is restricted to DE contexts.

[6]Stress in this example was added by me.

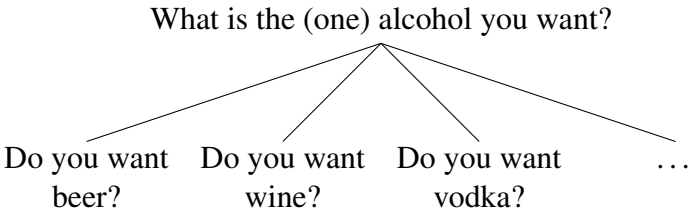
2.3. Rojas-Esponda (2014)

Rojas-Esponda proposes a unified account for the meaning of both variants of *überhaupt*. Set in a question-under-discussion framework (cf. Roberts 2012), the core of her idea is that both variants of *überhaupt* consititue a move to a higher up QUD.[7] Consider the conversation in (16), where A asks B questions of the sort *Do you want x-alcohol?* and B answers negatively.

(16) A: Möchtest du ein Glas Wein?
'Would you like a glass of wine?'
B: Nein, danke.
'No, thank you.'
A: Hättest du gerne ein Bier?
'Would a beer appeal to you?'
B: Nein. Ich TRINKE überhaupt keinen Alkohol.
'No. I drink ÜBERHAUPT no alcohol.' Rojas-Esponda (2014: 3)

In Rojas-Esponda's view, B's response including *überhaupt*$_u$ says that a precondition to the higher QUD doesn't hold. She gives the following representation of a QUD structure for (16) in (17).

(17)



The idea is that *überhaupt*$_u$ signals a move to the higher QUD: *What is the (one) alcohol you want?* This question carries a working assumption by A. The working assumption is: *You drink alcohol.* By uttering *überhaupt*$_u$ in combination with negation in (16), B denies this working assumption, and thereby ends the line of inquiry by A. Rojas-Esponda translates B's response as *I don't actually DRINK alcohol.*

In a response to Rojas-Esponda (2014), Zobel (2020) shows that certain cases like (18b) in the context of (18a) cannot be captured by Rojas-Esponda (2014)'s account.

(18) a. Context: *The restaurant is packed, the waiters are barely keeping up with orders. A is taking meal orders from a new table. When A turns to head to the kitchen, he realizes that he hasn't asked about drinks and does not know whether the customers already ordered them. A turns back to the table.*
b. Was hätten Sie überhaupt gerne zum Trinken?
what have you ÜBEHAUPT gladly to drink
'What would you ÜBERHAUPT like to drink?' Zobel (2020: 9)

[7] Rojas-Esponda (2014) considers the use of *überhaupt* in polar-questions, in combination with a universal quantifier and in combination with negation. She does not aim to account for embedded cases or wh-questions.

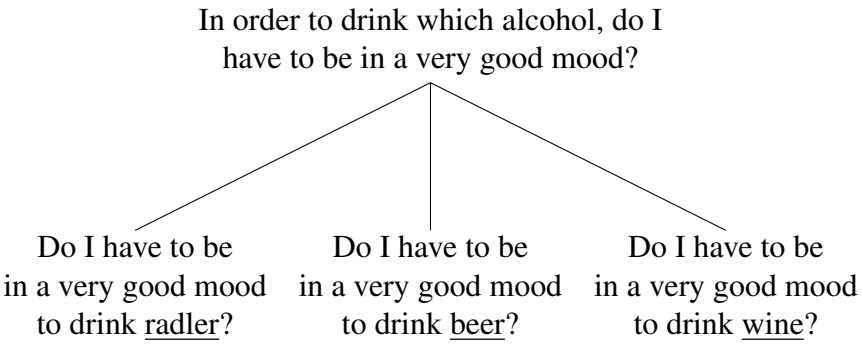
Zobel notes that in these cases unstressed variant marks the questions as one, which should have come earlier in the discourse. Crucially, neither the line of inquiry nor a precondition on the current QUD is apparent in (18). Zobel suggests that an incorporation of the notion of 'earlier in the discourse' into Rojas-Esponda's account would account for these cases.

Turning to embedded cases, I show below that the unstressed variant has a scalar effect, which cannot be captured by the account by Rojas-Esponda (2014). Consider (19), which is an equally conceivable as an answer to a line of inquiry as in (16).

(19) Um überhaupt RADLER zu trinken, muss ich schon sehr gut drauf sein.
In-order ÜBERHAUPT Radler to drink, must I SCHON very good on-it be
'To even drink RADLER, I have to be in a very good mood.'

In (19) the speaker expresses that Radler,[8] is the one alcohol she would drink, if any. A QUD structure for (19) is given in (20).

(20)



The crucial point is that in this case the alternatives on the bottom are ranked. A possible ranking might be according to likelihood or amount of alcohol, as in (21), where the alternative involving Radler ranks lowest.

(21) Ich muss sehr gut drauf sein,
I must very good on-it be
'I must be in very good mood...'
a. ...um Wein zu trinken.
'...in order to drink wine'
b. ...um Bier zu trinken
'...in order to drink beer'.
c. ...um Radler zu trinken.
'...in order to drink Radler'

A representation like (20) crucially lacks the scalar component expressed in (19). The sub-questions are not ordered to each other. Rather than targeting the precondition to the current QUD the effect of *überhaupt*$_u$ in (19) is to target the lowest ranked alternative. This scalarity is not part of the QUD-model by Roberts (2012) assumed by Rojas-Esponda, hence the scalar effect of unstressed *überhaupt* in (19) can not be captured by the QUD account.

[8]Radler is a drink with less alcohol than wine or beer.

2.4. Csipak and Zobel (2016)

Csipak and Zobel note that the stressed variant in shortened conditionals has a scalar effect. The element qualified by *überHAUPT*[9] is taken to be low in absolute terms, on a contextually determined scale.

(22) Er war mittelmäßig, wenn überHAUPT.
he was mediocre if ÜBERHAUPT
'He was mediocre, if that.' Csipak and Zobel (2016: 56)

The scale with which *überHAUPT* interacts in (22) is one of achievement. Stressed *überHAUPT* signals that the scalar element in the consequent, *mittelmäßig* 'mediocre', is at the low end of a scale in absolute terms and at the same time the highest possible value which can be said to hold true. This explains the odditiy of (23).

(23) # Er war der Beste, wenn überHAUPT.
he was the best if ÜBERHAUPT
'He was the best, if that.' Csipak and Zobel (2016: 56)

The DP *der Beste* 'the best' represents the maximal value of an achievement based scale. It is thus incompatible with being placed at the low end of a scale. These data show, that *überHAUPT* in shortened conditionals has a scalar effect. In the next section I provide further evidence for the scalar nature of unstressed *überhaupt* in embedded cases.

3. Unstressed *überhaupt* as a scalar focus-sensitive particle

The scalar component identified by Csipak and Zobel (2016) can also be found in other embedded cases, like *before*-clauses as in (24) or excessive constructions with TOO ADJ TO, as in (25). In both cases the element in focus cannot be *die beste* 'die Beste'.

(24) Bevor Lu überhaupt (#die BESTE/MITTELMÄßIG) ist, muss sie noch lange üben.
before Lu ÜB. (#the best/mittelmäßig) is, must she yet long train
'Befor Lu is even (# the BEST/mediocre), she has to train for a long time.'

(25) Lu ist zu faul, um überhaupt (#die BESTE/MITTELMÄßIG) zu werden.
Lu is too lazy to ÜB. (#the best/mediocre) to become
'Lu is too lazy to even become (#the best/mediocre).'

In (24) and (25) the scale on which *überhaupt*$_u$ operates is made explicit by the scalar elements *der/die Beste* 'the best' and *mittelmäßig* 'mediocre'. But *überhaupt*$_u$ interacts with non-scalar elements as well. Consider (26), where *überhaupt*$_u$ appears in an *um*-clause, and qualifies the noun *Brot* 'bread'.

[9]They note that the particle has stress on the second syllable in this case, but Sarah Zobel (p.c.) pointed out to me that in this case, stress might be obligatory due to independent phonological constraints. It could be that it is the unstressed variant that is actually at play in (22) and that it receives phonological stress due to its position in the sentence. I will not explore this option further.

(26) Context: *A remote village deep in the mountains in Europe, where bread is an everyday food.*

A: Kannst du mir japanische Algenblätter für meine sushi Rolls besorgen?
can you me Japanese seaweed for my sushi rolls get
'Can you get me Japanese seaweed leaves for my sushi rolls?'

B: Um überhaupt an BROT zu kommen, muss ich bis ins nächste Dorf
in-order ÜBERHAUPT at bread to come must I until in-the nearest village
fahren!
drive
'In order to get even BREAD, I have to drive to the next village.'

I propose that the scale on which *überhaupt*$_u$ is operating in (26) is one, where elements are ranked according to how much work it is to get them.[10] In this scenario, Japanese seaweed is harder to come by than bread. Unstressed *überhaupt* ranks the focused element *Brot* lowest on this scale.

I have shown that *überhaupt*$_u$ has a scalar meaning. It associates with scalar (e.g. *mittelmäßig* 'mediocre') and non-scalar elements (e.g. *Brot* 'bread'). It ranks the element in focus lowest on a contextually provided scale. I show below that *überhaupt*$_u$ is a focus-sensitive particle.

The scalar meaning of *überhaupt*$_u$ changes with the place of focus similar to other focus-sensitive operators like *even* or *only*. Consider the two purpose clauses with unstressed *überhaupt* (27a) and (27b), where only the place of focus changes.

(27) a. Um überhaupt BLUMEN zu pflanzen, habe ich Erde gekauft.
In-order ÜBERHAUPT flowers to plant, have I soil bought
'In order to even plant FLOWERS, I bought soil.'

b. Um überhaupt Blumen zu PFLANZEN, habe ich Erde gekauft.
In-order ÜBERHAUPT flowers to plant, have I soil bought
'In order to even PLANT flowers, I bought soil.'

What is the contrast between (27a) and (27b)? The distinction between (27a) and (27b) becomes evident when considering two scenarios licensing the use of either. The utterance in (27a) could be used in a scenario, where the speaker plans to remodel her garden. She wants to plant trees, bushes and a new lawn along with new flowers. The scale of alternatives is given below.

[10] Since purpose clauses involve some kind of desire or goal related modal, an intuition could be that the ranking is in fact about desirabilty, and the least desired thing is marked by *überhaupt*$_u$. This can be shown to not be the case. In (i), flowers are more desired than trees, still *Blumen* 'flowers' can be in focus. I thank an anonymous reviewer for this point:

(i) Ich will Blumen pflanzen, und vielleicht später noch Bäume. Bei den Bäumen bin ich mir nicht
I want flowers plant and maybe later also trees for the trees I am to-me not
sicher, aber um überhaupt BLUMEN zu pflanzen, habe ich Erde gekauft.
sure but in-order ÜBERHAUPT flowers to plant have I soil bought.
'I want to plant flowers and maybe later trees as well. For the trees I'm not sure yet, but to plant ÜBERHAUPT flowers have I bought soil.'

(28) (In order to) plant a new lawn,... < (In order to) plant trees,... < (In order to) plant bushes,... < (In order to) plant flowers,...

By uttering (27a), the speaker says that flowers are the lowest element on a scale of how much work it is to plant them and that she bought soil, to plant flowers.[11]
An appropriate scenario for (27b), where focus lies on the verb *pflanzen* 'to plant' is this: The speaker plans to become rich through a flower business. The scale for (27b) might include the various steps needed in order to reach success. It might look like this:

(29) (In order to) sell flowers,... < (In order to) harvest flowers,... < (In order to) plant flowers, ...

As in (28) the focused element is taken to require the least amount of work. The alternatives entail each other, each one requires its lower ranked alternatives to be true and therefore requires more work than the preceding alternative.
I have shown that *überhaupt*$_u$ has a scalar meaning sensitive to the place of focus. I have argued that in purpose clauses this ranking is according to amount of work required.

4. The meaning of *um* 'in order to'

In German, the infinitival complementizer *um* is used to express a purpose clause as in (30), corresponding to English 'in order'.

(30) Bo$_i$ hat eine Tablette genommen, um PRO$_i$ zu schlafen.
Bo$_i$ has a pill taken in-order PRO$_i$ to sleep
'Bo took a pill in order to sleep.'

What are the truth conditions of (30)? In a scenario where Bo held no desire to go to sleep, (30) is unacceptable, this suggests an element of desire is crucial. Sæbø (1991) notes that *p in order to q* is well explained by a paraphrase involving a causal relation between an agent's

[11] An anonymus reviewer points out that evidence for ranking by amount of work, comes from the fact, that addition of *können* 'be able to' does not seem to change the meaning, as in (1). I think this is often the case with purpose clauses. I am unsure what the effect of *können* 'be able to' is in (2)

(1) Um überhaupt Blumen PFLANZEN zu können, habe ich Erde gekauft.
in-order ÜBERHAUPT flowers plant to be-able, have I soil bought.
'In order to even be able to plant flowers, I bought soil.'

(2) Ich habe ein Fahrrad gekauft, um eine Tour zu machen/ machen zu können.
I have a bike bought in-order a tour to make/ make to be-able.
'I bought a bike, in order to go on a bike tour/ be able to go on a bike tour.'

desire for q[12] and the main clause proposition p: *p because the agent wants q*.[13] Following Sæbø's paraphrase I assume (31) as a lexical entry for *um* as a function taking two propositional arguments. The main clause proposition p and the embedded proposition q.

(31) $[\![\text{um}]\!]^w = \lambda q_{\langle s,t\rangle}.\lambda p_{\langle s,t\rangle}.\left[\forall w' \in MAX_{BOUL_{x,w}}(CIRC_w) : q(w')\right] \Rightarrow_C p(w)$

The truth conditions for *um* in (31) have three parts: (i) A bouletic modal relativized to a circumstantial modal base and a bouletic ordering source: $\forall w' \in MAX_{BOUL_{x,w}}(CIRC_w) : q(w')$, (ii) the truth of the main clause proposition in the evaluation world: $p(w)$ and (iii) a causal link, connecting the desire for embedded proposition q to the main clause proposition p: $\Rightarrow_C$.[14] (31) will return 1 iff the embedded proposition q is true in all realistic worlds that make most of x's desire in w true (i.e. iff x has the desire that q) and this is a cause for the main clause proposition p in the actual world w. In (30) q the embedded proposition is λw. *Bo sleeps in w* and the main clause proposition p is λw. *Bo takes a pill in w*. So (30) will be true iff Bo held the desire to sleep and this was a cause for him to take a pill.

Taking a closer look at the desire component, we find a universal quantifier of possible worlds that are realistic given a circumstantial modal base ($CIRC_w$) and make the highest number of propositions of a bouletic ordering source ($BOUL_{x,w}$) true. The ordering source in *um* will include propositions denoting the desires of x in w. As I will show shortly, modification of the bouletic ordering source will be crucial in determining the meaning of constructions with *um* and unstressed *überhaupt*.

In the next section, I develop my proposal, taking into account the following observations: (i) stressed *überhaupt* has a domain widening meaning (following Anderssen 2006), (ii) The meaning of the unstressed variant is both scalar and focus-sensitive and (iii) *um* involves universal quantification over bouletic alternatives.

5. The Proposal

My claim is that the unstressed variant, similar to the stressed variant, produces a domain-widening effect, but in an indirect way. I claim that in the case of *um* + unstressed *überhaupt*,

[12]The agent can be implicit, as constructions without overt agent can serve as antecedent. In (i), the agent is understood to be the one responsible for the bridge's height.

(i) The bridge is so high in order that ships may pass beneath it. Sæbø (2011: 1433)

[13]Frühauf (2022) notes that the two statements are not the same, as (iia) and (iib) are not equivalent. The paraphrase thus works only in one direction.

(ii) a. Susi hat ihr Smartphone in den See fallen lassen, weil sie auf dem schwankenden Boot ein Selfie machen wollte.
'Susi dropped her phone in the lake because she wanted to make a selfie on the bobbing boat.'

b. Susi hat ihr Smartphone in den See fallen lassen, um auf dem schwankenden Boot ein Selfie zu machen.
int.: 'Susi dropped her phone in the lake in order to make a selfie on the bobbing boat.'

Frühauf (2022: 288)

[14]The exact notion of 'cause', will not be explored in this paper.

the set of worlds quantified over by the bouletic modal in *um* will be larger than in constructions involving *um* alone. The set will be larger because *überhaupt*$_u$ interacts with the ordering source $BOUL_x$. The interaction is this: *überhaupt*$_u$ excludes all higher ranked focus alternatives to q from $BOUL_x$. In the case of *um* alone, the ordering source will include all of x's desires in w, as in (32a). In the case of *um überhaupt* the ordering source will be modified, as in (32b).

(32) a. $BOUL_{x,w}$
b. $BOUL_{x,w} \setminus \{q' : q' \in \text{ALT}(q) \wedge q' >_{a.o.w} q\}$

The set obtained by (32b) is the ordering source minus a set of certain propositions. These propositions are in the set of focus alternatives of q and are also ranked higher than q. In the case of purpose clauses, this ranking involves amount of work required (abbreviated 'a.o.w' above). All higher ranked focus alternatives on this scale are explicitly excluded. The meaning of *um überhaupt* is given in (33).

(33) $[\![\text{um überhaupt}_u]\!] =$
$\lambda q_{\langle s,t\rangle}.\lambda p_{\langle s,t\rangle}.\left[\forall w' \in MAX_{BOUL_x \setminus \{q' : q' \in \text{ALT}_F(q) \wedge q' >_{a.o.w} q\}}(CIRC_w) : q(w')\right] \Rightarrow_C p(w)$

As the ordering source places restrictions on the worlds entering the restrictor set of the universal quantifier, the set will contain more worlds, if the restrictions are lowered (i.e. taking out propositions from $BOUL_{x,w}$). The effect will be that also less-ideal worlds will be part of the set quantified over. Namely, those worlds, where only q but none of its higher ranked alternatives are true. The causal link will also hold if the embedded proposition is true in less-ideal desire-worlds as well. Consider once more the example from (27a) repeated in (34).

(34) Um überhaupt BLUMEN zu pflanzen, habe ich Erde gekauft.
In-order ÜBERHAUPT flowers to plant, have I soil bought
'In order to even plant FLOWERS, I bought soil.'

In (34), the embedded proposition q is in (35a). Focus lies on *Blumen* 'flowers'. Accordingly, the focus alternatives of q will be as in (35b), where *flowers* is replaced by an element of the same type (cf. Rooth 1985).

(35) a. $q = \lambda w.$ *I plant flowers in w*
b. $\text{ALT}_F(q) = \{\lambda w.$ *I plant a lawn in w* $> \lambda w.$ *I plant trees in w* $> \lambda w$. *I plant bushes in w* $> \lambda w$. *I plant flowers in w*$\}$

Following (32b) the ordering source $\text{BOUL}_{x,w}$ in the case of (34) is reduced by the following set: the set of all propositions of $\text{ALT}_F(q)$ that are ranked higher than q. The resulting set of propositions is in (36).

(36) $BOUL_{x,w} \setminus \{\lambda\ w.$ *I plant a lawn in w* $> \lambda w.$ *I plant trees in w* $> \lambda w.$ *I plant bushes in w*$\}$

We have now excluded all higher ranked focus alternatives of q from BOUL_x. In this way, we lower the requirements possible worlds have to meet to be accepted into the set quantified over

by *um*. We thereby obtain a larger set of worlds quantified over universally by *um*. In an indirect way, we arrive at a wider domain, as the set of worlds is bigger than before. As the restrictor set for the universal quantifier becomes bigger, we obtain a stronger statement.[15]

Let us now consider the variant of example (34) where focus lies on the verb *pflanzen* 'to plant' in (37) repeated from (27b). In this case, it is the planting that is considered to require the least amount of work.

(37) Um überhaupt Blumen zu PFLANZEN, habe ich Erde gekauft.
In-order ÜBERHAUPT flowers to plant, have I soil bought
'In order to even PLANT flowers, I bought soil.'

Analogous to (34) the embedded proposition is given in (38a). As focus lies on the verb in this case, the contents of $\text{ALT}_F(q)$ differ to the ones in (35b), they are given in (38b). As the alternatives entail each other, each one will required more work than its weaker alternative. They are again, ranked according to amount of work.

(38) a. $q = \lambda w.$*I plant flowers in w*
b. $\text{ALT}_F(q) = \{\lambda w.$ *I sell flowers* $w > \lambda w.$ *I harvest flowers in* $w > \lambda w.$ *I grow flowers in* $w > \lambda w.$ *I plant flowers in* $w\}$

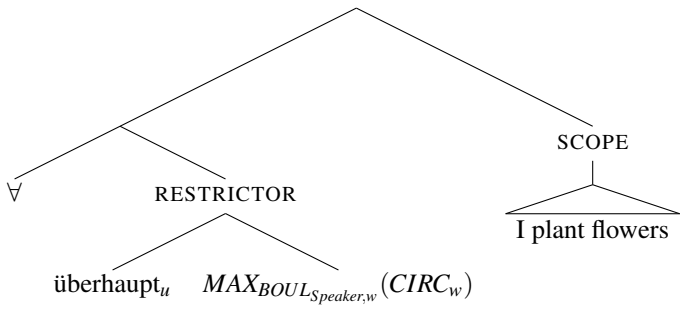
Again, the set of focus alternatives ranked higher than q will include all propositions except q itself. The ordering source will be reduced in the following way:

(39) $BOUL_{x,w} \setminus \{\lambda$ *w. I sell flowers in* $w > \lambda w.$ *I harvest flowers in* $w > \lambda w.$ *I grow flowers in* $w\}$

Less propositions in the ordering source means that we accept more worlds in the set quantified over by the desire component of *um*. The restrictions are lowered. Not only is q now true in the set of worlds, that make the most propositions of the ordering source true, but crucially, q will also be true in worlds that make only q and none of its higher ranked alternatives true. Then, *um* says that q being true in those less-ideal worlds is causally linked to p.

Structurally, I assume $\ddot{u}berhaupt_u$ in *um* to combine with $MAX_{BOUL_x}(CIRC_w)$. In other words: The restrictor set of the bouletic modal. (40) is a representation of the structure of the bouletic modal.

(40)



[15]This is a desired result as any statement with unstressed *überhaupt* entails its *überhaupt*-less counterpart.

I have claimed that *überhaupt*$_u$ removes all higher ranked alternatives to q, the embedded proposition from the ordering source. This exhaustification on the alternatives is supported by the data in (41). The sentence in (41) shows that a purpose clause with *überhaupt*$_u$ can be supplemented with the exclusive particle *nur* 'only' without a change in meaning.

(41) Su hat einen starken Kaffee getrunken, um überhaupt (nur) AUFZUSTEHEN.
Su has a strong coffee drank in-order ÜB. (only) get-up
'Su had a strong coffee, in order to even get up.'

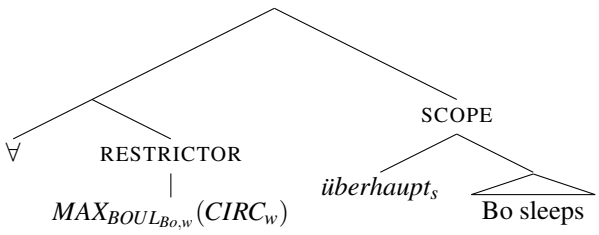
So what is the difference between the stressed and the unstressed variant? I claim that whereas *überhaupt*$_s$ removes restrictions provided by the context directly, *überhaupt*$_u$ leads to domain widening in an indirect way via modification of the ordering source of the bouletic modal as part of *um*. Consider first the case of *überhaupt*$_s$ in a purpose clause as in (42b) in the context (42a).

(42) a. Context: *Bo likes to sleep in air-conditioned rooms. It is in the middle of summer and very hot. Bo is in a hotel, where the air-conditioning is broken.*

b. ... also hat Bo eine Tablette genommen, um ÜBERHAUPT zu schlafen.
... so has Bo a pill taken, in-order ÜBERHAUPT to sleep
'... so Bo took a pill, in order to sleep at all.'

In the stressed case, I follow Anderssen (2006) in that *überhaupt*$_s$ removes restrictions provided by the context. In (42) the restriction removed is *in air-conditioned rooms*. We move from a more constrained desire (*sleep in a/c rooms*) to a broader one (*sleep*). A paraphrase including any is ... *in order to get any sleep*. The structure of the desire component of (42b) is given in (43). The stressed variant scopes over the embedded proposition q, which in (42) is λw. *Bo sleeps in w*.

(43)



The denotation of (42b) is given in (44).

(44) $[\![(42b)]\!]^w =$
$\left[\forall w' \in MAX_{BOUL_{Bo,w}}(CIRC_w) : \textit{Bo sleeps in } w'\right] \Rightarrow_C \textit{Bo took a pill in } w$
= 1 iff *Bo sleeps* is true in all circumstantially accessible worlds which make the most desires of Bo in w true and this is a cause for Bo to take a pill.

In other words, (42b) will be true iff the proposition Bo sleeps is a super set to his bouletic alternatives, and this causes the proposition Bo takes a pill to be true in the actual world.
Now let us turn to the unstressed case, consider (45b) in the context (45a).

(45) a. Context: *Bo wants to dig up his childhood. He wants to start writing a dream journal and keep track of his dreams. He then wants to talk to his therapist about his dreams and finally understand his childhood and his inner workings. On the first night of this project, Bo had drank six cans of Red Bull. He is now lying in bed wide awake.*

b. ...also hat Bo eine Tablette genommen, um überhaupt zu SCHLAFEN.
so has Bo a pill taken, to ÜBERHAUPT to sleep
'...so Bo took a pill in order to even SLEEP.'

In the unstressed case, the embedded proposition is (46a), the focus alternatives vary are provided by the context and are given in (46b).

(46) a. $q = \lambda w.$ *Bo sleeps in w*

b. $\text{ALT}_F(q) = \{\lambda w.$ *Bo understands his childhood in w* $> \lambda w.$ *Bo talks to his therapist in w* $> \lambda w.$ *Bo writes down his dreams in w* $> \lambda w.$ *Bo dreams in w* $> \lambda w.$ *Bo sleeps in w*$\}$

The ordering source as part of *um* will be modified by excluding from it all propositions ranked higher than $\lambda w.$ *Bo sleeps in w* from $\text{ALT}_F(\lambda w.$ *Bo sleeps in w*$)$. The truh-conditions of (45b) are given in (47).[16]

(47) $[\![(45b)]\!] =$
$\left[\forall w' \in MAX_{BOUL \setminus \{q' : q' \in \text{ALT}_F(BS) \wedge q' > BS\}}(CIRC_w) : BS(w')\right] \Rightarrow_C BP(w)$
= 1 iff *Bo sleeps* is true in all circumstantially accessible worlds which make the most desires except all stronger alternatives of *Bo sleeps* of Bo in *w* true and this is a cause for Bo to take a pill.

Im sum, this paper aimed to provide an explanation for the meaning of German *überhaupt* in purpose clauses, which takes into account its focus-sensitive scalar meaning but also preserves its domain widening meaning (cf. Anderssen 2006). Specifically, my claim is that in purpose clauses, unstressed *überhaupt* modifies the ordering source included in the desire component of *um*. By ruling out all the higher-ranked focus alternatives of the embedded proposition *q* in the construction *p in order to q*, the requirements for possible worlds to be in the set quantified over universally is lowered. In consequence more worlds are accepted in the set of worlds quantified over. We therefore obtain a wider set, in the case of unstressed *überhaupt*.

6. Licensing unstressed *überhaupt*

As noted by König (1983), there is good reason to treat *überhaupt*$_u$ as an NPI. The contrasts below are further evidence. The unstressed variant is fine in questions as in (48a) but not good in declaratives as in (48b).

[16] For the sake of clarity I use *BS* to represent the proposition $\lambda w.$ *Bo sleeps* in *w* and *BP* to represent the proposition $\lambda w.$ *Bo took a pill in w*.

(48) a. Hast du überhaupt ANGEFANGEN?
Have you ÜBERHAUPT start
'Did you even Start?'

b. # Paul hat überhaupt ANGEFANGEN.
Paul has ÜBERHAUPT started.
#'Paul even started.'[17]

In (49a) we find that *überhaupt*$_u$ in the restrictor of the universal quatifier *jeder* is acceptable. In the nuclear scope of *jeder* however, it is bad, as in (49b).

(49) a. Jeder, der es überhaupt VERSUCHT, kriegt eine Medaille.
Every-one who it ÜBERHAUPT tries gets a medal
'Everyone who even TRIES, gets a medal.'

b. # Jeder, der es versucht, kriegt überhaupt eine MEDAILLE.
Every-one who it tries gets ÜBERHAUPT a medal
#'Everyone who tries, gets even a medal.'

Naturally the question arises, how its use is licensed in the case of purpose clauses, as they are are non-DE as the non-entailment from (50a) to (50b) shows.[18]

(50) a. Bo stellt sich beim Kiosk an, um Eis zu kaufen.
Bo puts himself at-the kiosk on in-order ice-cream to buy
'Bo gets in line at the kiosk in order to buy ice cream.'

b. $\not\Rightarrow$ Bo stellt sich beim Kiosk an, um Schokoeis zu kaufen.
Bo puts himself at-the kiosk on in-order chocolate-ice-cream to buy
'Bo gets in line at the kiosk in order to buy chocolate ice cream.'

The licensing of *überhaupt*$_u$ in purpose clause follows from my account in the following way: The restrictor of a universal quantifier is known to license the use of NPIs, as in (51a), where the NPI *ever* is fine, as opposed to (51b), where *ever* appears in the nuclear scope of *every*.

[17] The relevant reading is the one where *even* has its most-likely reading.

[18] Note that the addition of a necessity modal in the matrix clause makes them DE, as the entailment in (i) shows.

(i) a. Lu muss sich am Kiosk anstellen, um Eis zu kaufen.
Lu must herself at-the kiosk get-in-line in-order ice-cream to buy
'Lu has to get in line at the kiosk in order to buy ice cream.'

b. $\Rightarrow$ Lu muss sich am Kiosk anstellen, um Schokoeis zu kaufen.
Lu must hersef at-the kiosk get-in-line in-order chocolate-ice-cream to buy
'Lu has to get in line at the kiosk in order to buy chocolate ice cream.'

(i) has a paraphrase as a so called anankastic conditional (cf. Bech 1983; von Stechow et al. 2006; Sæbø 1985; Sæbø 2020; von Fintel and Iatridou 2005). The use of *überhaupt*$_u$ as an NPI in this case will be licensed by the conditional nature of the construction *If Lu wants (NPI) to get ice cream, she has to get in line at the kiosk.* I will put this issue aside and focus on modal-less purpose clauses.

(51) a. Every [boy, who <u>ever</u> went to Paris,]$_{Restrictor}$[liked it.]$_{scope}$
b. # Every [boy, who went to Paris,]$_{Restrictor}$[<u>ever</u> liked it.]$_{scope}$

In parallel to an overt universal quantifier in (51), I propose that $\ddot{u}berhaupt_u$ is licensed in purpose clauses by virtue of its position in the restrictor of a universal bouletic modal.

(52) $\forall w' \in \ddot{u}berhaupt_u(\text{BOUL-ALT}_{x,w}) \subseteq q(w')$

(52) represents the desire component of a purpose clause with $\ddot{u}berhaupt_u$ where q is the embedded proposition. Note the parallels between (52) and (51a). In both cases the NPI is in the restrictor of a universal quantifier.[19]

7. Conclusion

I aimed to provide an explanation for the meaning of German *überhaupt* in purpose clauses, which takes into account its focus sensitive scalar meaning but also preserves its domain widening meaning (which has been argued for the stressed variant by Anderssen 2006). Specifically, my argument is that in purpose clauses, unstressed *überhaupt* modifies the ordering source included in the desire component of *um*. By ruling out all the higher-ranked focus alternatives of the embedded proposition q in the construction *p in order to q*, the requirements for possible worlds to be in the set quantified over universally is lowered. In consequence, more worlds are accepted in the set, leads to a wider domain, we thereby arrive at a domain widening effect, in an indirect way. Further, I have shown evidence for the NPI-status of *überhaupt* and argued that its use in *um*-constructions is licensed due to its position in the restrictor of the bouletic modal as part of *um*, which – like other universal quantifiers – allows for NPIs in its restrictor.

8. Open Issues and Problems

Assuming a position for unstressed *überhaupt* in the restrictor of the bouletic modal provides an explanation for the licensing problem. On the other hand, there are issues this assumptions raises. The first problem pertains to the syntactic assumptions and compositionality. If we take seriously the idea, that $\ddot{u}berhaupt_u$ combines directly with the ordering source as a set of propositions of type $\langle st,t\rangle$, we predict $\ddot{u}berhaupt_u$ as a modifier of sets of propositions to be of type $\langle\langle st,t\rangle,\langle st,t\rangle\rangle$, a function introducing some restrictions on a set of worlds. A generalization to account for its flexible combinatorial potential does seem more suitable, as occurs in many non-modal contexts. A generalization building out the intuition of Anderssen (2006) that the particle removes restrictions in different contexts, seems to be a promising line. In this way, restriction on the ordering source could be removed in the same way that restrictions are removed in the domain widening case.

There is moreover a question which concerns the focus-sensitivity of $\ddot{u}berhaupt_u$. As a modifier

[19] Covert universal quantification has also been argued to be the licensing factor for NPIs in the case of *before*-clauses by Condoravdi and Beaver (2003). Whereas *before*-clauses involve universal quantification over time points, *after*-clauses involve existential quantification (cf. Anscombe 1964).

of the ordering source, the particle is not in a position to scope over the focused material in *q*. Following Beaver and Clark (2003: 142), elements like *even* or *only* conventionally associating with focus, need to have the focused material in their syntactic scope. If the focus-sensitivity of *überhaupt*$_u$ is parallel to that of *even* (as the paraphrases suggest) a higher position might be better suited.

Further, in assuming a position in the restrictor of the universal bouletic modal for *überhaupt*$_u$ predicts that this position should be able to host other NPIs. So we should expect other NPIs such as *auch nur* or *jemals* to be fine in purpose clauses. This is borne out for *auch nur* as in (53). However *um*-clauses with the NPI *jemals* 'ever' are odd, as in (53)

(53) Gil hat jahrelang trainiert, um (*jemals/ auch nur) den dritten Platz zu holen.
Gil has for-years trained in-order (ever /AUCH NUR) the third place to get
'Gil trained for years, in order to (*ever/AUCH NUR) win third place.'

This problem can be attributed to the semantics of *jemals*, which prevents the sentence of being interpreted with respect to a reference time (Krifka, 1991: 172). As purpose clauses are episodic, the infelicity of *jemals* in purpose clauses can be accounted for.

Another interesting observation is that *um-überhaupt*-constructions are much more common and preferred when there is a necessity modal in the main clause as in (54), with the modal *muss* 'have to'.

(54) Um überhaupt/ÜBERHAUPT zu schlafen, muss Bo eine Tablette nehmen.
in-order ÜBERHAUPT to sleep must Bo a pill take.
'In order to (even sleep/sleep at all) Bo has to take a pill.'

These constructions can be paraphrased as a so called anankastic conditional of the following form: *If Bo wants to sleep, he must take a pill.*. Since the conditional licenses the use of NPIs in its antecedent, NPIs might be preferred in these structures.

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Anaphoric potential of cumulative dependencies[1]

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Abstract. This paper discusses the anaphoric potential of non-quantificational plural arguments, inquiring whether cumulative readings introduce new *quantificational dependencies*. I show that (i) *quantificational subordination* against non-distributive readings is often quite degraded, but (ii) common knowledge inference sometimes improves its acceptability, and (iii) non-distributive plural anaphora against cumulative readings may induce a co-varying reading. This suggests that cumulative readings may indeed introduce new dependencies, but their availability is limited. I propose that non-distributive readings 'underspecify' dependencies, while distributive readings highlight specific dependencies, and its interaction with pronoun maximality blocks quantificational subordination against cumulative readings. I implement it with *State-based Dynamic Plural Logic* which keeps track of *quantificational alternatives*.

Keywords: anaphora, co-variation, cumulative readings, distributivity, dynamic plural logic, dynamic semantics, plurality, quantificational subordination, state-based semantics.

1. Introduction

A pronoun is often used to refer back to an entity that has been mentioned in the prior discourse, a phenomenon called *discourse anaphora*. Discourse anaphora is number sensitive: a singular pronoun may not refer back to entities that have been introduced with plural expressions.

(1) a. Tom^{u_1} wrote a paper^{u_2}. He$_{u_1}$ submitted it$_{u_2}$ to L&P.
b. Tom^{u_1} wrote three papers^{u_2}. He$_{u_1}$ submitted {#it / them}$_{u_2}$ to L&P.

Singular indefinites under the scope of a quantifier may not antecedent singular pronouns.

(2) Every student^{u_1} wrote a paper^{u_2}. {#It / They}$_{u_2}$ is/are well written.

However, a singular indefinite under the scope of a quantifier may antecedent a singular pronoun if the pronoun is also under the scope of another quantifier. This phenomenon is called *quantificational subordination* (Karttunen, 1969: *et seq*) .

(3) a. Every student^{u_1} wrote a paper^{u_2}. b. They$_{u_1}$ **each** submitted it$_{u_2}$ to a journal.

Here, (3b) 'retrieves' the correspondence between students and papers, i.e. every student x submitted the paper x wrote. Such correspondences are called *quantificational dependencies*.

Now, a question arises: when are new quantificational dependencies introduced? And, when may a pronoun have access to quantificational dependencies stored in the context? I discuss

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these questions in light of non-distributive readings of non-quantificational plural arguments. Sentences with multiple plural arguments have several different readings as exemplified below.

(4) Three students^{u_1} read seven papers^{u_2}.
   a. **Collective reading**: a group of 3 students read 7 papers.
   b. **Distributive reading**: Each of the 3 students read 7 (possibly) different papers
   c. **Semi-distributive reading**: Each of the 3 students read the same 7 papers
   d. **Cumulative** (or **Co-distributive**) **reading**: each of the 3 students read at least one paper and each of the 7 papers are read by at least one student.
   e. **Paired-Cover reading**: there is a particular way to pair each of the 3 students with at least one paper and each of the 7 papers with at least one student, and each student read the paper that (s)he is paired with.

It turns out that the acceptability of quantificational subordination against cumulative readings is generally quite limited, but it sometimes improves in some contexts. Furthermore, co-varying readings are available with non-distributive plural anaphora. I propose that cumulative readings introduce new dependencies, but subordination fails because of the interaction between *under-specification of dependencies* and *pronoun maximality relative to quantificational alternatives*.

2. Technical background

I adopt a dynamic semantic approach, in which the meaning of a sentence updates the current discourse. *Discourse referents* (drefs) u_1, u_2,..., are addresses in which some values are stored, i.e. variables. *Information states* g, h,..., keep track of what entities have been mentioned at the discourse, i.e. variable assignments. Table 1 exemplifies information states and drefs.

	u_1	u_2	u_3	...
g	Alex	Beste	Chris	...

Table 1: Drefs and information states

Assignment extension updates an information state by adding a new value to u_n as defined in (5): g and h minimally differ in the new value on u_n.[2] An indefinite introduces a new value to an information state and a pronoun obtains its value directly from the current information state.

(5) $g[u_n]h = \forall u\,[u \neq u_n \rightarrow g(u) = h(u)]$

The role of quantificational dependencies has not been made clear yet. I adopt an enriched data structure to keep track of correspondences among values of drefs as well as their values. *Plural information states* (PIS) G, H, ..., are sets of information states (van den Berg, 1996; Nouwen, 2003; Brasoveanu, 2008: a.o.). A PIS can be given as a matrix as shown in Table 2.

Importantly, one may obtain plural individuals by summing up the values of a dref u across members of a PIS G even if each information state $g \in G$ assigns a singular value to u.[3]

[2] I assume total assignments and put aside the issues with them.

[3] I take plural individuals as sets of individuals and singular individuals as singleton sets of individuals.

G	u_1	u_2	u_3	u_4	...
g_1	Alex	David	Giorgio	Isla	...
g_2	Beste	Emile	Hannah	Isla	...
g_3	Chris	Fred	Hannah	Isla	...

Table 2: Plural information states

(6) $G(u) = \{g(u) : g \in G\}$

Dependencies are defined in (7b): u_m is dependent on u_n iff the values of u_m *co-vary* with the values of u_n. In Table 2, u_2 and u_3 are dependent on u_1, but u_4 is not.

(7) a. $G_{u_n=d} = \{g : g \in G \,\&\, g(u_n) = d\}$

b. In a plural information state G, u_m is *dependent* on u_n iff
$\exists d, e \in G(u_n)\,[G_{u_n=d}(u_m) \neq G_{u_n=e}(u_m)]$ (van den Berg, 1996)

The atomicity condition and the cardinality condition are defined 'globally', i.e. they check if the sum of the values of a dref under a PIS is an atom or comes with a certain cardinality.

(8) a. $\text{atom}(x) = \forall y\,[y \subseteq x \rightarrow y = x]$

b. $[\![\text{At}(u)]\!] = \{\langle G, H\rangle : G = H \,\&\, \text{atom}(H(u))\}$

c. $[\![\text{three}(u)]\!] = \{\langle G, H\rangle : G = H \,\&\, |(H(u))| = 3\}$

The dynamic distributivity operator δ (van den Berg, 1996: *et seq*) evaluates a formula ϕ with respect to subsets of a PIS. (9) evaluates ϕ with respect to $G_{u_n=d}$ and H_{u_d} for each $d \in G(u_n)$.

(9) $[\![\delta_{u_n}(\phi)]\!] = \{\langle G, H\rangle | G(u_n) = H(u_n) \& \forall d\,[d \in G(u_n) \rightarrow G_{u_n=d}[\![\phi]\!] H_{u_n=d})]\}$

This dynamic plural approach offers an analysis of quantificational subordination. Take the example (3) and a PIS illustrated in Table 3. Here, "each" introduces δ co-indexed with u_1. Accordingly, "it" picks up the value of u_2 with respect to $H_{u_1=d}$ for each d, i.e. h_1, h_2 and h_3, and its atomicity condition is evaluated against h_1, h_2 and h_3, instead of H as a whole.

(3) a. Every student^{u_1} wrote a paper^{u_2}. b. They$_{u_1}$ **each**$_{\delta_{u_1}}$ submitted it$_{u_2}$ to a journal.

H	u_1	u_2	...
h_1	student$_1$	paper$_1$	...
h_2	student$_2$	paper$_2$	...
h_3	student$_3$	paper$_3$	...

Table 3: Student-paper correspondence in the discourse

3. Cumulative readings and dependencies

The previous literature in the dynamic plural approach agrees that δ introduces new dependencies, but disagrees on whether one may do so without δ. Brasoveanu (2008); Dotlačil (2013); Henderson (2014); Kuhn (2017: a.o.) allow new drefs to be dependent to old drefs as defined in (10a), and van den Berg (1996); Nouwen (2007); Law (2020: a.o.) do not as defined in (10b). I call (10a) *randomely dependent extension* and (10b) *dependency-free extension*.[4]

(10) a. **Randomly dependent extension**
$G[u]H \Leftrightarrow \forall g\,[g \in G \rightarrow \exists h\,[h \in H \,\&\, g[u]h]] \,\&\, \forall h\,[h \in H \rightarrow \exists g\,[g \in G \,\&\, g[u]h]]$

b. **Dependency-free extension**
$G[u]H \Leftrightarrow \exists D\,[H = \{h \mid \exists g\,\exists d\,[g[u]h \,\&\, \nu(u)(h) = d \,\&\, g \in G \,\&\, d \in D]\}]$

To see their difference, consider two PISs given in Table 4 and 5, which respectively exemplify PISs with dependencies and PISs without dependencies.

G	u_1
g_1	x_1
g_2	x_2

$\xrightarrow{G[u_2]H}$

H	u_1	u_2
h_1	x_1	y_1
h_2	x_2	y_2

Table 4: A context with dependencies

G	u_1
g_1	x_1
g_2	x_2

$\xrightarrow{G[u_2]H}$

H	u_1	u_2
h_1	x_1	y_1
h_2	x_1	y_2
h_3	x_2	y_1
h_4	x_2	y_2

Table 5: A context without dependencies

(10a) may produce both, but (10b) may only produce one exemplified in Table 5, i.e. only the former may introduce new dependencies without the δ operator. As a result, (10a) can describe cumulative readings with genuine quantificational dependencies while (10b) cannot. Table 6 and 7 respectively show possible output PISs that corresponds to a cumulative reading of (4).

H	u_1	u_2
h_1	student_1	paper_1
h_2	student_1	paper_2
h_3	student_2	paper_3
h_4	student_2	paper_4
h_5	student_2	paper_5
h_6	student_3	paper_6
h_7	student_3	paper_7

Table 6: Random dependency

H	u_1	u_2
h_1	student_1	paper_1
⋮	⋮	⋮
h_7	student_1	paper_7
⋮	⋮	⋮
h_{21}	student_3	paper_7

Table 7: Dependency-free

Accordingly, randomly dependent extension may describe a cumulative reading with the distributive evaluation of lexical relation as defined in (11). In this definition, evaluation of relations is fully faithful to the quantificational dependencies stored in the discourse. Thus, a cumulative reading arises as a direct consequence of cumulative dependencies.

(11) $[\![R(u_1,...,u_n)]\!] \Leftrightarrow \{\langle G,H\rangle : G = H \,\&\, \forall h \in H\,[\langle h(u_1),...,h(u_n)\rangle \in I(R)]\}$

[4]Elworthy (1995); Krifka (1996a) adopt different frameworks, but their predictions converge with (10a).

On the other hand, dependency-free extension cannot derive a cumulative reading with this distributive evaluation of relations. If one distributively evaluates a lexical relation against the PIS given in Table 7, it can only describe a semi-distributive reading. Thus, it has to be combined with an additional mechanism of cumulative predication. For example, (12) defines the cumulative evaluation of relations (Law, 2020: a.o.). In this definition, evaluation of relation is made independent of the quantificational dependencies stored in the discourse. Even if a PIS does not store any dependencies between two drefs, $*R$ expresses cumulative predication.[5,6]

(12) a. $[\![R(u_1,...,u_n)]\!] \Leftrightarrow \{\langle G,H\rangle : G = H \,\&\, \langle G(u_1),...,G(u_n)\rangle \in I(*R)]\}$

b. (i) $R \subseteq *R$, (ii) if $\langle a_1,...,a_n\rangle \in *R$ and $\langle b_1,...,b_n\rangle \in *R$, then $\langle a_1+b_1,...,a_n+b_n\rangle \in *R$, and (iii) nothing else is in $*R$.

Now, these two options make opposite predictions for introduction of new dependencies under cumulative readings. All else being equal, if cumulative readings introduce new dependencies, they should be able to feed quantificational subordination and they should not, otherwise.

4. Quantificational dependencies with cumulative readings

In this section, I examine the predictions of randomly dependent extension and dependency-free extension. It turns out that the empirical picture seems more nuanced than these predictions. Only a few speakers accept the intended subordination reading (13b-ii).[7]

(13) a. Three^{u_1} students wrote seven papers^{u_2} (between them).

b. They$_{u_1}$ each submitted them$_{u_2}$.

i. Each of the three students submitted the seven papers.

ii. % Each of the three students submitted the papers they wrote

Furthermore, the acceptability of the intended anaphora varies depending on several factors. First, some speakers report that an example with a creation verb "write" in (13) is better than one with a non-creation verb "read" in (14). Not every speaker has found the contrast, though.

(14) a. Three^{u_1} students read seven papers^{u_2} (between them).

b. They$_{u_1}$ each wrote a review on them$_{u_2}$.

i. Each of the three students wrote a review on the seven papers.

ii. ?? Each of the three students wrote a review on the papers they read.

[5]One may also combine (10a) and (12). However, this combination predicts a discrepancy between dependencies relevant to anaphoric potential and dependencies relevant to evaluation of lexical relations.

[6]The combination of (10b) and (12) requires *mereological plurals*, i.e. D_e has to be closed under sum (union-formation in the assumption adopted in this paper), but the combination of (10a) and (11) does not.

[7]Note that a cumulative reading of (13a) would be true when one student wrote just one paper. Thus, one may argue that the degraded status would be due to violation of plurality requirement of "them." While it is surely relevant, Nakamura (2024) shows that plural pronouns also trigger a *partial plurality inference* (since Sauerland, 2003). See §5.4 for the data. Thus, quantificational subordination against cumulative dependencies are degraded not just because of violation of plurality requirement of "them."

Second, the intended anaphora becomes more accessible with common knowledge that helps one infer a functional correspondence. At this point, it seems that different speakers prefer different ways to make the correspondence salient.

(15) a. Three participants^{u_1} interviewed seven elderly relatives^{u_2}.
b. They$_{u_1}$ each got informed consent from them$_{u_2}$ before talking them$_{u_2}$ through a questionnaire. (Robert Truswell, p.c.)

(16) a. Three MA students^{u_1} sent seven documents^{u_2} to the department this afternoon.
b. They$_{u_1}$ each intend to use them$_{u_2}$ to impress their$_{u_1}$ potential supervisors^{u_3}.

Thus, quantificational subordination with cumulative readings sounds better if common knowledge implies a unique mapping from the values of the subject to the values of the object.

One may suspect that it is because common knowledge reasoning makes a paired-cover reading more salient than a cumulative reading. To examine this possibility, I adopt the guided-reading-course-scenario in Haslinger (2021) with modification. Imagine that three students, Ann, Belle and Chris, took a guided-reading course in which seven papers listed. (17) is the target sentence. (17a), (17b) and (17c) respectively describe a semi-distributive scenario, a paired-cover scenario and a cumulative scenario. Contrary to the expectation, the informants I consulted with reject (17) under the pair-list scenario (17b) and the cumulative scenario (17c).

(17) Three students^{u_1} read seven papers^{u_2}. They$_{u_1}$ **each** wrote a review on them$_{u_2}$.
a. **Semi-distributive**: A, B and C all read all the seven papers. For assessment, they all wrote a review on the seven papers. → **felicitous**
b. **Paired-cover**: A is assigned papers 1-3, B is assigned papers 4-5 and C is assigned papers 6-7. They read all the papers assigned to them. For assessment, they all wrote a review on the papers that are assigned to them. → **infelicitous**
c. **Cumulative**: A, B and C are asked to read some of them. For assessment, they all wrote a review on the papers that they chose by themselves. In the end, three anonymized reviews are submitted. One reviews 1-3, another reviews 4-5 and the other reviews 6-7. It's not clear who read which, but all the three students wrote at least one review and all the seven papers are reviewed. → **infelicitous**

This suggests that both paired-cover readings and cumulative readings make subsequent quantificational subordination marginal. This is intuitively puzzling because the common knowledge inferences drawn in (15) and (16) seem to force a paired-cover reading, i.e. the context provides a particular way to pair individuals.

At the same time, there is a reason to believe that non-quantificational plural arguments indeed introduce new quantificational dependencies. Non-distributive plural anaphora may induce a co-varying readings as exemplified in (18b).[8]

[8]Nouwen (2003) wonders if (18b-ii) is a distinct reading or a sub-case of weak truth condition enabled with cumulative predication, pointing out that correspondences introduced with non-quantificational plural arguments may be permuted, unlike those introduced with δ.

(18) a. Three^{u_1} students wrote seven papers^{u_2} (between them).

b. They$_{u_1}$ submitted them$_{u_2}$ to a journal.

i. Each of the three students submitted the seven papers to a journal.

ii. Each of the three students submitted the papers they wrote to a journal.

Thus, the challenge is to derive the degraded status of quantificational subordination against dependencies introduced with non-quantificational plural arguments while (i) capturing its nuanced sensitivity to common knowledge reasoning, and (ii) deriving a co-varying reading with non-distributive plural anaphora. I will sketch a possible approach in the next section.[9,10]

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(1) a. [Tom, Dick and Harry]^{u_1} **each** wrote an article^{u_2}. They$_{u_1}$ (each) sent it$_{u_2}$ to L&P.

b. # To be precise, Tom sent the article Dick wrote, Dick sent the article Harry wrote and Harry sent the article Tom wrote. (Nouwen, 2003)

(2) a. [Tom, Dick and Harry]^{u_1} wrote three articles^{u_2}. They$_{u_1}$ sent them$_{u_2}$ to L&P.

b. To be precise, Tom sent the article Dick wrote, Dick sent the article Harry wrote and Harry sent the article Tom wrote. (Nouwen, 2003)

On this point, an anonymous reviewer of Homogeneity and Maximality Workshop 2 (HNM2) provides an interesting case of disambiguation. Here, the speaker denies her previous statement with "they$_{u_1}$ uploaded them$_{u_2}$ on EasyChair." because the dependencies between u_1 and u_2 were actually not preserved in this situation. This deniability with dependency permutation suggests that the co-varying interpretation is indeed a distinct reading.

(3) Three students^{u_1} wrote seven abstracts^{u_2}. Then, they$_{u_1}$ uploaded them$_{u_2}$ on EasyChair ... (5 minutes later) ... Ah, I was wrong, sorry! In fact, the 3 students did something weirder: they$_{u_1}$ uploaded each other's abstracts on EasyChair, not their own.

[9]In the earlier version of this work, I offered an analysis with a trivalent version of Dynamic Plural Logic, in which plural assignment extension may (re)assign *dummy value* ★ (cf. DeVries, 2016).

(1) $G[u]H \Leftrightarrow \exists D[H = \{h | \exists g \exists d[g[u]h \,\&\, h(u) = d \,\&\, g \in G \,\&\, d \in D \cup \{\bigstar\}]\}]$

In this approach, cumulative dependencies are semi-distributive dependencies in which the object dref stores ★ in some members of a PIS. It blocks quantificational subordination against cumulative dependencies with a trivalent definition of pronouns, i.e. a pronoun is defined iff its antecedent has a non-dummy value in each member of a PIS. Also, it emulates randomly dependent extension for bivalent expressions, i.e. some expressions 'ignore' ★ by treating it as a universal verifier, which does not contribute to their truth condition. However, this analysis neither explains why common knowledge sometimes improves quantificational subordination against cumulative dependencies nor derives co-varying readings of non-distributive plural anaphora.

[10]One may argue that plural anaphora with "each" is degraded simply because the same interpretation may be obtained without it. While this alternative is not implausible, it may not explain why common knowledge reasoning improves the acceptability of quantificational subordination against cumulative readings. Furthermore, it is not trivial to define "the same interpretation." For example, one can find a case in which the intended anaphora is still degraded even though its alternative without "each" cannot arrive at the same reading.

(1) Three^{u_1} students wrote seven papers^{u_2} (between them).

a. They$_{u_1}$ submitted them$_{u_2}$ to a different journal. → the internal reading available

b. They$_{u_1}$ each submitted them$_{u_2}$ to a different journal. → the internal reading **unavailable**

5. Quantificational alternatives and Maximality in State-based DPlL

I pursue an approach with randomly dependent extension that overcomes the challenge sketched above. Henceforth, I call sentences with multiple non-quantificational plural arguments *multi-plural sentences*.[11] The idea is that quantificational subordination fails because multi-plural sentences 'underspecify' dependencies, but the subsequent anaphora with a quantifier highlights specific dependencies. To see that multi-plural sentences underspecify dependencies, recall that randomly-dependent extension permits a wide range of PISs. The possible output PISs for (4) include one illustrated in Table 6, in which no pair of students read the same book.

(4) Three students^{u_1} read seven papers^{u_2}.

However, cumulative readings tolerate cases in which some students read the same books. The context may also include such PISs exemplified in Table 8. Semi-distributive dependencies can be taken as an extreme case, in which all the students read all the books as shown in Table 9.

H	u_1	u_2
h_1	student_1	book_1
h_2	student_1	book_2
h_3	student_1	book_3
h_4	student_2	book_2
h_5	student_2	book_3
h_6	student_2	book_4
h_7	student_3	book_5
h_8	student_3	book_6
h_9	student_3	book_7

Table 8: Cumulative dependency

H	u_1	u_2
h_1	student_1	book_1
⋮	⋮	⋮
h_8	student_2	book_1
⋮	⋮	⋮
h_{15}	student_3	book_1
⋮	⋮	⋮
h_{21}	student_3	book_7

Table 9: Semi-distributive dependency

Thus, randomly-dependent extension allows the same formula to express a semi-distributive reading, paired-cover readings and a cumulative reading. In this sense, a multi-plural sentence underspecifies dependencies, i.e. it does not highlight any particular dependencies. I propose that this prevents subordination against dependencies introduced with a multi-plural sentence.

I build a positive proposal in the rest of this section. §5.1 introduces a *state-based* version of *Dynamic Plural Logic (DPlL)*, and propose that pronouns perform maximization relative to *quantificational alternatives*. §5.2 shows how it accounts for the core data, §5.3 discusses the effect of common knowledge, and §5.4 discusses its consequence for pronoun number.

[11] As far as I know, this term comes from Haslinger (2021).

5.1. Maximization relative to quantificational alternatives

I introduce *State-based DPlL* to express the relevant notion of 'underspecified dependencies'.[12] First, I define *quantificational alternatives* as sets of *possibilities*, i.e. pairs of a possible world and a PIS.[13] I use s as a variable for quantificational alternatives. Then, I take a context to be a set of quantificational alternatives, and a formula denotes a function from an input context to an output context (Heim, 1982; Groenendijk et al., 1995). Note that c is a *downward closed set* of quantificational alternatives s, i.e. if $s \in c[\phi]$, for any $s' \subset s$, $s' \in c[\phi]$. In this setting, evaluation of lexical relations, cardinality conditions, and (non-)atomicity conditions are defined in (19).[14]

(19) a. $c[R(u_1,...,u_n)] = \{s : s \in c \,\&\, \forall\langle w,G\rangle \in s\, \forall g \in G\,[\langle g(u_1),...,g(u_n)\rangle \in I_w(R)]]\}$
b. $c[\text{three}(u)] = \{s : s \in c \,\&\, \forall\langle w,G\rangle \in s\,[|(G(u))| = 3]\}$
c. $c[\text{At}(u)] = \{s : s \in c \,\&\, \forall\langle w,G\rangle \in s\,[\text{atom}(G(u))]\}$
d. $c[\text{Non-At}(u)] = \{s : s \in c \,\&\, \forall\langle w,G\rangle \in s\,[\neg\text{atom}(G(u))]\}$

I also introduce the sequencing operator ';' to signify dynamic conjunction.

(20) $c[\phi;\psi] = c[\phi][\psi]$

Now, I refine plural extension in State-based DPlL as given in (21).

(21) $c[u] = \{s' : \exists s \in c\,[\forall\langle w,G\rangle \in s\,\exists\langle w',H\rangle \in s'\,[G[u]H] \,\&\, \forall\langle w',H\rangle \in s'\,\exists\langle w,G\rangle \in s\,[G[u]H]$
$\&\, \forall\langle w,I\rangle \in s'\,\forall\langle w',J\rangle \in s'\,[I(u) = J(u)]]\}$

(21) is a straightforward refinement in the current setting except the last conjunct. This ensures that every possibility in a quantificational alternative s agrees on the global value of u, i.e. c is partitioned based on the value of u. Due to randomly dependent extension, every quantificational alternative in $c[u]$ covers all the possible patterns of dependencies. In other words, if ϕ is non-distributive, each quantificational alternative in $c[\phi]$ covers a semi-distributive reading and all the possible paired-cover readings, and those quantificational alternatives are distinguished just in terms of the global values of drefs that occur in ϕ. In this sense, dependencies introduced with plural extension is underspecified at the level of quantificational alternatives.

Next, I refine the δ operator in this state-based system as given in (22).

(22) $c[\delta_{u_n}(\phi)] = \{s' : \exists s \in c\,[\forall\langle w',H\rangle \in s'\,\exists\langle w,G\rangle \in s\,[w = w' \,\&\, G(u_n) = H(u_n) \,\&\, \forall d \in H(u_n)$
$\exists s'' \in c[\phi]\,\forall\langle w'',K\rangle \in s'\,[\langle w,G_{u_n=d}\rangle \in s \,\&\, \langle w',H_{u_n=d}\rangle \in s'' \,\&\, \langle w'',K_{u_n=d}\rangle \in s'']]]\}$

(22) is a straightforward refinements of δ in this setting except an additional universal quantification over $\langle w'',K\rangle \in s'$. This ensures that for any two possibilities $\langle w,I\rangle$ and $\langle w',J\rangle$ in s', their

[12] The idea that plural predication involves some kind of underspecification is not new (Schwarzschild, 1996; Krifka, 1996b; Malamud, 2012; Bar-Lev, 2019; Križ and Spector, 2021; Haslinger, 2021: a.o.).
[13] This idea can be taken as a successor of the notion expressed with this term in Brasoveanu (2011, 2013).
[14] However, see §5.4 for a reason to regard the non-atomicity condition as a pragmatic inference. As this is not directly relevant to the main point of the discussion, I assume that plurals hard-wire the non-atomicity condition.

subset possibilities with respect to each value d of u_n belong to the same quantificational alternative in $c[\phi]$, i.e. $I, J \in s$ iff $I(u_n) = J(u_n)$ and $\forall d \in J(u_n) \exists s' \in c[\phi] [\langle w, I\rangle \in s' \,\&\, \langle w', J\rangle \in s']$. It interacts with $c[u]$ in an important way. Recall that $c[u]$ distinguishes quantificational alternatives based on the global value of u. If it is evaluated under the scope of δ, $c[u]$ distinguishes quantificational alternatives based on 'local' values of u under each subset of PIS $H_{u_n=d}$. Crucially, the above mentioned universal quantification over $\langle w'', K\rangle$ in (22) ensures that two possibilities belong to the same quantificational alternative iff their subset possibilities belong to the same quantificational alternative in $c[\phi]$ with respect to each d in u_n.

To see this, consider three possibilities illustrated in Table 10.

$\langle w,$

G	u_1	u_2
g_1	d_1	e_1
g_2	d_2	e_1
g_3	d_2	e_2

$\rangle$ $\langle w',$

H	u_1	u_2
h_1	d_1	e_1
h_2	d_1	e_2
h_3	d_2	e_2

$\rangle$ $\langle w'',$

K	u_1	u_2
k_1	d_1	e_1
k_2	d_1	e_2
k_3	d_2	e_1
k_3	d_2	e_2

$\rangle$

Table 10: Two possibilities with different dependencies

These possibilities agree in the global values of u_1 and u_2, but store different patterns of dependencies. First, suppose that $[u_2]$ is not evaluated under the scope of δ_{u_1}. In this case, all the three possibilities belong to the same quantificational alternative because $G(u_2) = H(u_2) = K(u_2)$. Second, suppose that $[u_2]$ is evaluated under the scope of δ_{u_1}. In this case, the partition of the context relies on local values of u_2. If one looks at the case in which u_1 has the value d_1, then $G_{u_1=d_1} = \{e_1\}$ and $H_{u_1=d_1} = K_{u_1=d_1} = \{e_1, e_2\}$. Therefore, there is $s_1 \in c[u_2]$ such that $\langle w, G_{u_1=d_1}\rangle \in s_1$ and there is $s_2 \in c[u_2]$ such that $\langle w', H_{u_1=d_1}\rangle \in s_2$ and $\langle w'', K_{u_1=d_1}\rangle \in s_2$. If one looks at the case in which u_1 has the value d_2, then $G_{u_1=d_2} = K_{u_1=d_2} = \{e_1, e_2\}$ and $H_{u_1=d_2} = \{e_2\}$. Therefore, there is $s_3 \in c[u_2]$ such that $\langle w, G_{u_1=d_2}\rangle \in s_3$ and $\langle w'', K_{u_1=d_2}\rangle \in s_3$, and there is $s_4 \in c[u_2]$ such that $\langle w', H_{u_1=d_2}\rangle \in s_4$. As a result, none of these possibilities belong to the same quantificational alternative. If one focuses on the case in which u_1 has the value d_1, $\langle w', H_{u_1=d_1}\rangle$ and $\langle w'', K_{u_1=d_1}\rangle$ belong to the same quantificational alternative s_1. However, they differ when u_1 has the value d_2 because $\langle w', H_{u_1=d_2}\rangle$ and $\langle w'', K_{u_1=d_2}\rangle$ belong to different quantificational alternatives s_3 and s_4. Similarly, if one focuses on the case in which u_1 has the value d_2, $\langle w, G_{u_1=d_2}\rangle$ and $\langle w'', K_{u_1=d_2}\rangle$ belong to the same quantificational alternative s_3. However, they differ when u_1 has the value d_1 because $\langle w', H_{u_1=d_1}\rangle$ and $\langle w'', K_{u_1=d_1}\rangle$ belong to different quantificational alternatives s_1 and s_2. Hence, each of these three possibilities belongs to a different quantificational alternative if $[u_2]$ is evaluated under the scope of δ_{u_1}.

In general, if plural extension $[u_m]$ is evaluated under the scope of δ_{u_n}, quantificational alternatives are distinguished based the value of u_m under each particular value d of u_n. In other words, quantificational alternatives are distinguished by the precise dependency between u_n and u_m established in each possibility (recall the definition (7b).) Hence, if ϕ is distributive, each quantificational alternative in $c[\phi]$ covers a specific pattern of dependencies and each dependency pattern is expressed with a different quantificational alternative. In this sense, δ removes underspecification in quantificational alternatives. Note that if ϕ does not introduce new values to any dref, $c[\delta_{u_n}(\phi)]$ just preserves partition given in c because ϕ itself does not partition c.

In this state-based setting, I propose that pronouns require maximality *relative to* quantificational alternatives as defined in (23), which plays the central role in my analysis.[15]

(23) $c[\textsc{max}(u_n)] =$
$\{s'' : \exists s \in c \forall s' \in c\,[s \not\subset s' \rightarrow s'' \subseteq s \,\&\, \forall \langle w, G\rangle \in s \forall \langle w', H\rangle \in s''\,[G(u_n) \subseteq H(u_n)]\}$

It requires that each quantificational alternative in $c[\textsc{max}(u_n)]$ only contains the possibilities that assign the maximal value to u_n among the possibilities that belong to the same partition in c. Consider a quantificational alternative $s \in c$ without any $s' \in c$ such that $s \subset s'$. Then, for each such s, $c[\textsc{max}(u_n)]$ maintains the possibilities that assign the maximal value on u_n and discard the other possibilities from s. Crucially, (23) is 'blind' to the worlds in c and thus it does not distinguish a semi-distributive reading, paired-cover readings and a cumulative reading. If (23) occurs outside the scope of δ, it maximizes the global value of u_n. If it occurs inside the scope of δ co-indexed with u_m, it maximizes the local value of u_n for each value d in u_m.

(23) is sensitive to whether an antecedent sentence comes with δ or without δ. In the former case, δ_{u_m} in the antecedent sentence has already offered specific quantificational alternatives. Thus, (23) under the scope of δ_{u_m} just requires that those alternatives store the maximal value on u_n for each particular value d in u_m. In the latter case, the antecedent sentence does not come with δ, i.e. each quantificational alternative covers all the possible dependencies. This is the direct consequence of randomly-dependent extension. Now, since (i) each quantificational alternative of a multi-plural sentence contains semi-distributive dependencies, and (ii) $\textsc{max}(u_n)$ maximizes u_n blindly to worlds in each quantificational alternative, if (23) is evaluated under the scope of δ_{u_m}, each quantificational alternative maintains the semi-distributive dependency and discard other dependency patterns. Accordingly, if $\textsc{max}(u_n)$ is evaluated under δ and against dependencies introduced with a multi-plural sentence, the output context is only compatible with a semi-distributive reading. This is my short answer to the puzzle described in §4.[16]

5.2. Interaction between cumulative dependencies and maximisation

In this section, I demonstrate how the proposed analysis works in each paritular case. I start with cases of quantificational subordination with a quantifier. Consider (3).

(3) a. Every student^{u_1} wrote a paper^{u_2}. b. They$_{u_1}$ **each** submitted it$_{u_2}$ to a journal.

Quantifiers introduce a maximal value to its dref and I adopt a different maximisation operation defined in (24) (cf. Brasoveanu, 2008; Dotlačil and Roelofsen, 2021; Roelofsen and Dotlačil, 2023). I take $\textsc{max}^{u_n}(\phi)$ as an abbreviation of $u_n; \textsc{max}_{u_n}(\phi)$. While (23) is blind to worlds and takes no description, (24) is world-sensitive and takes a description ϕ.

[15] It is crucial that s in (23) is the maximal quantificational alternative, i.e. *alternative* in Inquisitive Semantics (Ciardelli et al., 2018). Otherwise, it is trivially satisfied in each s' that is a singleton set of possibilities.

[16] As one may notice, State-based DPlL resembles *Dynamic Plural Inquisitive Semantics* in Dotlačil and Roelofsen (2021); Roelofsen and Dotlačil (2023) in the sense that both are state-based dynamic plural semantics. However, they crucially differ in the sense that the partitions in c in State-based DPlL represent specifications of dependencies while the partitions in c in Dynamic Plural Inquisitive Semantics represent resolution conditions.

(24) a. $c[\textsc{max}^{u_n}(\phi)] = c[u_n][\textsc{max}_{u_n}(\phi)]$
b. $c[\textsc{max}_{u_n}(\phi)] = \{s : s \in c[\phi] \,\&\, \forall\langle w, H\rangle \in s\, \forall\langle w', G\rangle \in \cup c[\phi]\, [w = w' \rightarrow G(u_n) \subseteq H(u_n)]\}$

(3a) and (3b) are respectively translated as (25). I assume that the translation of pronouns comes with the (non-)atomicity condition and the maximization condition (23).[17,18]

(25) a. $[\textsc{max}^{u_1}(\delta_{u_1}(\text{At}(u_1);\text{student}(u_1)));\delta_{u_1}(u_2;\text{At}(u_2);\text{paper}(u_2);\text{wrote}(u_1)(u_2))]$
b. $[\text{Non-At}(u_1);\textsc{max}(u_1);\delta_{u_1}(\text{At}(u_2);\textsc{max}(u_2);u_3;\text{journal}(u_3);\text{submit}(u_1)(u_2)(u_3))]$

Table 11 and 12 respectively exemplify typical PISs in the output context of (3a) and (3b).

$\langle w,$

G	u_1	u_2
g_1	student_1	paper_1
g_2	student_2	paper_2
g_3	student_3	paper_3

$\rangle$

Table 11: An output possibility in (3a)

$\langle w,$

H	u_1	u_2	u_3
h_1	student_1	paper_1	journal_1
h_2	student_2	paper_2	journal_2
h_3	student_3	paper_3	journal_3

$\rangle$

Table 12: An output possibility in (3b)

First, $\textsc{max}(u_1)$ is evaluated outside the scope of δ_{u_1} and requires that each quantificational alternative only maintains possibilities $\langle w, H\rangle$ and discards other possibilities $\langle w', K\rangle$ such that $K(u_1) \subset H(u_1)$. In this case, $\textsc{max}^{u_1}(\text{At}(u_1);\text{student}(u_1))$ has already maximized the value of u_1, i.e. u_1 stores the maximal set of students in each s, and thus $\textsc{max}(u_1)$ does not discard any possibility from each quantificational alternative. Second, $\textsc{max}(u_2)$ is evaluated inside the scope of δ_{u_1}, interacting with $\text{At}(u_1)$. For each $s \in c$, it requires that u_2 stores an atomic value for each $H_{u_1=d}$ and it is maximal among any $K_{u_1=d}$ such that $\langle w, K\rangle \in s$. Since it requires the maximal singular value, it is amount to the uniqueness requirement relative to each subset of $H_{u_1=d}$. In this case, the quantificational alternatives in c are distinguished based on dependency patterns because of δ_{u_1} in (25a). Thus, $\textsc{max}(u_2)$ does not discard any possibilities from each quantificational alternatives, and thus does not block quantificational subordination in this case.

Next, consider cases of co-varying interpretations of plural anaphora without quantifiers.

(18) a. Three^{u_1} students wrote seven papers^{u_2} (between them).
b. They$_{u_1}$ submitted them$_{u_2}$ to a journal^{u_3}.

These sentences are translated as (26), and Table 13 and 14 exemplify possible PISs in the output context of (18a) and (18b) which support a cumulative reading.

(26) a. $[u_1;\text{three}(u_1);\text{students}(u_1);u_2;\text{seven}(u_2);\text{papers}(u_2);\text{wrote}(u_1)(u_2))]$
b. $[\textsc{max}(u_1);\textsc{max}(u_2);u_3;\text{journal}(u_3);\text{submit}(u_1)(u_2)(u_3)]$

[17]The translation of "every" essentially follows van den Berg (1996); Brasoveanu (2008), but I omit some details that are not relevant to the main point of this paper.
[18]I put aside sub-clausal compositionality, but one may easily make this system compositional in the style of Dotlačil and Roelofsen (2021); Roelofsen and Dotlačil (2023), which follow Muskens (1996); Brasoveanu (2008).

$\langle w,$

G	u_1	u_2
g_1	student_1	paper_1
g_2	student_1	paper_2
g_3	student_1	paper_3
g_4	student_2	paper_2
g_5	student_2	paper_3
g_6	student_2	paper_4
g_7	student_3	paper_5
g_8	student_3	paper_6
g_9	student_3	paper_7

$\rangle$

Table 13: An output PIS for (18a)

$\langle w,$

H	u_1	u_2	u_3
h_1	student_1	paper_1	journal_1
h_2	student_1	paper_2	journal_1
h_3	student_1	paper_3	journal_1
h_4	student_2	paper_2	journal_1
h_5	student_2	paper_3	journal_1
h_6	student_2	paper_4	journal_1
h_7	student_3	paper_5	journal_1
h_8	student_3	paper_6	journal_1
h_9	student_3	paper_7	journal_1

$\rangle$

Table 14: An output PIS for (18b)

Since neither (18a) nor (18b) introduce δ, the quantificational alternatives in c are distinguished with the global values of u_1 and u_2, and each alternative covers all the possible patterns of dependencies. As (26) does not involve any occurrence of δ, both occurrences of MAX are non-distributively evaluated. Importantly, pronoun maximization $\text{MAX}(u_n)$ outside the scope of δ only concerns the global value of u_n relative to possible worlds and quantificational alternatives, i.e. the sum of student$1-3$ and the sum of paper_{1-7} in this particular case. Since a semi-distributive reading, paired-cover readings and a cumulative readings are indistinguishable with the global values of argument drefs alone, non-distributive pronoun maximization does not rule out any of these possible readings. As a result, the resultant c maintains quantificational alternatives each of which exhaust a semi-distributive reading and all the possible paired-cover readings. Thus, (18b) does not block a co-varying reading of plural pronouns.[19]

It can also handle cases in which the antecedent sentence involves a quantifier but the pronoun sentence does not. Take (27) as an example. It also has a reading that each of the students submitted the paper which (s)he wrote.

(27) a. Every^{u_1} student wrote a paper^{u_2}. b. They$_{u_1}$ submitted them$_{u_2}$ to a journal^{u_3}.

These sentences are translated as (28).

(28) a. $[\text{MAX}^{u_1}(\delta_{u_1}(\text{At}(u_1);\text{student}(u_1)));\delta_{u_1}(u_2;\text{At}(u_2);\text{paper}(u_2);\text{wrote}(u_1)(u_2))]$
b. $[\text{MAX}(u_1);\text{MAX}(u_2);u_3;\text{journal}(u_3);\text{submit}(u_1)(u_2)(u_3))]$

Table 11 and Table 12 can be reused as illustrations of typical PISs in the output context of (27a) and (27b). In this case, the occurrence of δ_{u_1} in (28a) expands c so that each quantificational alternative corresponds to a particular type of dependencies. Then, $\text{MAX}(u_1)$ and $\text{MAX}(u_2)$ are both evaluated against this set of quantificational alternatives. Since they are not under the scope of δ, however, they simply narrow down each s to the possibility that assigns the globally maximal value to u_1 and u_2. Since each s contains a particular PIS due to δ_{u_1}, it does not discard any possibility. Thus, just like (26b), (28) does not block a co-varying reading.

[19]To derive a permuted reading given in Footnote 4, one may assume that a plural pronoun may take the global value of its antecedent as a mereological sum, cf Footnote 3.

Now, I finally turn to cases of quantificational subordination against cumulative readings.

(13) a. Three^{u_1} students wrote seven papers^{u_2} (between them).
b. They$_{u_1}$ each submitted them$_{u_2}$ to a journal.

These sentences are translated as (29).

(29) a. $[u_1;\text{three}(u_1);\text{students}(u_1);u_2;\text{seven}(u_2);\text{papers}(u_2);\text{wrote}(u_1)(u_2))]$
b. $[\textsc{max}(u_1);\delta_{u_1}(\textsc{max}(u_2);u_3;\text{journal}(u_3);\text{submit}(u_1)(u_2)(u_3))]$

Table 13 and Table 14 can be reused to illustrate possible PISs in the output context of (13a) and (13b). The first occurrence $\textsc{max}(u_1)$ does not cause a problem because it is in the exactly the same environment as the one in (26). The question is which value the second occurrence $\textsc{max}(u_2)$ picks. Now, the additional layer of information with quantificational alternatives becomes crucial. Since (29a) does not involve any δ, each quantificational alternative in c contains possibilities that cover a semi-distributive reading and all the possible paired-cover readings. This is not problematic if $\textsc{max}(u_2)$ is not evaluated under the scope of δ, as we have just seen in the discussion on (18b). However, this time, it is evaluated under the scope of δ_{u_1}. In this environment, in each s, $\textsc{max}(u_2)$ only maintains the possibilities that assign the maximal value on u_2 for $K_{u_1=d}$ for each d. Since a possibility with a semi-distributive dependency assigns the globally maximal value of u_2 with respect to each value of u_1, this possibility is always the one that meets this maximization requirement in each s. As a result, each quantificational alternative in the resultant c only maintains possibilities with a semi-distributive dependency. Thus, the proposed maximization blocks quantificational subordination in this case. Importantly, this explains the degraded status of quantificational subordination against cumulative dependencies while deriving co-varying readings of non-distributive plural anaphora. The remaining question is why common knowledge sometimes improves quantificational subordination against cumulative dependencies. The next section addresses this question in light of State-based DPlL.

5.3. Common knowledge, expectation and adjustment of the context

I propose that common knowledge inference may improve the status of quantificational subordination against cumulative dependencies because it may 'adjust' the context prior to maximization by discarding possibilities with semi-distributive dependencies from c.

First of all, the lexical meaning of creation verbs and common knowledge reasoning contribute to identification of correspondences. For example, the common knowledge on writing tells that there is a unique author (or a unique group of co-authors) for each product of writing. This may disambiguate a multi-plural sentence. Consider a toy example (30).

(30) Two students^{u_1} wrote two papers^{u_2}.

Suppose $D = \{a_1, a_2, p_1, p_2\}$ and consider three worlds w_1, w_2 and w_3 given in (31).

(31) a. $I_{w_1}(R) = \{\langle a_1, p_1\rangle, \langle a_2, p_2\rangle\}$ (paired-cover reading)

b. $I_{w_2}(R) = \{\langle a_1, p_1\rangle, \langle a_1, p_2\rangle, \langle a_2, p_2\rangle\}$ (paired-cover reading with an overlap)

c. $I_{w_3}(R) = \{\langle a_1, p_1\rangle, \langle a_1, p_2\rangle, \langle a_2, p_1\rangle, \langle a_1, p_2\rangle\}$ (semi-distributive reading)

While $I_{w_1}(R)$ is consistent with the common knowledge because any distinct paper is associated with a unique author, $I_{w_2}(R)$ and $I_{w_3}(R)$ are not. Now, consider the PISs that are respectively associated with w_2 and w_3 as illustrated in Table 15 and Table 16.

K	u_1	u_2
k_1	a_1	b_1
k_2	a_1	b_2
k_3	a_2	b_2

Table 15: The PIS corresponding to (31b)

K'	u_1	u_2
k'_1	a_1	b_1
k'_2	a_1	b_2
k'_3	a_2	b_1
k'_4	a_2	b_2

Table 16: The PIS corresponding to (31c)

Suppose that one may discard the possibilities $\langle w_2, K\rangle$ and $\langle w_3, K'\rangle$ from the output context of (30) due to contextual inconsistency. Then, consider that (32) is uttered after (30).[20]

(32) They$_{u_1}$ each submitted them$_{u_2}$.

As discussed in §5.2, MAX(u_2) in this environment only maintains the possibilities with semi-distributive dependencies. However, by supposition, such possibilities have already been discarded from the context. As a result, the possibilities with the maximal value of u_2 have to be chosen from paired-cover dependencies compatible with the common knowledge of writing. This means that (32) now has a reading in which each student submitted papers that (s)he wrote, which is a subordination reading. Thus, if common knowledge reasoning narrows down the input context 'prior' to maximization, quantificational subordination against cumulative dependencies becomes available. In this sense, the individual variation may point to variation in common knowledge sensitivity, i.e. it hinges on whether an individual takes common knowledge inference as contextual entailment and 'accommodates' the input context along with it.

This consideration might also apply to comprehenders' expectation for future discourse (Rohde, 2008: a.o.). For example, Krifka (1996a) reports that the subordination reading is clearer if the two cardinal modifiers match.

(33) a. Three students^{u_1} wrote three articles^{u_2}.

b. They$_{u_1}$ each sent them$_{u_2}$ to L&P. (Krifka, 1996a)

Also, it seems that quantificational subordination against cumulative readings becomes more acceptable for some speakers if the object numeral is divisible by the subject numeral.[21]

(34) a. Two students^{u_1} wrote four papers^{u_2}.

[20] I take (32) as a toy example, and ignore the competition between "it" and "them" for an expository sake.

[21] I thank to an anonymous reviewer of Homogeneity and Maximality workshop 2 (HNM2) for this example. Note that the reviewer's original point is that small numbers improve the acceptability, though.

b. They$_{u_1}$ each sent them$_{u_2}$ to L&P. (an anonymous reviewer for HnM workshop)

There is no *prima facie* reason to think that a specific choice of two cardinals triggers common knowledge inference. However, if a multi-plural sentence involves two matching numerals or the combination of a numeral and its multiple, a comprehender may think that a future continuation of the discourse may retrieve a non-trivial dependency expressed with this multi-plural sentence. If such an expectation may lead to adjustment of the context, discarding possibilities with semi-distributive dependencies prior to maximization, then it may have the same effect as common knowledge inference. Much more work is necessary to assess this conjecture and it is left for the future work. However, the point is that the individual variation may indicate individual variation in sensitivity to common knowledge and expectation, and the proposed analysis is flexible enough to incorporate these factors by letting them adjust the input context for sentences with pronouns so that some possibilities are discarded prior to maximization.

5.4. Remarks on pronoun number

In this section, I discuss the effect of pronoun number on maximization. First, I have shown that maximization on singular pronouns leads to the uniqueness requirement. One may wonder if it predicts that quantificational subordination only has a *strong reading*, i.e. (3) is true iff every student submitted **all** the papers (s)he wrote. This seems to be a good prediction for (3).[22]

(3) a. Every student^{u_1} wrote a paper^{u_2}. b. They$_{u_1}$ **each** submitted it$_{u_2}$ to a journal.

However, (35) seems to allow a weak reading: it may still be judged true when a customer had more than one credit card and used one of these credit cards to pay the check.

(35) a. Every customer^{u_1} had a credit card^{u_2}. b. They$_{u_1}$ each used it$_{u_2}$ to pay the check.

This is not necessarily a problem, though. Even if a singular indefinite introduces an atomic value to a dref, it is still compatible with the *at least one* reading. For example, consider (36) in regard to a PIS H and a world w. The value of u_1 under H is atomic, but the (dynamic) truth condition of (36) is still compatible with I_w(dog) and I_w(own) (cf. Sudo, 2023).

(36) Ann owns a dog^{u_1}.
a. $H(u_1) = d_1$ b. $I_w(\text{dog}) = \{d_1, d_2, d_3\}$ c. $I_w(\text{own}) = \{\langle \text{Ann}, d_1\rangle, \langle \text{Ann}, d_2\rangle, \langle \text{Bill}, d_3\rangle\}$

Thus, one may just assume that in any possible output PIS of (35), there is at most one value in u_2 for each distinct value of u_1. As MAX(u_n) is blind to the information stored in possible worlds, the result of maximization is still compatible with possibilities that support a weak reading.[23]

Second, Nakamura (2024) shows that *partial plurality inferences* (since Sauerland, 2003) are also observed with plural pronouns as exemplified in (37): "them" only requires that its value is plural with respect to at least one of the values of u_1.

[22] See also Nouwen (2003) for the related discussion.

[23] One may combine the proposed analysis with a pragmatic approach to the weak/strong ambiguity, e.g., a *homogeneity approach* (Chatain, 2018; Champollion et al., 2019).

(37) Scenario: There are ten PhD students in this department. This semester, seven of them wrote exactly one paper, while the other three students wrote more than one paper. They all submitted their papers to a journal.

a. Every PhD student^{u_1} wrote (some) papers^{u_2} in this semester.

b. They$_{u_1}$ each submitted {#it / them}$_{u_2}$ to a journal.

This suggests that the non-atomicity inference arises due to pragmatic competition (Sauerland, 2003; Sauerland et al., 2005: a.o.), and Nakamura (2024) proposes a DPlL analysis to derive this presuppositional inference, applying Sudo's (2023) *dynamic scalar implicature* approach. The analysis in this paper is compatible with it. Recall that δ splits c based on dependency patterns. For example, consider d_1, e_1, e_2 such that $I_{u_1=d_1}(u_2) = e_1$ and $J_{u_1=d_1}(u_2) = \{e_1, e_2\}$. As the value of u_2 is introduced under the scope of δ_{u_1}, such I and J are members of different quantificational alternatives, i.e. the local value of u_2 is different in $I_{u_1=d_1}$ and $J_{u_1=d_1}$. As a result, maximization relative to quantificational alternative does not discard possibilities with I because J belongs to a different quantificational alternative. Thus, those PISs which support pronominal partial plurality inferences survive through the update with pronoun maximization.

6. Conclusion

There is a good reason to believe that cumulative readings introduce new dependencies, but it raises a puzzle of why quantificational subordination against them is marginal. I offered a solution with *State-based DPlL* equipped with pronoun maximality relative to *quantificational alternatives*: it discards dependencies other than semi-distributive dependencies only if the antecedent sentence is non-distributive, and a pronoun is evaluated distributively. This derives co-varying readings of non-distributive plural anaphora while blocking quantificational subordination against cumulative readings. Then, I argued that common knowledge may improve it by discarding possibilities with semi-distributive dependencies from the context prior to maximization, and conjectured that expectations for discourse continuation may play the same role.

Some issues are left for future work. First, cumulative readings with quantificational or definite objects also do not seem to feed quantificational subordination.

(38) a. Three^{u_1} students read {seven papers/the (seven) papers/all the papers/every paper}^{u_2}.

b. ?? They$_{u_1}$ each wrote a review on them$_{u_2}$.

No speaker has reported a contrast among (38) so far, i.e. they sound equally bad. Although more work is necessary, the same analysis may work for them. Also, one speaker reported a subtle difference between definite plurals and universal quantifiers in an example with "write."

(39) It's surprising that this many papers have been written in this research group this year.

a. Actually, three^{u_1} students wrote the (seven) papers^{u_2}. ?They$_{u_1}$ each submitted them$_{u_2}$ to L&P.

b. Actually, three^{u_1} students wrote {all the papers / every paper}^{u_2}. ??They$_{u_1}$ each submitted them$_{u_2}$ to L&P.

Second, factors other than common knowledge and expectation may affect the acceptability of quantificational subordination against cumulative readings. For example, signaling the speaker's ignorance about dependencies improves the felicity for some but not all speakers. It might also be due to the pair-list interpretation of "who read which paper."

(40) Three students^{u_1} read seven papers^{u_2}. ??(I don't know who read which paper, but) they$_{u_1}$ each wrote a review on them$_{u_2}$.

Also, an overt description sometimes improves the acceptability of subordination.

(41) Three PhD applicants^{u_1} provided seven supporting documents^{u_2}. They$_{u_1}$ each use {??them / the documents}$_{u_2}$ to convince their$_{u_1}$ potential supervisors.^{u_3}

There could be yet other relevant factors, and investigation on them is left for future research.

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Meiosis and hyperbole as scalar phenomena[1]

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Abstract. Meiosis and hyperbole are phenomena that involve deliberate under- and overstatements that are uttered without the intention to deceive or otherwise break with cooperative communication. Much of the literature on these figures of speech concerns the specific rhetorical roles they play as well as their relation to other tropes, like metaphor and irony. In this work, I intend to study meiosis and hyperbole from a truth-conditional perspective. In particular, I look at how we can define under- and overstatement in terms of the relation between the propositional content and a contextually salient scale. The resulting theory is empirically grounded by empirical tests and formalized in a standard framework of possible world semantics. The advantage of doing this is twofold: (i) it will become possible to provide formal clarity on how to classify certain untruthful utterances and (ii) we can make explicit the role semantic content plays in the deliberate utterance of untruthful statements.

Keywords: understatement, meiosis, overstatement, hyperbole, scalarity, untruthfulness

1. Introduction

Timid has organized a housewarming party and invited 60 people, expecting around 30 of them to come. In reality, 58 people showed up and his new living room was extremely packed with people. The next day, he talks to Scarlett, who was at his party. Timid is insecure and asks Scarlett whether she thinks the party was a success. Now consider these two possible responses by Scarlett, who wants to point out to Timid that his insecurity is baseless.

(1) There were a hundred people in your living room.

(2) Nobody came.

In and by itself these sentences may not seem very felicitous in this context. But with some contextual clues, they become so. Scarlett can use (1) to make her point through exaggeration: *"Are you kidding me? There were a hundred people in your living room! Of course it was a success!"*. For (2), it helps to imagine Scarlett adopting a mocking tone: *"Yes, poor you. What a disaster! Nobody came!"*.

Used in this way, (1) is a case of hyperbole and (2) a case of meiosis. Hyperbole and meiosis are conversational moves that involve deliberate over- or understatements. These are usually (but not always, see below) untrue[2] statements. They are different from lies, however, since the goal of these kinds of utterances is not to deceive but, rather, to function cooperatively.

[1]I'd like to thank the audience of Sinn und Bedeutung and the Conference of the European Society for Philosophy and Psychology as well as Richard Breheny, Oliver Deck and Stephanie Solt for comments.

[2]I'm relying here on common terminology (e.g. Dynel 2016) that distinguishes truth and falsity on the one hand and truthfulness and untruthfulness on the other. While the former notions are about accordance to some state of affairs, the latter involve the speaker's beliefs. For instance, say that Scarlett believes Paris is the capital of Italy. If during a quiz Oscar is asked what the capital of Italy is and Scarlett wants to trick him into giving the wrong answer, she may tell him that Rome is the capital of Italy. In doing so, she is saying something that is true, while also being untruthful.

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Hyperbole and meiosis are normally classified as rhetorical devices. This means that studies of these figures of speech focus predominantly on their rhetorical use and their relation to other rhetorical figures such as irony. Here, I take a somewhat different perspective by investigating over- and understatements from a truth-conditional perspective. My interest in examples like (1) and (2) is in the question of how to link their propositional content to their classification as a certain kind of figure of speech.

My main concern will be to understand the "over" and "under" in the notions "overstatement" and "understatement". Intuitively, (2) is an understatement because it presents things as somehow "less" than what is really the case. Scarlett "pretends" (for want of a better word, cf. Wilson 2006) there was nobody at the party, when in fact, there were many. Conversely, (1) is an overstatement because the number of party goers is presented to be a lot higher than it really was. These paraphrases of what makes something an over- or understatement suggest that hyperbole and meiosis are *scalar* in nature. By saying that these phenomena are *scalar* I mean that their meaning and use involves some kind of order that is connected to the semantic content of the uttered sentence. My goal is to explore to what extent we can have a theory of these figures of speech that defines them not in terms of their pragmatic effect, or rhetorical use, but rather in terms of formal aspects of their semantics and the context of their use. As a consequence, I will show that even untruthful utterances involve reasoning about scalar alternatives.

2. First steps towards a scalar theory of meiosis and hyperbole

There is an obvious intuition that utterances qualify as under- or overstatements because of where their propositional content is positioned on some scale. I will assume for now that some sort of ordering of propositions $\prec$ is relevant.[3]

Given this ordering, we could try and define meiosis and hyperbole as untruthful utterances of propositions at extreme ends of that scale. Here's a simplistic approach to get us started:

(3) a. An utterance with propositional content p is **meiotic** if and only if the speaker believes p to be false and there exists a proposition p' that she believes to be true such that $p \prec p'$.

b. An utterance with propositional content p is **hyperbolic** if and only if the speaker believes p to be false and there exists a proposition p' that she believes to be true such that $p' \prec p$.

One immediate consequence of these definitions is that meiosis and hyperbole are predicted to

[3]I assume this ordering should be seen as that normally seen with scalar alternatives. As a consequence one could try to reduce meiosis and hyperbole to a kind of inverse of implicature. For instance, an utterance is meiotic/hyperbolic if and only if it untruthfully conveys what a truthful utterance would deny by scalar implicature. For instance, in Timid's context the meiotic *"nobody came"* is denied as an implicature when it would be truthfully uttered that *"not everyone came"*.

However, I think it is wrong to assume such close ties to implicature. First of all, (2) can still be used as meiosis if all 60 of Timid's friends come to the party, but in that case it is not what is denied by implicature by any truthful utterance, since *"not everyone came"* is not truthful in that context. Second of all, under- and over-statements do not necessarily involve entailment scales as may already be the case for (1), but can be more clearly seen by examples like the hyperbolic *"I'm dead"* for conveying that you are very tired.

essentially be the same phenomenon. For every scale that orders $p \prec p'$ there's another scale that orders $p' \prec p$, so whether something is meiosis or hyperbole only seems to depend on what we think the direction of the scale happens to be in the context. In practice, however, there will be no natural way to decide the relevant ordering of the scale. For instance, when Scarlett says "nobody came", we can't just judge this as an understatement simply because we have the intuition that a state of affairs with zero party guests is "lower" on the scale than cases where more guests came. In other words, we have no a priori way of deciding whether Scarlett is understating how many people came or whether she is *over*stating how *few* came. (Walton 2017, page 115, makes a similar point, discussing an example from Gibbs 2007).

To illustrate this issue, consider a different friend of Scarlett's, called Brag, who also gave a party and also invited 60 people, expecting around 30 guests to attend. In Brag's case, however, only 20 people showed up. Contrary to Timid, however, Brag is telling Scarlett what a success he thought his party was. Scarlett can again use both the sentences in (1) and (2) to counter Brag's claim that things went well:

(1) There were a hundred people in your living room.

(2) Nobody came.

The difference with earlier, however, is that the sarcastic tone she needed to adopt when uttering (2) addressing Timid should be adopted with (1) when addressing Brag. For instance, she can counter his supposition of success adopting a mocking tone and saying "*O yes, what a resounding success it was! There were a hundred people in your living room!*". The tone is different with (2): "*A success!? Are you kidding me? Nobody came!*".

I take it that the *tone* of (1) in Timid's context and (2) in Brag's context is indicative of verbal irony. Some authors (for instance, Walton 2017) think that irony is one of the things that sets meiosis apart from hyperbole: in contrast to meiosis, hyperbolic utterances are not cases of verbal irony. Yet others disagree and claim that hyperbole falls under irony as well (e.g. Gibbs 2007). Even if this debate were settled, however, it wouldn't help us towards categorizing utterances as one kind of figure of speech or another. This is because I don't know of any objective definition of verbal irony. More importantly, I don't know of any objective empirical *test* of whether or not something is ironic. So, it seems to me that it would be better if we could avoid intuitions about verbal irony, whatever you may think that is. This is why I will talk about something that I will call *deniable irony*, instead. This phenomenon covers some (but most probably not all) cases of what people have called (verbal) irony, but importantly it comes with an empirical test, so that we can easily connect it to intuitions. Crucially, I will claim that meiosis involves deniable irony, while hyperbole does not.

Deniable irony is a pragmatic phenomenon where an untrue utterance can be denied by the speaker, without changing the conversational goal. The utterance has this property if and only if a subsequent utterance can reveal or explicate the untruthfulness by denying the first utterance. That is, an utterance involves deniable irony if the speaker can contradict herself without altering the original speech act. To test deniable irony, I propose to use a mechanism that I call Wayne's test. Let me illustrate how this test works by going through an example. Say Sue is complaining to Sam that her salary raise was less high than she expected it to be. Sam didn't get a raise at all, as Sue well knows, and he's hurt that Sue doesn't realize that her complaint is

difficult to sympathize with for him. He can now utter (4).

(4) I feel so sorry for you.

He can make this utterance in two quite distinct ways. Uttered plainly, (4) would be a disingenuous statement of sympathy. Used ironically, however, (4) could be used by Sam to indicate towards Sue how displeased he is with Sue's insensitivity. The irony involved here is of the deniable kind, as can be shown by Wayne's test. The test involves adding "*... Not!*" to the utterance and testing whether that addition alters the function of the original utterance. In this case, adding *Not* maintains (in fact, strengthens) the demonstration of annoyance, and, so, the ironic use of (4) contains deniable irony.

(5) I feel so sorry for you... Not!

In addition, Wayne's test shows that using "*I feel so sorry for you*" as a act of disingenuous sympathy is not deniably ironic. In that case, adding "*... Not!*" would be extremely odd. More importantly, the denial introduced by Wayne's test would reveal the disingenuity and remove the display of sympathy.

If we apply Wayne's test to cases of meiosis and hyperbole, then we see that (2) contains deniable irony in Timid's context but not in Brag's. Vice versa, deniable irony is at play in (1) when Scarlett responds to Brag, but not when she responds to Timid. For instance, in the context of Timid's housewarming party, Scarlett's understated response could have been extended as follows:

(6) [to Timid:] Yes, poor you, I'm not sure it was a success. Nobody came!... Not!

What we thought of as hyperbole in Timid's context does not involve deniable irony, though, as can be illustrated by the unacceptability of the "*... Not!*" rider in (7) when addressing Timid.

(7) [to Timid:] What!? Are you kidding me? There were a hundred people in your living room #... Not!

In Brag's context, where fewer guests showed up than expected, Brag's boast that the party was a success can be countered as in (8).

(8) [to Brag:] Oh yes, your party was a huge success. There were a hundred people in your living room!... Not!

But Scarlett couldn't do the same with the claim that the living room was empty:

(9) [to Brag:] Are you kidding me? Nobody came!... #Not!

I should clarify what I mean with "unacceptability" (indicated by the "#") in (7) and (9). In this context, the addition of "*... Not!*" changes the intended meaning of the preceding sentence. Let me illustrate this with another example. Say I praise someone's baking skills by saying "*That was the best cake I've ever had*". This is arguably a case of hyperbole, I am overstating how much I liked the cake. Is this a case of irony? I don't know, because I don't know what you mean by irony. But I can show it is not a case of *deniable irony*, for as soon as I deny the utterance, the conversational goal is altered. If we assign a praising interpretation to the first part of (10), then the continuation with "*... Not!*" is infelicitous. Put the other way around: the addition of the denial rules out the praising understanding of the initial utterance.

(10) a. [praising:] That was the best cake I've ever had#...Not!
b. [dissing:] That was the best cake I've ever had...Not!

Deniable irony allows us to distinguish two different kinds of exaggeration, one which involves deniable irony, meiosis, and one which does not, hyperbole.

Note that I used the term *deniable irony* as a pragmatic phenomenon, rather than as a kind of irony. It is clearly related, however, to what in the literature is called *impersonation* or *pretence irony* (e.g. Currie 2006; Simonin 2018). This is the kind of irony that involves the speaker transparently taking on a false persona. The addressee recognizes the false pretence. In other words, denying the false utterance allows the speaker to switch back to her genuine persona. Meiosis of the kind we've been looking at so far – i.e. (2) when addressing Timid and (1) when addressing Brag – involves pretence. Scarlett is temporarily pretending to be respectively Timid and Brag to highlight the silliness of the claims they made about their party. As a consequence, these cases of meiosis contain deniable irony. The hyperbolic utterances do not contain pretence and, as such, do not contain deniable irony.

The upshot is that we have an empirical test that shows that meiosis and hyperbole are different phenomena. As a consequence, our simplistic scalar approach above must be abandoned. Meiosis is not simply hyperbole on the other end of the scale - it is profoundly different. Below, I will show that this difference can be reduced to scalar properties. Before I do this, I should introduce a phenomenon that is often classified as meiosis, but that does not involve deniable irony. Consider the following examples:

(11) Tim Henman is not the most charismatic tennis player in the world. (Wilson, 2006)

(12) That could have gone better. (When everything went wrong)

(13) Well, your living room wasn't empty. (Scarlett to Timid)

(14) Well, not everyone came. (Scarlett to Brag)

These examples have in common that they are all truthful in the intended context. Tim Henman is known to be relatively uncharismatic and, so, he is not the most charismatic tennis player in the world. When everything goes wrong, things could have gone better. Neither was Timid's living room empty, nor did all the invited guest come to Brag's party. As such, none of these utterances can involve (deniable) irony.

Key to understanding these utterances, I think, is to look at the role of denial in all this. The examples above are cases that deny the propositional content of cases of deniably ironic meiosis. For example, Scarlett can highlight Timid's success in three related ways: (15), which deniably ironically says that his living room is empty; (16), which combines (15) with an overt demonstration that (15) is believed to be false; or (13) where this falsehood is expressed in a single proposition.

(15) Your living room was completely empty!

(16) Your living room was completely empty!...Not!

(13) Your living room wasn't empty!

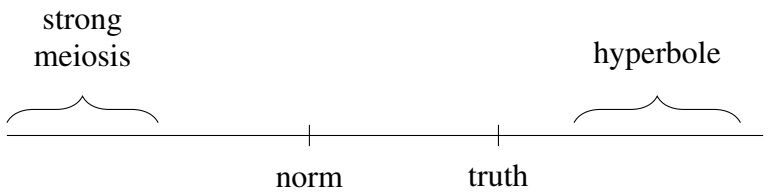
In what follows, I will distinguish between *strong meiosis* and *weak meiosis*. The former kind is exemplified by Scarlett uttering (2) or (15) to Timid. The latter kind is exemplified in (13).[4] Given this we can formally distinguish three figures of speech:

figure	deniable irony	truthfulness
weak meiosis	no	truthful
strong meiosis	yes	untruthful
hyperbole	no	untruthful

The idea is that this table will give us some much needed empirical grounding. In the next section I will match the distinction between strong meiosis and hyperbole with properties of scalar semantics. Following that, I will compare strong and weak meiosis.

3. A scalar definition for hyperbole and (strong) meiosis

Walton (2017) offers a way of thinking about the meiosis/hyperbole distinction that goes beyond the simplistic scalar comparison we dismissed above. According to Walton's approach, meiosis and hyperbole involve comparison of not two, but three points on a scale. Here's a sketch of such an approach: Hyperbole involves the exaggeration of a gap between what is really the case and some salient alternative to that. For the Timid context, for instance, we have the expectation that 30 people came, the reality that 58 people came and the exaggeration of the difference between the two in saying that 100 people came. Similarly in Brag's context, there's the expectation that 30 people came, the reality that 20 people showed up and the exaggeration of the gap by saying that nobody came. Strong meiosis is different from hyperbole in that it states that the gap is in the opposite direction. In the Timid context, there are more people than expected. The meiotic *"Nobody came!"* states there were fewer than expected. Similarly, in the Brag context, there are fewer people than expected and the meiotic utterance here conveys that many people came. Schematically,



The idea is then that meiosis and hyperbole involve some or other contextual norm. The Timid context is one where *"many"* people attended the party in the sense that more people came then we expected to come. Conversely, in the Brag case *"few"* people, that is, fewer than expected, attended. Hyperbole exaggerates *how* many / few people came. Strong meiosis denies that many / few people came.

I will now present a formal framework that makes these intuitions precise. The result will be a definition of (strong) meiosis and hyperbole based on scalar properties of the context and the semantic content of the utterance. We can use deniable irony as a test of how good this theory is: exaggerations that comply with the definition of strong meiosis should display deniable irony, while exaggerations that follow the definition of hyperbole should not.

[4]The example in (16) could be seen as strong followed by weak meiosis.

3.1. Formal prerequisites

Let $\mathscr{W}$ be a set of worlds, the worlds compatible with the beliefs of the interlocutors. A question under discussion is an explicit or implicit contextual question that is associated with an equivalence relation $\mathscr{R}$ such that world w and w' stand in the $\mathscr{R}$-relation if and only if they provide the same answer to the question under discussion. As a result, a question under discussion induces a partition over $\mathscr{W}$, where each cell is a set of worlds agreeing about the answer to the contextual question. Formally,

$$Q(\mathscr{R}) \;=\; \{[w]_{\mathscr{R}} \mid w \in \mathscr{W}\}$$

An *order-inducing question under discussion* occurs whenever $\mathscr{R}$ is based on an ordering over worlds $\leq_o$.

$$\mathscr{R}_{\leq_o} \;=\; \{(w,w') \mid w \leq_o w' \;\&\; w' \leq_o w\}$$

Given $\leq_o$, we can now order propositions. Let p and p' be sets of worlds

$$p \preceq_o p' \;:\Leftrightarrow \forall w \in p, w' \in p' : w \preceq w'$$

When no confusion will arise, I will drop the subscript on the ordering. Moreover, I will write $p \prec p'$ to indicate that $p \preceq p'$, but $p' \not\preceq p$.

Here's an example: Let's say that the question under discussion is the degree question *How many people attended Timid's party?*. Let's say that $\varepsilon(w)$ returns the number of guests at Timid's party in world w. In this context, we can order worlds in accordance to ε: i.e. $w \leq w'$ whenever $\varepsilon(w) \leq \varepsilon(w')$ or $w \leq w'$ whenever $\varepsilon(w') \leq \varepsilon(w)$. We have an ordering of propositions: $p \preceq p'$ whenever $\forall w \in p \forall w' \in p' : w \leq w'$. The order-inducing question under discussion $Q(\mathscr{R}_{\leq_o})$ is a partition of $\mathscr{W}$ such that for each cell c: $\forall w, w' \in c : \varepsilon(w) = \varepsilon(w')$. Note that $\preceq$ forms a total order on this partition.

We cannot assume that utterances fully resolve the question under discussion. So, we need some way of expressing which cells are compatible with a proposition. For this we use the function $\tau_{Q(\mathscr{R}_{\leq_o})}$, which takes a sentence M and returns a subset of $Q(\mathscr{R}_{\leq_o})$, namely $\{[w]_{\mathscr{R}} | w \in [\![M]\!]\}$, where $[\![M]\!]$ is the intension of M.

3.2. Definitions

Let a context C be a triple (Q,n,h) with Q a question under discussion, $n,h \in Q$ where n is the cell in Q that is expected to contain the actual world in that context and h is the cell that does contain the actual world.

Hyperbole An utterance of a sentence M in context (Q,n,h) counts as hyperbole if and only if $n \prec h$ and $\forall c \in \tau_Q(M)$: $h \prec c$ and the scalar distance between h and c is large

Strong Meiosis An utterance of a sentence M in context (Q, n, h) counts as meiosis if and only if $n \prec h$ and $\forall c \in \tau_Q(M)$: $c \prec n$ and the scalar distance between c and n is large

To illustrate, let's apply this to Scarlett's interactions with Timid and Brag. We have a function ε that maps worlds to the number of people attending Timid's / Brag's party. The QUD Q is a partition of cells {**0**,**1**, **2**,...,**60**,...,}. So, **23** is the class of worlds where 23 people attended the party. Two possible orderings make sense, **23**$\prec$**24** and **23**$\prec$**60**, etc. or **24**$\prec$**23**, **60**$\prec$**23**, etc.

(17) Timid's context = $(Q, \mathbf{30}, \mathbf{58})$, where **30**$\prec$**58**
   a. τ_Q(*there were 100 people in your living room*)=**100**; **58**$\prec$**100** $\rightsquigarrow$ hyperbole
   b. τ_Q(*nobody came*) = **0**; **0**$\prec$**30** $\rightsquigarrow$ strong meiosis

(18) Brag's context = $(Q, \mathbf{30}, \mathbf{20})$, where **30**$\prec$**20**
   a. τ_Q(*there were 100 people in your living room*)=**100**; **100**$\prec$**30** $\rightsquigarrow$ strong meiosis
   b. τ_Q(*nobody came*) = **0**; **20**$\prec$**0** $\rightsquigarrow$ hyperbole

As we saw above, these predictions match the observations for deniable irony. Only the cases predicted to be (strongly) meiotic are deniably ironic.

4. Strong versus weak meiosis

The definitions for hyperbole and strong meiosis single out the specific circumstances that hold with these figures of speech. What about weak meiosis? Here is an attempt:

Weak Meiosis (to be abandoned) An utterance of a sentence M in context (Q, n, h) counts as weak meiosis if and only if $n \prec h$ and $\exists c \in \tau_Q(M)$ such that the scalar distance between c and n is small compared to the distance between c and h.

This definition predicts a particular connection between weak and strong meiosis: If M is a case of strong meiosis in C, then $\neg M$ is a case of weak meiosis in C. If all the worlds in $\tau(M)$ are far from n, then it must be the case that $n \in \tau(\neg M)$ and, so, there's at least one cell in $\tau(\neg M)$ that is close to n. This is how it should be: (13) is the negation of (15), where (15) is strong meiosis and (13) is weak meiosis when addressing Timid.

(13) Your living room wasn't completely empty.

(15) Your living room was completely empty.

But note that the following also holds: if M is a case of hyperbole in some C, then it follows that $\neg M$ is weak meiosis in C. If all the worlds in $\tau(M)$ exaggerate the gap between n and h, then all the worlds in $\tau(M)$ are far from n. Then it must be that $n \in \tau(\neg M)$. This is less desirable: (2) is hyperbolic in the Brag context, but (13) is not a case of weak meiosis when addressing Brag. This suggests that the definition above is far too general and that we need to try and explain instead the close connection between weak and strong meiosis.

Both strong meiosis and hyperbole involve uttering untrue statements and both are meant to be transparently untruthful. Why then does the former involve deniable irony, but not the latter? Above, I suggested pretence may have something to do with that, but I think scalarity can provide us with additional tools to start to understand things.

Scales facilitate pragmatic reasoning. In particular, weak statements – i.e. statements compatible with large regions of the scale – tend to be understood as pertaining to quite specific scalar values. The most well-known example of this is scalar implicature. If I claim that not everyone came to my party, the proposition I am expressing is compatible with all QUD cells, except for the top one. In particular, it is compatible with the other extreme of the scale: cases where no-one attended the party. Uttering this statement, triggers the implicature that this other extreme is not the case. So, "*not everyone*" implicates "*not no-one*".

This is not the only inference triggered by weak scalar statements, however. In a phenomenon often called "negative strengthening" (e.g. Horn 1989), a weak scalar statement is interpreted as referring to a state of affairs that is close to what a scalar implicature would deny. For instance, strengthening "*not everyone came*" produces the inference that only few people came.

Adjectives give rise to particularly clear cases of strengthening. For instance, saying that you don't have very good news, is usually interpreted as the news being bad. This is clearly a case of weak meiosis. The speaker is saying something rather weak, but true. It is compatible with both the norm and the actual state of affairs. In fact, our running example of weak meiosis is an example of where strengthening applies. When Scarlett claims "your living room wasn't empty" in response to Timid's insecurity, she's inviting him to strengthen this to "the living room was rather full". Similarly, Scarlett can state "not everyone came" to Brag to get him to acknowledge that, in fact, only few people came. It seems then that weak meiosis and strengthening go hand in hand. I don't have a good explanation of why this is, but I'd like to simply take this as an empirical fact and use it to explain the distribution of deniable irony.

Strong meiotic statements and weakly meiotic ones are contradictories. The weak meiosis counterpart (13) of the strong meiosis use of (15) is simply its negation.

(15) Your living room was completely empty.

(13) Your living room wasn't completely empty.

My hypothesis is that the function of deniable irony *is* denial. The ironic utterance of (15) proffers the proposition expressed by (13) and, by doing so, (15) is conveying the strengthened meaning of (13). In other words, the goal of deniable irony in strong meiosis is to invite a strengthening inference by claiming (through denial) something quite weak.

This, I claim, is exactly why there is no deniable irony in hyperbole. Yes, hyperbolic statements are untrue, but they are not ironic in this specific sense. This is because if they were ironic in this way, they would invite inferences that are in opposition to the goal of hyperbole. This is what we saw in the application of Wayne's test. The sentence in (15) is hyperbolic when uttered in Brag's context. If, however, I impose deniable irony on this statement, by applying the rider of Wayne's test, I automatically trigger the strengthening inference.

(16) Your living room was completely empty... Not!

This effectively conveys that many people came, which is incompatible with the Brag scenario.

We have seen that hyperbole and strong meiosis are different phenomena, both in terms of the presence of deniable irony and in terms of the semantic preconditions that need to apply (as per the definitions given above). An utterance is a case of weak meiosis whenever it is the negation

of a potential case of strong meiosis. My proposal is that deniable irony is interpreted as denial and that through that denial the speaker intends to trigger negative strengthening.

Understatements require negative strengthening to work, since their literal content does not entail what the speaker intends to convey. For instance, (15), meiotic when addressing Timid, does not entail that more people than expected attended. That is only brought in via negative strengthening. On the other hand, hyperbole already entails the intended content. When (15) is addressing Brag it entails that fewer people than expected attended. In other words, even though (15) is untrue in that context, it entails the key message: that *few* people came.[5]

5. Hyperbole and evaluation

As I suggested above, meiosis uses negative strengthening to convey that things are further up (or down) the scale than they were expected (desired, believed, etc.) to be. Hyperbole directly conveys this by exaggerating how much further up (or down) the scale things are. It seems to me that the function of this exaggeration is evaluative in nature, in the sense that it conveys two things at the same time: (i) something about the world (e.g. how many people attended the party); and (ii) some connected speaker evaluation of this.[6]

This idea of hyperbole conveying multiple things at the same time is not new. It is, for instance, the key idea behind the computational approach in Kao et al. (2014). The idea there is that multiple questions under discussion are at play at once. For Kao et al. these QUDs either concern the world (as the QUDs we introduced above) or they are affective in nature: conveying whether or not the speaker is in a state of heightened emotion. (Or, in their terms, *arousal*.) Utterances can contribute to either or both of these QUDs. Kao et al. implement the effect of multiple QUDs using the Bayesian rational speech act (RSA) framework (Goodman and Frank, 2016; Scontras et al., 2021). This means that utterances update prior distributions. Where in the standard RSA setup there is a single prior distribution, for Kao there are two such priors: one a distribution over a set of possibilities (sets of worlds) corresponding to a factual question under discussion and the other a conditional prior for each cell in that partition. That is, for each cell there is a prior probability for the speaker being in some affective state. Utterances update both these priors. Crucially, utterances can be useful in two ways: they can update our

[5]Walton (2017) claims the existence of a related pragmatic difference between under- and overstatement. According to him, meiosos seems to rely on a shared belief in some proposition. In a sense, meiosis functions to remind the hearer of something. For instance, to remind Brag that the number of people attending his party was low. Hyperbole does not rely on such a reminding function. Walton's suggestions are in line with the idea found in Wilson and Sperber (1992) that irony is echoic in nature.

While I agree echoing / reminding is a prominent use of understatement, I am not convinced that meiosis cannot take place without it. Imagine you ask me to teach an extra course next month and imagine you are (wrongly) under the impression that I am not particularly busy at the moment. I can convey my dismay at your request by exclaiming "Sure, I've got nothing to do. (Not!)" or "Sure, I've only got the odd task lying around." If I succeed in getting you to recognize the irony, then these are cases of (strong and weak) meiosis where I am conveying new information to you.

[6]Here I go beyond the claim made in Carston and Wearing (2015) that hyperbole is evaluative. Carston and Wearing simply mean to say that hyperbole expresses deviation from some norm: "the exaggeration of some property F is used to communicate is that there is more or less of F than the speaker expected (or wanted)." As I have shown above, both meiosis and hyperbole are evaluative in this sense.

prior beliefs of what the world is like (e.g. how many people attended the party) and they can update our prior beliefs of what the speaker is like (e.g. whether or not they are emotional). Crucial to Kao et al.'s model is that, typically, cases of hyperbole are utterance where the literal meaning is unlikely to be true. That is, the literal meaning points to cells in the factual QUD that have low prior probability. At the same time, the speaker has a high probability of being in some affective state in these cells. In cases of hyperbole, it is therefore much more likely that the affective QUD is being addressed than the factual one.

I believe it would be natural to extend Kao et al.'s framework with a more fine-grained second QUD. It seems unnatural to me to assume there is a binary distinction in the affective state of the speaker. In fact, it seems to me that the 'bigger' the hyperbole, the more pronounced the evaluative effect. Both (19) and (20) can be used by the speaker hyperbolically to express that she is (very) busy, but (20) expresses a stronger evaluation than (19).

(19) I've got a hundred thing to do today.

(20) I've got millions of things to do today.

I think this link between the factual QUD (how busy the speaker is) and the evaluative QUD (how bad things are) is crucial to understanding hyperbole. The speaker conveys information about their subjective evaluation by means of an exaggerated (untrue) statement about the world. In fact, hyperbole fits in a range of phenomena where information about the world is assumed to be directly connected to some kind of subjective evaluation. Take (21):

(21) Thankfully, almost all students passed the exam.

The speaker of (21) clearly intends to convey some state of affairs: that close to 100% of the students passed. At the same time, she evaluates this state of affairs as being something good. Interestingly, there is even a third inference triggered by (21). Not only can we conclude from (21) that the speaker thinks it is good that the proportion of passing students is close to 100%, we can also conclude that she thinks more students passing is better than fewer students passing. To see this, compare (21) and (22).

(22) Thankfully, not quite all students passed the exam.

Just like (21), (22) conveys the state of affairs that close to 100% of the students passed and once more the speaker is indicating that she thinks this is good. Crucially, however, this evaluation is directed. She thinks it is good because she thinks fewer students passing is better than more students passing – the opposite of what we infer from (21); (see Sanford et al. 2002; Nouwen 2005; Geurts 2010 for similar observations). What examples like the above show is that interlocutors presume an alignment between the evaluative and the factual scale (Geurts, 2013). This is missing from Kao et al.'s proposal. While their proposal will predict that affective interpretation is more likely with more extreme utterances, it doesn't have anything in place to match particular states of affairs with particular evaluations. As a consequence, a hyperbolic utterance will (i) assign a high probability to the affective state of the speaker; (ii) assign high(er) probabilities to possibilities that have low prior likelihood; but (iii) it will not distinguish between these possibilities. For instance, if we apply the Kao et al. model to (1) in Timid's context, we start out with a normal prior concerning the number of attendees with a mean of 30. Also, the prior probability for the speaker being in an affective state is higher for

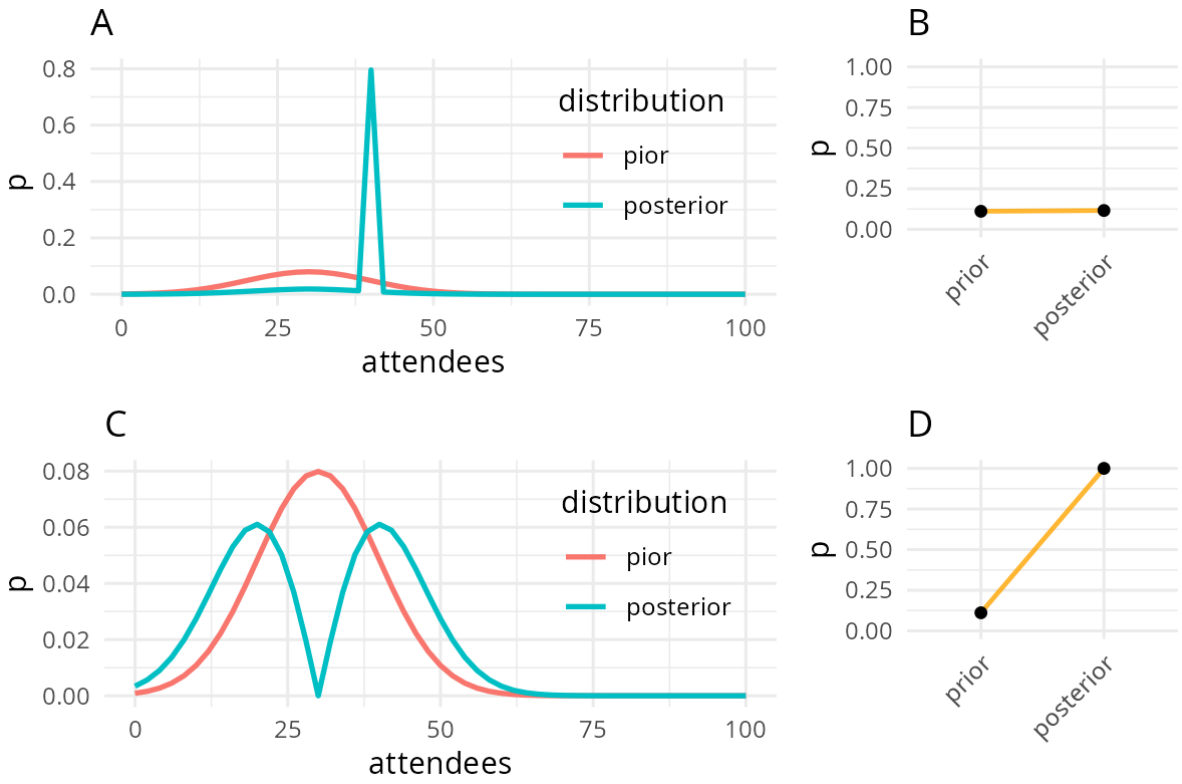


Figure 1: Simulation of Kao et al.'s model applied to utterance (2) in Timid context. Plots A and C show the posterior distribution over the factual QUD for utterance "*There were 40 people at the party*" and "*There were 100 people at the party*", respectively. Plots B and D show the posterior probability of an affective interpretation for these utterances.

more extreme cases (very few or very many attendees) and low for cases closer to the mean. Updating with (1), will lead to a high probability of affect, and the probability mass for the state of affairs moving away from the mean. Figure 1, resulting from a simulation using Kao's model with the priors as described, illustrates this.[7]

(1) There were a hundred people in your living room.

Plots A and B in Figure 1 show that utterances whose meaning is close to the norm are interpreted literally and don't have an impact on the affect prior. Plots C and D show that utterances whose meaning is far from the norm are not interpreted literally and change the affect prior entirely. This is all as it should be. A further prediction is made that hyperbolic utterances invite the inference that there is some deviation from the norm. The model doesn't predict, however, which direction that deviation should go into, which means that a hyperbolic utterance of (1) is not necessarily interpreted as many people turning up, but could potentially be seen as conveying that few (fewer than expected) people came.

I believe the framework developed above may help to remedy these problems. In Kao et al.'s setup, as is standard in RSA, the prior and posterior distributions are distributions over a set

[7] `https://github.com/rnouwen/meiosishyperbole.git`

of possibilities. No structure is assumed for this set. However, as we saw above, hyperbole is a phenomenon that depends on an ordering-induced QUD. What's more, given that hyperbole involves evaluation, we should take seriously the idea that interlocutors entertain alignment between the ordered partition related to the factual QUD and the scale of evaluation.

To have a setup with two scales, we do the following. As before, we have a QUD that is a set of propositions and, as before, propositions can be ordered by some $\preceq$. We assume there is some scale of evaluation, an ordered set of degrees $\langle E, \leq \rangle$, and that propositions can be evaluated using a measure function $\varepsilon : \wp(\mathscr{W}) \rightarrow E$.

The exact details of this measure function are unknown, but interlocutors may have simplifying assumptions that align E and the QUD. (Think of things like: a party with more people is better than a party with fewer people, an accident with more casualties is worse than an accident with fewer, etc.) The simplest of such alignments would be the following:

$$s \preceq s' \Leftrightarrow \varepsilon(s) \leq \varepsilon(s')$$

In the original Kao et al. framework, there was a prior distribution P over possibilities and for each possibility there was a probability of affect. Now, we have a scale of affect, or more accurately a scale of evaluation, which means that for each possibility we need a probability distribution over E. This distribution is informed by ε. Obviously, $\varepsilon(s)$ is the most likely evaluation of s. But there will be uncertainty as well, so we could take $\varepsilon(s)$ as the mean of a normal distribution (with unknown standard deviation). Let d range over degrees of evaluation ($d \in E$) and s over cells in the factual QUD partition:

$$P(d|s) \sim \mathscr{N}(\mu = \varepsilon(s), \sigma)$$

Figure 2 shows the results from incorporating such a prior into a Kao et al. inspired RSA model. For the simulations ε aligned with the factual QUD. In fact, I represented the QUD as the set of integers $\{0,\ldots,100\}$ and did the same for E. This allows confusion of representation of number of attendees and degrees of evaluation. So, for instance $\varepsilon(\mathbf{49}) = 49$. Plots A and B show the prior distribution on the factual QUD, as well as posterior distributions for both states (factual QUD) and evaluation (affective/evaluative QUD). So, the x-axis in figure 2 plays a double role. From left to right the number of attendees increases, but so does the positivity of the evaluation.

Figure 2 shows that the alignment of evaluation and QUD changes the predictions made by the model. In plot A we see that utterances that express meanings close to normality are interpreted literally and that their evaluative meaning is moderate. Plot B shows that utterances whose literal meaning is extreme are not interpreted literally. They convey meanings that are in between the norm and the literal meaning. At the same time, their evaluative meaning is one that *is* extreme. So the hyperbolic utterance are interpreted as conveying extreme evaluation while at the same time they signal the untruth of the sentence uttered.

Another way of looking at plot B is that it shows the interpretive side of the definition I gave for hyperbole in section 3. We now have a probabilistic norm, but clearly the interpretation of hyperbole illustrated here is such that $n \prec h \prec \tau(M)$ (with M the uttered sentence).

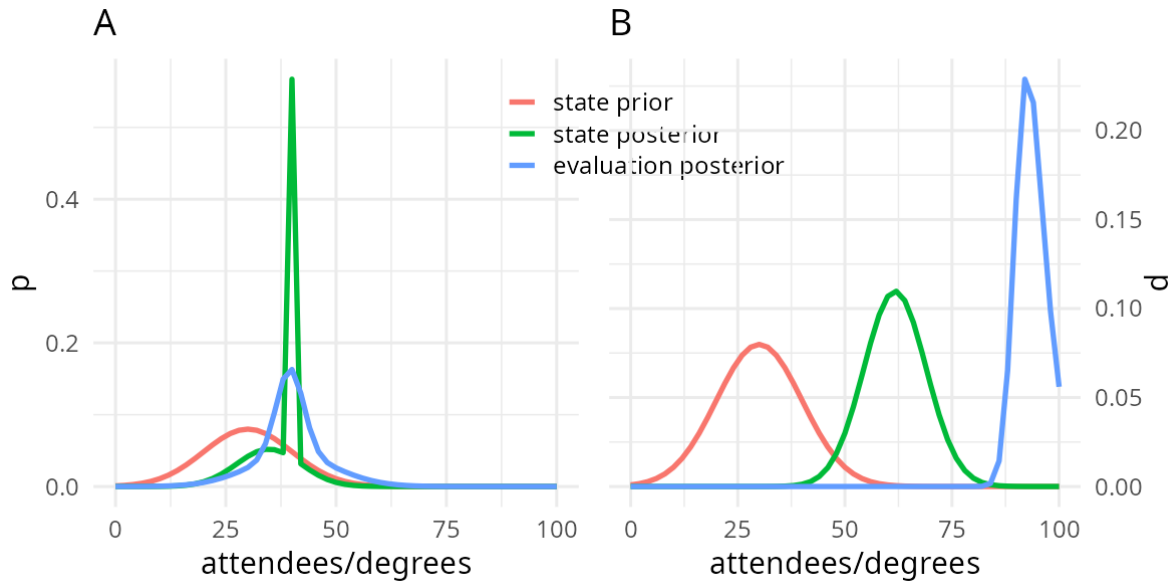


Figure 2: Simulation of the variation on the Kao et al. model where scalar alignment is assumed between the order-induced factual QUD and the evaluation. The posteriors in plot A are for "*There were 40 people at the party*" and those in B are for "*There were 100 people at the party*".

It will remain to be seen how good the predictions of this model are in other contexts. The assumed monotonic alignment is not always the most natural one. Think for instance about an utterance about today's temperature. Generally, extreme temperatures, both very high ones and very low ones, are evaluated as bad, while medium temperatures are good.[8] A consequence of that particular pattern of evaluation is that the evaluation of extremely cold temperatures is indistinguishable from the evaluation of extremely hot temperatures. In accordance, the model will not be able to draw the correct inferences. For instance, hyperbolic "*It's absolutely freezing*" would wrongly be predicted to be compatible with (relatively) cold and with (relatively) warm temperatures. In other words, the (over)simplification that scalar alignment is monotonic does a lot of heavy lifting in predictions such as those in Figure 2.

6. Conclusion

In this short paper, I have proposed to approach over- and understatements from a scalar formal framework. This framework allows us to provide explicit definitions that determine which transparently false statements count as overstatement and which count as understatement. I've also proposed an empirical test to ground predictions made by these definitions. Ultimately, my hope is that a relatively simple framework like the above will allow further study of untrue utterance and connected phenomena, like irony, utilizing the formal rigor that truth-conditional semantics brings along. Furthermore, as I showed in the previous section, the framework I developed connects naturally to computational approaches to rhetorical pragmatics. I leave a more detailed investigation of this combination for further research.

[8]See Nouwen (2024) for how exactly this kind of alignment drives the interpretation of degree adverbs.

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The role of gesture in ʔayʔaǰuθəm determiners and demonstratives[1]

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Abstract. This paper examines the contribution of co-speech gesture with determiners and demonstratives in ʔayʔaǰuθəm (ISO 639-3: coo), an endangered Salish language spoken in British Columbia, Canada. Using a small experiment designed after similar work by Ebert et al. (2020) on German, we show that gestural content is not-at-issue accompanying ʔayʔaǰuθəm determiners but shifts to the at-issue dimension with at least one class of demonstratives, the so-called "gesture demonstratives". The experiment also confirms Ebert et al.'s observation that co-speech gesture makes different contributions with indefinite-like versus definite-like determiners. Overall, the findings suggest that speech-accompanying gestures are interpreted similarly even in unrelated languages with quite different systems of determiners and demonstratives.

Keywords: ʔayʔaǰuθəm, determiners, demonstratives, co-speech gesture, at-issueness

1. Introduction

In this paper, we explore the interaction of co-speech gesture with determiners and demonstratives in ʔayʔaǰuθəm (a.k.a. Comox-Sliammon; ISO 639-3: coo), a Salish language traditionally spoken by the Tla'amin, Homalco, Klahoose, and K'ómoks communities in British Columbia, Canada. According to the most recent census, only 78 speakers report as fluent (FPCC 2023), though there is a growing community of language learners.

Just like other languages in the Salish family (e.g., Klallam, cf. Montler 2007; Squamish, cf. Gillon 2006), ʔayʔaǰuθəm boasts a remarkably rich inventory of determiners and demonstratives. So far, at least five distinct determiners and 17 distinct demonstratives have been attested in the language, amounting to a total of 22 distinct D elements (cf. Huijsmans et al. 2020; Reisinger et al. 2021; Reisinger & Huijsmans 2021; Huijsmans & Reisinger 2022a, 2022b). These elements encode a variety of dimensions, such as evidentiality, deixis, gender, and number. Recently, Huijsmans and Reisinger (2022a) proposed that the use of co-speech gesture might be a further dimension of variation, leading to a split in the demonstrative system. More specifically, they argue that the "gesture demonstratives" (GDEMs) require the use of co-speech gesture, while the "salience demonstratives" (SDEMs) do not.

This claim forms the starting point for the current investigation. Beyond the observations in Huijsmans and Reisinger (2022a), the interpretation of co-speech gesture with ʔayʔaǰuθəm D elements has not been explored. In general, little is known about the role of gesture in Salish languages, apart from Webb's pioneering work on viewpoint gestures in Halkomelem (cf. Webb 2021, 2022).

[1] Our deep gratitude goes to our generous and patient consultants, especially Elsie Paul, Freddie Louie, Betty Wilson, Doreen Point, Molly Harry, Phyllis Dominic, and the late Marion Harry, who all contributed directly to this project. *č̓eč̓ehatanapɛšt!* We would also like to thank two anonymous SuB reviewers, the audience at SuB 28, and the Salish Working Group for their helpful feedback and support. Research for this project was supported through a SSHRC Insight grant (435-2016-1694) awarded to Henry Davis and the Jacobs Research Funds. Contact info: huijsman@ualberta.ca, daniel.reisinger@ubc.ca.

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In this paper, we build on Ebert et al.'s (2020) work, which explores what co-speech gesture contributes when it accompanies German demonstratives and determiners. Based on native-speaker judgements and two experiments, they argue that gesture conveys not-at-issue content by default but changes to at-issue content when accompanying demonstratives. They also find that co-speech gesture contributes differently with definite and indefinite determiners.

Inspired by Ebert et al.'s (2020) work, we designed a small experiment to test whether their hypotheses also map over to ʔayʔaǰuθəm. Based on this investigation, we argue that gesture contributes at-issue content when accompanying GDEMs, whereas it is not-at-issue when it co-occurs with other D elements, thus providing cross-linguistic support for Ebert et al.'s observation that demonstratives act as "dimension shifters". Second, we provide evidence that co-speech gesture evokes a similarity reading with indefinite-like determiners and an identity reading with definite-like determiners, again confirming another one of Ebert et al.'s findings from their work on German. Third, we propose that, at least for some speakers, GDEMs require the use of co-speech gesture, which is not the case for other D elements. And fourth, we find that iconic gestures are vaguer than pointing gestures and, thus, more easily accommodated by speakers.

Particularly the first two findings suggest that Ebert et al.'s (2020) core observations about the semantics of co-speech gesture accompanying D elements hold beyond Indo-European languages. This is especially interesting since the organization of the system of D elements in ʔayʔaǰuθəm shows important differences with English and German, as will be discussed below. The findings also partially confirm Huijsmans and Reisinger's (2022a) claim that GDEMs require co-speech gesture to establish reference, contributing to core semantic content.

The paper is structured as follows: Section 2 introduces Ebert et al.'s (2020) framework for analyzing co-speech gesture, while Section 3 provides an abridged overview of ʔayʔaǰuθəm demonstratives and determiners. In Section 4, we present the experiment that we used to answer some open questions on the interaction between co-speech gesture and D elements in the language. Following a brief discussion of the SDEMs in Section 5, we then attempt to formalize the different contributions of co-speech gesture for some of the D elements in Section 6. A summary of our main findings and their implications concludes this paper in Section 7.

2. Background

With the recent rise of "super semantics" (cf. Schlenker 2018b), the study of co-speech gesture has received increased attention among semanticists and pragmaticians (e.g., Lascarides & Stone 2009; Lücking 2013; Ebert & Ebert 2014; Schlenker 2018a; Tieu et al. 2018, 2019; Ebert et al. 2020; Barnes & Ebert 2023; Walter 2023). In this section, we provide a brief overview of some key insights emerging from this research.

As already noted by Neill (1992), co-speech gesture is not a monolithic phenomenon. Rather, gestures may come in many different shapes or forms. In this paper, we will be particularly concerned with two of the most common types of co-speech gesture, namely pointing gestures and iconic gestures (see Figures 1 and 2). While the former directly identify the target object, usually by the use of the index finger, but occasionally also via gazes or head movements, the

latter involve some kind of demonstration by the speaker to represent a property of the target object, such as its shape or size (cf. Umbach & König 2018).

Figure 1: A pointing gesture

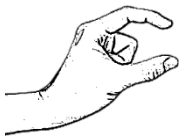

Figure 2: An iconic gesture

Both pointing and iconic gestures behave similarly in that they introduce a gesture referent into the discourse (cf. Ebert et al. 2020). For pointing gestures, this gesture referent is always the object that the speaker points to. For iconic gestures, on the other hand, the gesture referent will be an abstract object that the speaker creates *through* the gesture.

Yet, what exactly is the contribution of co-speech gesture? Ebert et al. (2020) propose that co-speech gestures typically add not-at-issue meaning to an utterance, making their contribution analogous to appositives. Consider, for instance, the examples in (1) and (2). In both cases, the utterance itself conveys at-issue information (i.e., 'the speaker brought a bottle to the talk'), while the accompanying gesture imposes an additional piece of not-at-issue content. In (1), the iconic gesture conveys that 'the bottle is big' and, in (2), the pointing gesture conveys that 'the bottle is the entity pointed to'. Crucially, these pieces of not-at-issue information cannot be denied or challenged, highlighting that they behave similarly to appositives.

(1) I brought [a bottle of water] to the talk. (Ebert et al. 2020:163)
BIG

(2) I brought [the bottle of water] to the talk. (adapted from Ebert et al. 2020)
POINTING TO BOTTLE

Yet, as Ebert et al. (2020:168) propose, the interpretation of co-speech gestures also depends on what exactly they are accompanying. More specifically, they argue that gestures accompanying an indefinite determiner express a similarity reading, while gestures that co-occur with a definite determiner evoke an identity reading. This is illustrated by examples (3) and (4). While (3) conveys that the gesture referent is similar to the DP referent (and could be used, e.g., upon seeing someone else with a bottle of water: *I brought a bottle of water to the talk too*), (4) indicates that the gesture referent is identical to the DP referent. Regardless of these differences, the gesture contribution remains not-at-issue in both cases.

(3) I brought [**a** bottle of water] to the talk.
POINTING TO BOTTLE

(4) I brought [**the** bottle of water] to the talk.
POINTING TO BOTTLE

Last, when co-speech gestures accompany a demonstrative, their interpretation will change yet again. In this case, Ebert et al. (2020:163–164) claim, the contribution of the gesture shifts from not-at-issue information to at-issue information. This domain shift is shown in (5) and (6). For the utterance in (5), which involves the definite determiner *the*, the contribution of the pointing gesture (i.e., 'the bottle is the entity pointed to') is not-at-issue and, consequently, cannot be targeted by negation. However, if we replace the definite determiner with a demonstrative, as in (6), the gesture contribution suddenly becomes at-issue and, thus, can be negated. Due to this behaviour, Ebert and Ebert (2014) describe demonstratives as "dimension shifters".

(5) I didn't bring [**the** bottle of water]. #I brought a different one.
POINTING TO BOTTLE

(6) I didn't bring [**that** bottle of water]. I brought a different one.
POINTING TO BOTTLE

With this theoretical background in place, we can now begin to explore the contribution of co-speech gesture for determiners and demonstratives in ʔayʔaǰuθəm.

3. Forms

As mentioned in the introduction, ʔayʔaǰuθəm has at least 22 distinct determiners and demonstratives. This richness in D elements is driven by the fact that many of these forms encode multiple pieces of information, such as evidentiality, deictic distance, gender, and number (cf. Reisinger et al. 2021; Reisinger & Huijsmans 2021). For the purposes of this investigation, we will only focus on an illustrative subset of forms — specifically, the demonstratives *təy̓ta* and *tan̓*, the definite-like determiner *tə,* and the indefinite-like determiner *kʷ*. We set aside their evidential and deictic contributions here for reasons of space, referring the reader to Reisinger et al. (2021), Reisinger and Huijsmans (2021), and Huijsmans and Reisinger (2022a) for details.

The form *təy̓ta* is a GDEM, used to introduce a new referent into the discourse via gesture, as in (7).[2]

(7) *Context: Marianne and Daniel just arrived at Gloria's place. Gloria is in the kitchen getting them something to drink, and Marianne admires the flowers she has on her table in the living room. Daniel hasn't noticed them, so Marianne* ***points*** *at them and says:*

ʔu,	k̓ʷə[n]-t=gi	{**təy̓ta** / #tan̓}	qʷasəm.	hihiw	ʔaǰ-umiš-mut.
oh	see-CTR=DPRT	{GDEM / SDEM}	flower	really	good-appearance-INT

'Oh, look at those flowers. They're really beautiful.'

[2] The first line of each example is a phonemic representation in the North American Phonetic Alphabet (NAPA) showing morpheme breaks, the second line provides a gloss, and the third line gives the translation. Infelicitous examples are marked with a hash (#), and marginal uses are marked with a question mark (?). The abbreviations used in this paper follow the Leipzig Glossing Rules, with the following additions: ACT = active, CLF = cleft, CONJ = conjunction, CTR = control transitivizer, DIM = diminutive, DPRT = discourse particle, GDEM = gesture demonstrative, INT = intensifier, PRT = particle, NCTR = non-control transitivizer, RPT = reportative, SDEM = salience demonstrative, STAT = stative. A hyphen (-) is used to mark an affix, an equal sign (=) a clitic, a tilde (~) a reduplicant, and angle brackets (< >) an infixation into the root.

The form *taṅ̓*, an SDEM, is not felicitous in this context. Instead, the demonstrative *taṅ̓* is used to refer to a referent that is already salient in the discourse. In (8), for instance, the referent is salient because the picture is held by the addressee and is in the joint attention of both discourse participants. Here, use of the GDEM *təẏ̓ta* would be infelicitous.

(8) *Context: I see you examining a picture of a young man, and I'm curious who it is.*

gat=ga {#təẏ̓ta / **taṅ̓**}?
who=DPRT {GDEM / SDEM}
'Who is that?'

Unlike the GDEMs, SDEMs do not require gesture. They are therefore compatible with non-exophoric referents (i.e., abstract referents not located in the external world, such as pieces of discourse). In (9), for example, the speaker refers to what she has explained earlier with *taṅ̓*.

(9) *Context: From a narrative on traditional teachings.*

hiɬ=ga ʔə=xʷ=nəm̓=s **taṅ̓** tə=θ=θu
COP=DPRT CLF.PRT=OBL.NMLZ=be.like=3POSS SDEM DET=2SG.POSS=go
su~suh-uθut paya ʔ.
PROG~do.traditional.ritual-CTR.REFL always
'That's why you always do your morning ritual.' (Watanabe 2014:090)

The determiner *tə* heads referential DPs but, unlike English *the*, does not require familiarity, as shown in (10). This is consistent with the observation that Salish languages lack common ground restrictions (cf. Matthewson 2006, 2008; Davis & Matthewson 2009; Reisinger et al. 2021).

(10) *Context: From a traditional narrative about the character qayx̣ (= the Mink). He is in trouble with his community, who are trying to catch him to punish him. His grandmother, the knothole who saves him here, has not been introduced previously in the story.*

ʔəwk̓ʷ gat ǰəƛ̓~ǰəƛ̓ x̣aƛ̓-s kʷ=s=ƛ̓əkʷ-t=it.
all who PL~run want-3POSS DET=NMLZ=catch-CTR=3PL.POSS
xʷaʔ čəm̓ məʔ-nu-m. ʔu, niʔ=k̓ʷa **tə**=t̓ᶿəstaya. hiɬ=k̓ʷa
NEG what.is.with get-NCTR-PASS oh be.there=RPT DET=knothole COP=RPT
pipaʔa č<ič>iya<ʔ>-s qayx̣ taṅ̓, tə=knothole.
one.person grandmother<DIM>-POSS Mink SDEM DET =knothole
'Everyone was chasing him, trying to grab him. They couldn't catch him. Oh, there was a knothole. It was one of Mink's grandmothers there, the knothole.'

The determiner *tə* usually refers to a unique/maximal entity in the context but does not impose maximality as a common ground requirement.[3] Instead, maximality is calculated relative to a

[3] The demonstratives seem to carry an oppositive requirement of non-uniqueness. Rather than treating this as part of the presupposed or at-issue content of the demonstratives, we propose that this arises through competition between forms, following Ahn (to appear). Demonstratives involve more content to identify the referent than determiners and so should be chosen over determiners only when this additional content is necessary (building on Schlenker's (2005) 'Minimize Restrictors!').

situation salient to the speaker. This is illustrated in (11), where the speaker first refers to one salient set of toys using *tə qaqsim* 'the toys' and then introduces more toys in the second conjunct. Use of *tə* in the first conjunct does not require that the toys are maximal relative to the situation salient to the addressee, unlike with English *the*. Thus, no awkwardness arises here.

(11) *Context: My niece comes over to play. She asks where the toys are. Most are in a box, and a few are on the shelf. Pointing to the toys in the room, I tell her:*

niʔ	nəp-ít	tə=k̓^{w}ax^{w}a	**tə**=qaqsim	ʔiy	niʔ
be.there	put.in-STAT	DET=box	DET=toys	CONJ	be.there
	ṫu<ṫ>ɬ-ít	ʔə=taʔa	**tə**=sq^{w}aq.		
	put.on<PL>-STAT	OBL=GDEM	DET=some/rest		

'? The toys are in the box, and the rest are there.'

Lastly, the determiner *k^{w}* is the closest of all D elements in ʔayʔaǰuθəm to an indefinite determiner. In contrast to the other forms, it is used where there is no reference to a specific individual, as exemplified by (12).

(12) *Context: At a ring shop, I walk up to a display case with the type of thing I want and tell the salesperson:*

ʔət^{θ}=χaƛ̓	t^{θ}=yəq-ʔəm	ʔə={#tə / **k^{w}**}=ṫ^{θ}agatiq^{w}uǰatən.
1SG.POSS=desire	1SG.POSS=buy-ACT.INTR	OBL={DET / DE**T**}=ring

'I want to buy a ring.'

The determiner *k^{w}* is also used when asserting that there are no entities matching the NP description, as in (13). The use of the *tə* determiner is not felicitous in such cases.

(13) *Context: Marianne is about to start weaving a basket with Betty, but she doesn't have an awl. She tells Betty:*

x^{w}uk^{w}t	{#tə / **k^{w}**}=ət^{θ}=χ^{w}uχ^{w}ṗ.
not.exist	{DET / DET}=1SG.POSS=awl

'I don't have an awl.'

4. Experiment

To gain a better understanding about how the elements described in the preceding section interact with co-speech gesture, we designed a small experiment — loosely modelled after Ebert et al.'s (2020) experimental work — and tested a series of proposals on how co-speech gesture is used in the language. In particular, we sought to validate the following hypotheses:

Hypothesis 1:
Co-speech gesture is at-issue for ʔayʔaǰuθəm GDEMs, but not at-issue for ʔayʔaǰuθəm determiners (cf. Ebert et al. 2020 for similar claims, based on German).

Hypothesis 2:
Co-speech gesture encodes identity when it accompanies the definite-like determiner *tə*, but similarity when it co-occurs with the indefinite-like determiner *kʷ* (cf. Ebert et al. 2020 for similar claims, based on German).

Hypothesis 3:
GDEMs obligatorily require co-speech gesture (cf. Reisinger & Huijsmans 2021:328 for this claim).

Hypothesis 4:
Iconic gestures cannot perfectly represent the targeted property and are consequently more easily accommodated than pointing gestures.

In the following sections, we will present the experiment and discuss its results.

4.1. Method

Participants: Three female elders, all above the age of 70, took part in the experiment — this represents roughly 3.85 percent of the fluent population. Two of the participants speak the Tla'amin dialect, the other one the Homalco dialect.

Materials: The experiment encompassed 85 test items in which we paired a video clip with a picture. In the videos, Marianne would ask a yes/no question about some object in ʔayʔaǰuθəm. Each of her questions included a determiner or demonstrative and, in some cases, also a co-speech gesture to identify the target object. The accompanying picture would show someone interacting with an object.

The test items represented four conditions, which will be described in more detail below.

(14) *Experiment conditions*:

a. matching condition (30 items)
b. mismatch condition (30 items)
c. adjective condition (10 items)
d. no-gesture condition (15 items)

In the matching condition, the object targeted by Marianne in the video and the object shown in the accompanying picture were identical (e.g., Marianne asks in the video whether Daniel reads *təy̓ta pukʷ* 'that book' while *pointing at the yellow book* on the table in front of her, and the picture shows Daniel reading the *yellow book*).

Conversely, in the mismatch condition, Marianne's target object did not match the object shown in the picture (e.g., Marianne asks in the video whether Daniel reads *təy̓ta pukʷ* 'that book' while *pointing at the yellow book* on the table in front of her, but the picture shows Daniel reading the *red book*.). Such a mismatch scenario is exemplified in Figure 3.

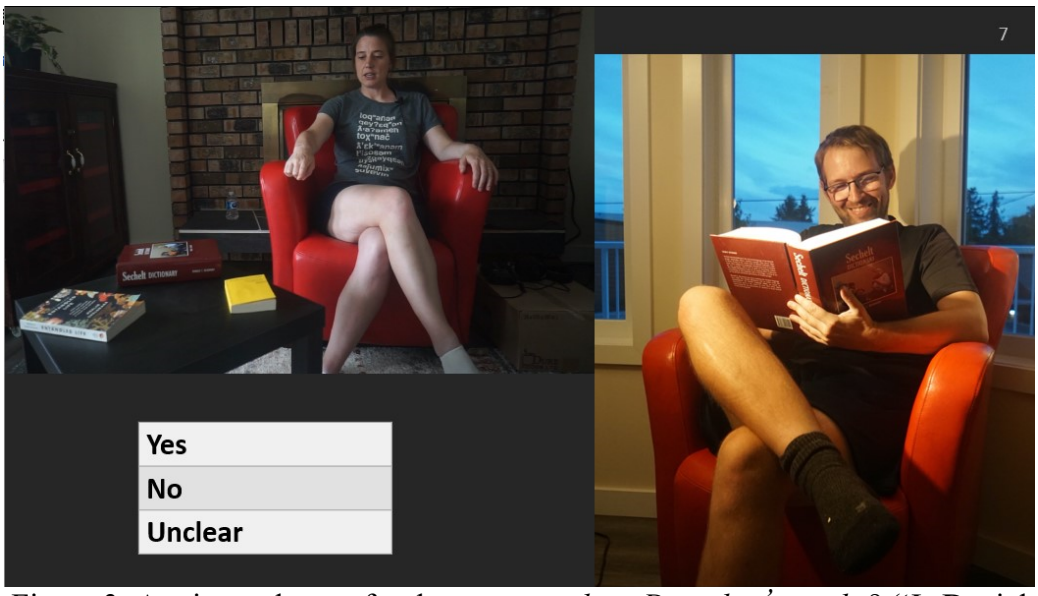

Figure 3: A mismatch case for the prompt *tałusa Daniel təy̓ta puk*^{w}*?* (‘Is Daniel reading that book?’). The video on the left shows Marianne asking the question and using a pointing gesture to pick out the yellow book. The picture on the right shows Daniel reading the red book.

As a control, the experiment also included an adjective condition, where Marianne would pick out the target object by using an adjectival modifier in her yes/no question (e.g., *tałusa Daniel k*^{w} ***t̓at̓*$^{\theta}$*im*** *puk*^{w}*?* ‘Is Daniel reading a **red** book?’) instead of a co-speech gesture. Since adjectives contribute at-issue content, the test items belonging to this condition would serve as a good baseline for evaluating the degree of at-issueness of co-speech gesture in the other conditions.

Finally, to test whether the use of co-speech gesture is *obligatory* or *optional* for the different determiner and demonstrative forms, we also included a small set of test items in which Marianne uses neither an adjective nor a gesture to pick out a target object (e.g., Marianne asks whether Daniel reads *təy̓ta puk*^{w} ‘that book’, but does not gesture to any of the three books on the table in front of her).

Within the conditions mentioned above, the test items further varied along some other dimensions. First, to test our hypotheses concerning the contribution of co-speech gesture with different types of D elements, Marianne’s yes/no questions obviously had to include forms representing the different types of determiners and demonstratives that have been attested in the language. For this purpose, we used the gesture demonstrative *təy̓ta*, the definite-like determiner *tə*, and the indefinite-like determiner *k*^{w}, all described in the previous section. We did not include salience demonstratives as their saliency requirement would have necessitated a different experimental set-up (see Section 5 for further discussion). Secondly, to determine whether and how the type of co-speech gesture may affect the results, Marianne sometimes employed pointing gestures and sometimes iconic gestures accompanying the determiners and demonstratives. And, finally, to make the experiment less repetitive for the participants, we also decided to vary the target objects in the videos and pictures (i.e., books vs. bottles vs. cups vs. knives vs. papers).

The test items were complemented by 14 filler items, which showed some kind of artwork (e.g., Caspar David Friedrich's »Wanderer above the Sea of Fog«, Sandro Botticelli's »Primavera«, Vincent van Gogh's »Sorrowing Old Man«, etc.) and contained an audio prompt in ʔayʔaǰuθəm that asked the participants to describe what they are seeing.

Once we had created all the materials, we put the 85 test items into a slideshow and ran a PowerPoint macro to randomize their order. Subsequently, we interspersed the 14 filler items in regular intervals.

Procedure: At the beginning of the experiment, we explained to each of the participants that we are interested in how speakers talk about objects. Then, we instructed them to answer the questions that Marianne asks in the videos, using a three-point rating scale (i.e., *ʔiʔ* 'yes' | *xʷaʔ* 'no' | *xʷač təx̣ʷníxʷən* 'unclear').[4] To keep the participants as unbiased as possible, we did not tell them that we were examining the role of gesture. One of the researchers then presented them the slideshow, while the other researcher kept track of the participants' answers by entering them into a spreadsheet. Each of the sessions was also audio recorded.

After we had run the experiment with our participants, the data filtering process began. Of the 255 judgments we had gathered (85 items * 3 speakers), 46 items had to be discarded. For one participant, we had to exclude four judgments as she did not use the provided three-point rating scale to answer the questions, but instead offered ambiguous paraphrases. For another participant, we had to discard 42 judgments because she did not pay attention to the videos at first, until we instructed her again around the halfway point of the experiment. In the end, we were thus left with a total of 209 judgments.

4.2. Results and discussion

In this section, we summarize the results for the different conditions and discuss what they can tell us about the interaction of co-speech gestures and D elements in ʔayʔaǰuθəm.

In Hypotheses 1, we surmised that co-speech gesture contributes at-issue information when it accompanies a demonstrative, but not-at-issue information when it accompanies determiners. Consequently, we predict that, if gesture is indeed at-issue for the demonstratives, the GDEM *təẏta* should exhibit a significantly stronger mismatch effect in the experiment than the determiners. By mismatch effect, we mean the number of *xʷaʔ* 'no' answers when the entity indicated by gesture in the video and the entity in the accompanying picture do not match.

As for the determiners, Hypothesis 2 assumed that co-speech gesture gives rise to an identity interpretation with definite-like forms, whereas it evokes a similarity reading with indefinite-like forms. If this is the case, then the definite-like determiner *tə* should display a stronger mismatch effect than the indefinite-like determiner *kʷ*.

[4] We opted for this three-point rating scale instead of the Likert scale that Ebert et al. (2020) used in their experiment on German demonstratives, as we hoped it would be more intuitive for the participants we worked with. Also, as the reader may have noticed in Figure 3, the scale on the slides is given in English. This is because two of the three participants do not read (or write) in ʔayʔaǰuθəm. They were instructed to respond in ʔayʔaǰuθəm (which they did), but we provided the scale on the slides to remind the participants to give polar responses or flag a question as unclear.

The experiment confirms both of these assumptions. As shown in Figure 4, we found that the mismatch effect was strongest for the GDEM *təy̓ta* (83.33 percent), slightly weaker for the definite-like determiner *tə* (72.00 percent), and weakest for the indefinite-like determiner *kʷ* (40.00 percent).

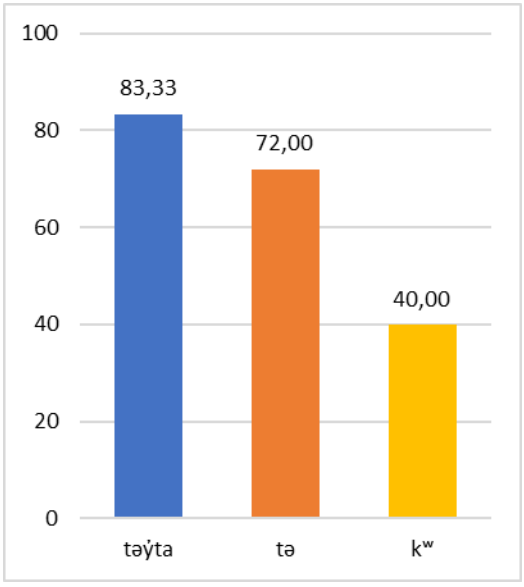

Figure 4: Mismatch effects for the three forms in percent
(= 'no' answers when the object indicated by gesture in the video
and the object shown in the picture did not match).

While we observed some minor inter-speaker variation for individual test items in this condition, the overall trend seemed to be robust across all speakers. As illustrated by Figure 5, the results for each speaker exhibit the same cline from gesture demonstrative to definite-like determiner to indefinite-like determiner.

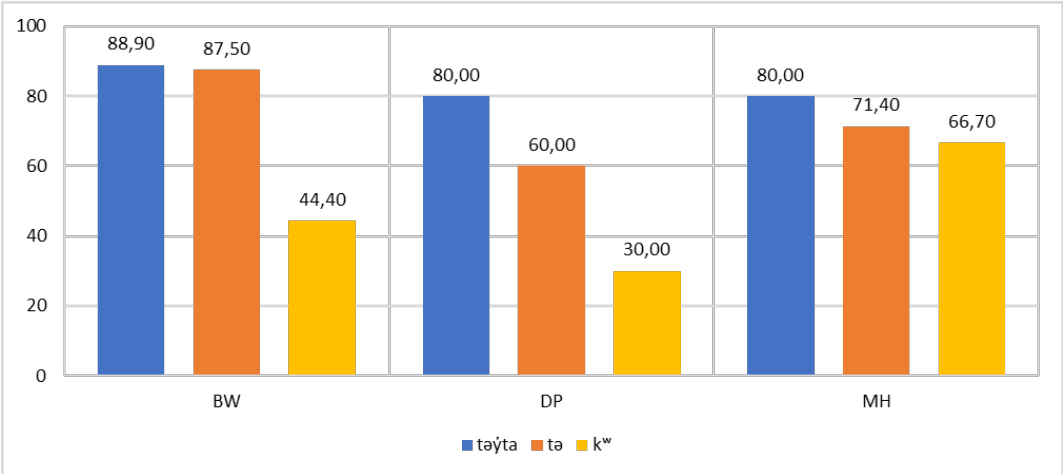

Figure 5: Mismatch effects for the three forms in percent by individual participants
(= 'no' answers when the object indicated by gesture in the video and the object
shown in the picture did not match).

On the one hand, the remarkably strong mismatch effects for *təy̓ta* suggest that co-speech gesture is at-issue when it accompanies a GDEM. Indeed, the effect is comparable to the mismatch effects that can be observed for mismatches in the adjective condition (92.86 percent). On the other hand, the fact that mismatch effects are higher for the definite-like determiner *tə* than for the indefinite-like determiner *kʷ* also confirms our hypothesis that the former encodes an identity relation between the gesture referent and the DP referent, while the latter encodes a similarity relation.

In Hypothesis 3, we speculated that the use of co-speech gesture is *obligatory* for GDEMs, but only *optional* for the determiners. Consequently, we predicted that the participants would be more willing to accept gestureless uses of *tə* and *kʷ* as 'matches', whereas gestureless uses of *təy̓ta* would be infelicitous and trigger an 'unclear' judgment in the matching task.

The results of the no-gesture condition only partially confirm these assumptions (Figure 6). On the one hand, just as expected, speakers did not treat gestureless uses of the determiners as problematic, but instead willingly accepted them as 'matches'. While the indefinite-like determiner *kʷ* reached a perfect matching score of 100.00 percent, the definite-like determiner *tə* exhibited a matching effect of 91.67 percent. This confirms that co-speech gesture is optional, and not required for the determiners.

On the other hand, the results for the GDEM *təy̓ta* did not fully confirm our initial assumptions. While this form showcased — with 54.85 percent — a considerably weaker matching effect than the determiners, this value was still much higher than we expected, given our hypothesis. This raises the question whether co-speech gesture actually is obligatory for the gesture demonstratives.

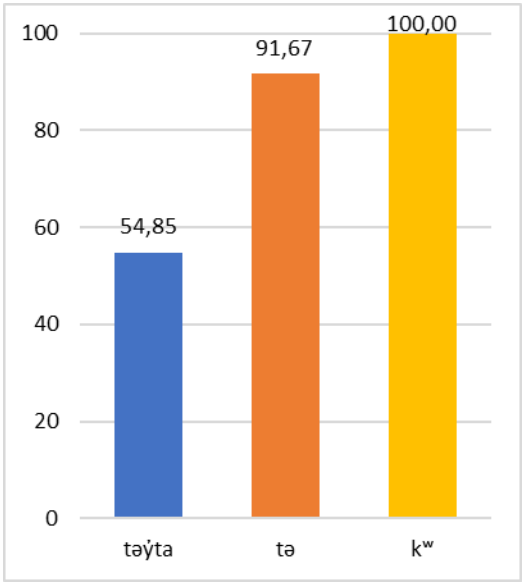

Figure 6: Match effects for the three forms in percent
(= 'yes' answers when there was no gesture to an object in the video).

While we can only speculate, it is worth noting that the high matching score for the GDEM in this condition reflects some striking inter-speaker variations. Only one of the participants treated the gestureless uses of *təy̓ta* as 'unclear' (as predicted) and would offer some

explanations for her judgments (e.g., [comments translated from ʔayʔaǰuθəm:] “I don’t really know which cup you are looking at. You didn’t say.” or “I’m not sure what knife you said, it’s the big one she’s using.”). The other two participants, on the other hand, consistently accepted the gesture demonstrative without gesture (not as expected). One potential explanation for this discrepancy could be that these two participants might have accommodated the missing gesture, perhaps by wrongly assuming that Marianne must have made some subtle gesture (such as a quick gaze) towards the correct target object in the video. If this is the case, a different experimental set-up (e.g., one where Marianne is blindfolded or not facing the objects on the table) could remedy this issue.

Last, in Hypothesis 4, we conjectured that iconic gestures are inherently less precise than pointing gestures and, consequently, tend to be more easily accommodated. Considering this, we predicted that mismatch effects for pointing gestures should be higher than mismatch effects for iconic gestures.

As highlighted by Figure 7, the experiment corroborates this hypothesis. For each of the three forms, the items involving pointing gesture showcased a stronger mismatch effect than the items involving iconic gestures. Using the results for *təy̓ta* as an example, participants judged mismatches more strictly when a pointing gesture was used (mismatch effect: 91.67 percent) and, conversely, were more forgiving when an iconic gesture was used (mismatch effect: 75.00 percent). Since the same pattern also holds for the two determiner forms, it is reasonable to assume that iconic gestures come with an inherent vagueness and are, thus, more easily accommodated.

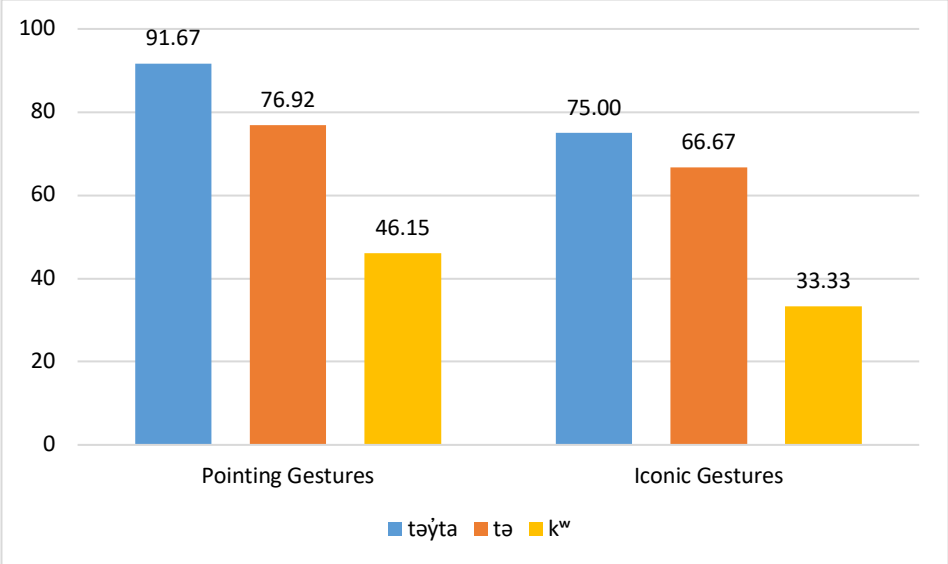

Figure 7: Mismatch effects for the three forms in percent by gesture type (= ‘no’ answers when the object indicated by gesture in the video and the object shown in the picture did not match).

5. SDEMs

As mentioned in Section 4.1, we did not include any SDEMs in the experiment. This is because in the videos for the experiment, Marianne introduces an entity into the discourse via gesture,

a context that supports the use of GDEMs but not SDEMs, which require reference to an individual already salient in the context. Because SDEMs did not fit the experimental context, we have not yet discussed what gesture adds with them.

As mentioned in Section 3, SDEMs identify an individual that is uniquely salient in the context. This is exemplified in (15).

(15) *We've been at a bazaar, and I bought a mirror from one gentleman. He keeps it at the stand for me, so I don't have to carry it until I'm ready to go. When we walk back to collect it, he doesn't remember which mirror I bought since he had a few. He holds one up to give me.*

xʷa hiy=əs {**taṉ** / #tə} məmḵayustən ʔə=yəq-t-an-uɬ.
NEG COP=3SBJV {SDEM / DET} window CLF.PRT=buy-CTR-1SG.ERG-PST
hiɬ tə=tituḵ šuʔ-ut-an-uɬ.
COP DET=small choose-CTR-1SG.ERG-PST
'I didn't buy {that / #the} mirror. I bought a smaller one.'

Though SDEMs do not require gesture, we have come across examples in our fieldwork where they are compatible with it, as for instance in (16).

(16) *Context: Daniel and I are on a ferry approaching an island in an area with many islands. We're both on the deck gazing at it. I* ***point*** *to it and tell Daniel:*

hiɬ **taṉ** məƛnač.
COP SDEM məƛnač
'That is məƛnač (island).'

Since gesture here only adds optional information, we propose that it makes a not-at-issue, appositive-like contribution (just like it does for the determiners). In future work, we hope to confirm this with a similar experiment.

6. Analysis

To capture the contribution of co-speech gesture accompanying ʔayʔaǰuθəm D elements, we adapt the analysis in Ebert et al. (2020), where both pointing and iconic gestures establish a gesture referent. This gesture referent is a rigid designator, symbolized as: ⌜ ☛ *I* ⌝. Just like Ebert and her colleagues, we analyze gesture as contributing not-at-issue content by default, analogous to appositives. This not-at-issue content is silently imposed on the common ground, whereas at-issue content is proposed as an update to the common ground (Farkas & Bruce 2010). The addressee may accept a proposed update (the default case) or reject it, while a not-at-issue imposition enters the common ground automatically.

For their analysis, Ebert et al. (2020) adopt and extend a unidimensional, dynamic system first proposed by Anderbois et al. (2013). In this system, not-at-issue content is computed together with at-issue content, allowing reference to be established across these dimensions. At-issue and not-at-issue content are interpreted relative to two propositional variables:

p – proposed as an update to the common ground
*p** – imposed on the common ground

The content of an utterance is relativized to these two variables so that the at-issue and not-at-issue contributions can be computed in parallel. This will be illustrated through some examples below.

The GDEM *təy̓ta* accompanied by co-speech gesture (17a) is interpreted as in (17b). The demonstrative introduces a discourse referent *x* claimed to have the NP property, and the obligatory co-speech gesture introduces a discourse referent *z* that is equivalent to the gesture referent ⌜ ☛ *I* ⌝. To derive the desired identity interpretation, the discourse referents *x* and *z* are equated. Last, there is also a not-at-issue imposition such that *z* has the NP property, just as *x* does. As mentioned earlier, the selected forms also encode other information, such as evidentiality and deixis (see Section 3). As we have set these components aside for the purposes of this paper, we also do not include them in the denotations here.

(17) a. ⟦ *təy̓ta* NP ⟧^{w,g}
POINTING TO ⌜ ☛ *I* ⌝

b. $\exists z \wedge z =$ ⌜ ☛ *I* ⌝ $\wedge \exists x \wedge \mathrm{NP}_p(x) \wedge x =_p z \wedge \mathrm{NP}_{p^*}(z)$
Presupposition: There is a unique entity matching the NP description and equivalent to the gesture referent.

Importantly, here, the gestural contribution is at-issue and integral to identifying the referent of the GDEM.

For the formalization of SDEMs, we require a slightly different toolkit. Adapting Schwarz's (2009) analysis of German strong-article definites, we propose that these demonstratives come with a null index argument *i*. The utterance of the SDEM *tan̓* with co-speech gesture (18a) will then be interpreted as in (18b). The index *i* is associated with a discourse referent established through prior mention or through contextual salience (Roberts 2002) and equated with the discourse referent *x*, as introduced by the demonstrative. The optional co-speech gesture introduces the discourse referent *z* for the gesture referent and makes a not-at-issue contribution such that *x* is also equivalent with *z* (and *z* has the NP property).

(18) a. ⟦ *i tan̓* NP ⟧^{w,g}
POINTING TO ⌜ ☛ *I* ⌝

b. $\exists z \wedge z =$ ⌜ ☛ *I* ⌝ $\wedge \exists x \wedge \mathrm{NP}_p(x) \wedge x =_p i \wedge x =_{p^*} z \wedge \mathrm{NP}_{p^*}(z)$
Presupposition: There is a uniquely salient discourse referent i *in the domain of familiar discourse referents and* i *matches the NP description.* (adapted from Roberts 2002:23)

The determiner *tə* is used to refer to the unique individual with the NP property in the context.[5] It optionally co-occurs with gesture, which introduces the discourse referent *z* for the gesture referent. Again, the gesture contributes not-at-issue content such that *x* is equivalent to *z* (and *z* has the NP property). Thus, we can formalize the determiner *tə* accompanied by co-speech gesture (19a) as in (19b).

(19) a. ⟦ *tə* NP ⟧^{g,w}
POINTING TO ⌜ ☛ *I* ⌝

b. $\exists z \wedge z =$ ⌜ ☛ *I* ⌝ $\wedge \exists x \wedge \mathrm{NP}_p(x) \wedge x =_{p^*} z \wedge \mathrm{NP}_{p^*}(z)$
Presupposition: There is a unique entity matching the NP description in the context.

Finally, the utterance of the determiner *k*^{w} with a speech-accompanying gesture (20a) can be interpreted as in (20b). We propose that the determiner *k*^{w} simply introduces the variable *x* with the NP property, while an optional co-speech gesture may additionally establish a discourse referent *z* for the gesture referent. In this scenario, the not-at-issue contribution of the gesture is that *x* and *z* are similar (and *z* has the NP property).[6]

(20) a. ⟦ *k*^{w} NP ⟧
POINTING TO ⌜ ☛ *I* ⌝

b. $\exists z \wedge z =$ ⌜ ☛ *I* ⌝ $\wedge \exists x \wedge \mathrm{NP}_p(x) \wedge \mathrm{SIM}_{p^*}(x)(z) \wedge \mathrm{NP}_{p^*}(z)$

One final note is in order. As seen in (17) to (19), the GDEM *təy̓ta*, the SDEM *tan̓*, and the determiner *tə* all come with existence presuppositions. This is important as these D elements are referential, even under negation. However, as we alluded to in Section 3, presuppositions for Salish languages are generally treated as preconditions, without placing common ground restrictions (cf. Matthewson 2006, 2008; Davis & Matthewson 2009; Reisinger et al. 2021). This does not fit the current model, as adopted from Anderbois et al. (2013), where presuppositions instead act as checks on the common ground. Perhaps, contributions we have previously called 'presuppositions' are better modelled as appositive-like. This, however, will be a topic for future work.

7. Conclusion

Overall, the findings of our experiment support the key claims made by Ebert et al. (2020) for German determiners and demonstratives, particularly regarding how co-speech gestures may be interpreted differently with different types of D elements. In addition, we also found some support for our hypothesis that the use of co-speech gesture is obligatory with GDEMs in ʔayʔaǰuθəm, though the results were less clear in this regard.

To summarize, we established that gesture contributes at-issue content when accompanying GDEMs. This is supported by the fact that participants were as sensitive to mismatches between the gesture referent and the DP referent when a GDEM was used as they were to

[5] Where, as discussed in Section 3, the relevant context depends on what is salient to the speaker (and need not be shared with the addressee).

adjective mismatches. We also found some evidence that gesture is obligatory with this class of demonstratives, and that the absence of co-speech gesture leads to infelicity if not accommodated. However, given considerable inter-speaker variation with respect to this latter point, more work on this issue is needed.

Through the experiment, we were also able to show that gesture is optional and contributes not-at-issue content when accompanying determiners. Consequently, the absence of gesture did not lead to any infelicity with these forms. Moreover, we found that, while participants were certainly sensitive to mismatches involving the determiner *tə*, this sensitivity was less pronounced than when the GDEM *təy̓ta* was used.

Finally, our experiment also confirmed that the interpretation of co-speech gesture may vary, depending on whether it accompanies definite-like or indefinite-like determiners. With definite-like *tə*, the gesture referent is interpreted as equivalent to the DP referent. This meant that participants objected to mismatches with *tə* at similar (though slightly lower) levels as to mismatches with the GDEMs. In contrast, with indefinite-like *kʷ*, co-speech gesture establishes a similarity interpretation between the gesture referent and the DP referent. Since there are multiple dimensions on which items can be similar, participants objected to mismatches with *kʷ* considerably less often.

Overall, our findings for ʔayʔaǰuθəm are remarkably similar to Ebert et al.'s (2020) for German, despite obvious differences in the determiner and demonstrative systems, suggesting commonalities in how co-speech gestures are interpreted cross-linguistically. In the future, we would like to expand our experimental work also to SDEMs in order to determine whether gesture is always at-issue with demonstratives or if it is not-at-issue with these forms, as we hypothesized in Section 5. If so, this would mean that only certain demonstratives act as dimension shifters along the lines proposed in Ebert et al. (2020).

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Polarity reversal questions and the semantics of prosodic incorporation[1]

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Abstract. English polarity reversal questions (PRQs, e.g. *Gertrude mowed the lawn, didn't she?*) comprise individual biased questions despite the fact they consist of two apparently independent clauses, which, if uttered as two prosodically distinct sentences (*Gertrude mowed the lawn. Didn't she?*) give instead the sense that the speaker is backtracking on their claim. Many recent accounts stipulate the special discourse effects of PRQs into their context update potential at the level of a construction (Malamud and Stephenson, 2015; Farkas and Roelofsen, 2017; Bill and Koev, 2023: a.o.). We propose that the range of interpretations of PRQs, and their difference from string-identical sequences of two sentences, can be attributed to the fact that PRQs are prosodically integrated, packaging two syntactically independent clauses into a single Intonational Phrase and thus a single context update. We argue that this assumption, combined with a vanilla treatment of the discourse effects of uttering declarative and interrogative clauses, can derive the interpretations of PRQs, explain important limitations on their form, and account for their differences from non-integrated sequences, without relying on construction-specific stipulations.

Keywords: tag questions, polarity reversal questions, context update, prosody, semantics-pragmatics interface, Table model

1. Introduction

The form of a sentence relates in principled ways to the discourse effects of uttering that sentence. For instance, declaratives canonically express **assertions**—supplying information—whereas interrogatives canonically express **questions**—requesting information. This robust correlation between form and interpretation might suggest a straightforward mapping from the former to the latter: that the form of the sentence in some way *encodes* its illocutionary force.

However, the world is not so simple. Syntactically identical sentences can be used to different conversational ends, such as rhetorical questions, which seem to comprise assertions despite interrogative syntax (Han, 2002; Caponigro and Sprouse, 2007; Biezma and Rawlins, 2017: a.o.), and reportative evidentials, which are not always assertive despite their declarative syntax (AnderBois, 2014; Faller, 2019; Pancheva and Rudin, 2019: a.o). Moreover, similar illocutionary forces can be expressed using sentences of different syntactic types: both interrogative and declarative sentences can be used to ask questions if accompanied by final rising intonation (Hirschberg and Ward, 1995; Gunlogson, 2001, 2008; Malamud and Stephenson, 2015; Farkas and Roelofsen, 2017; Jeong, 2018; Westera, 2018; Rudin, 2022: a.o.).

So while the syntactic form of a sentence is generally a reliable cue for the kind of effect its utterance will have in discourse, we must take into account factors like intonation and discourse

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context before we can derive a complete account of the discourse effect of an utterance. We need models of how clause typing affects context-update potential, but also models of how other factors such as intonation modulate that context-update potential, and of how general rules of *pragmatics* derive additional inferences downstream from the conventionalized context-update potential of an utterance (Roberts, 2012; Farkas and Roelofsen, 2017; Murray and Starr, 2018; Roberts, 2023b: a.m.o.)

This paper considers the interaction of conventionalized context-update potential and general rules of pragmatic inference via a case study of English **Polarity Reversal Questions** (PRQs), as in (1):

(1) a. You sent the envelope, didn't you?
b. You didn't send the envelope, did you?

PRQs are chimerical: syntactically, they appear to be a sequence of two separate root clauses, a root declarative clause followed by a root interrogative clause of opposite polarity that has undergone VPE (Sailor 2009, 2014). But their discourse effect is, intuitively, to ask a single (biased) question, roughly a request for confirmation of what the speaker is tentatively committed to (Sadock, 1971; Ladd, 1981: a.m.o.). Given the appearance of bi-clausality and the assumption that interpretation follows form, we want to know: why are PRQs interpreted the way they are, in view of the form they have?

An initial reasonable proposal might look something like this. PRQs look like a declarative followed by an interrogative, so we could simply treat them as such (see e.g. Asher and Reese 2007). But there is a wrinkle to the reasonable proposal: string-identical **Non-Integrated Sequences** (NISs) of a declarative followed by an interrogative produce a different discourse effect to PRQs:

(2) a. You sent the envelope. #Didn't you (send the envelope)?
b. You didn't send the envelope. #Did you (send the envelope)?

Whereas the sequences in (1) comprise individual biased questions, those in (2) signify internal conflict: that the speaker is 'backtracking' on their assertion, and deciding to ask the question instead. This contrast has been used as evidence against treating PRQs as simple declarative + interrogative sequences (Northrup 2014), motivating analyses capturing their discourse effects with *sui generis* stipulations. For instance, Krifka (2015) analyzes PRQs using a covert speech-act level disjunction operator; Malamud and Stephenson (2015) assign them a non-compositional discourse effect of projected speaker commitment to the denotation of the declarative; Farkas and Roelofsen (2017) assign them an additional 'marked' discourse effect of signaling the speaker's evidence-based credence toward the denotation of the declarative, depending on intonation; Bill and Koev (2023) relate the declarative to the question via a covert TAG operator that drapes an epistemic possibility modal over the denotation of the declarative. A recent exception is Scheffler and Malamud (2023), who present a compositional analysis of a subset of PRQs ending in *won't you*. Though their account is compositional, they nonetheless treat the interrogative tag as altering the discourse effect of the declarative, lowering the speaker's degree of commitment to the proposition it denotes. Every account of the phenomenon of which we are aware shares the feature that lack of full speaker commitment of the kind ordinarily associated with assertions of declarative sentences is hard-coded into the

conventional discourse effect of PRQs, making them something other than a simple sequence of an ordinary assertion followed by an ordinary polar question.

In this paper we argue that there is hope for the reasonable proposal, leveraging a neglected fact about the difference in form between PRQs and NIS: **prosody**. We propose that both PRQs and NISs are, in fact, what they look like: a declarative sentence followed by an interrogative sentence, cashed out on the level of context update as an ordinary assertive update potential and an ordinary question update potential. They differ in that PRQs, and not NISs, are prosodically integrated into a single Intonational Phrase (IP), which we take to individuate context updates.

We show that this simple assumption, in combination with a general theory of context update and a general theory of pragmatics, can not only derive the right interpretations for PRQs and their difference from NISs, but also explain why PRQs necessarily involve polarity reversal. NISs comprise an assertion, which projects only one future for the conversation, with a polar question, which projects two, resulting in pragmatic incoherence. But PRQs package an assertion and a polar question into a single composed context update, 'skipping' to a context in which the speaker is committed to p but is projecting both p and $\neg p$ as possible future additions to the common ground. The incoherence of projecting only one possible future for the conversation before subsequently projecting a second one is avoided; the tension between the speaker's commitment to p and projection of $\neg p$ as a possible future addition to the common ground drives pragmatic inferences that derive the PRQ's characteristic bias. PRQs are, in fact, what they look like: a sequence of a declarative sentence, with an ordinary assertive update potential, and an interrogative sentence, with an ordinary polar question update potential, prosodically packaged into a single composed update.

2. Empirical Landscape

In this section we lay out the empirical ground we aim to cover. First, let us be clear about what, exactly, a polarity reversal question is. Morphosyntactically, PRQs have the anatomy of two separate root clauses: a declarative **anchor** p followed by an interrogative **tag** of opposite polarity $\neg p$? These are exemplified with positive anchors in (3) and negative anchors in (4).

(3) a. Sarah can suplex a refrigerator, can't she?
b. It will rain tomorrow, won't it?
c. You turned off the stove, didn't you?

(4) a. Sarah can't suplex a refrigerator, can she?
b. It won't rain tomorrow, will it?
c. You didn't turn off the stove, did you?

In addition to the polarity reversal, the tag must also have the same T as the anchor (5), and an elided verb phrase (6) (Sailor, 2009, 2014).

(5) *Sarah can suplex a refrigerator, won't she?

(6) *Sarah can suplex a refrigerator, can't she suplex a refrigerator?

A negative tag can have both preposed ('high') or non-preposed ('low') negation.

(7) It will rain tomorrow, won't it/will it not?

Having established what a PRQ is, we now lay out our analytical desiderata. The first item on the agenda is interpretation. PRQs contribute one of two kinds of speech acts, depending on the context of utterance.

The first species we will term *confirmation questions*: The speaker tentatively asserts p, albeit not with full confidence, and asks for confirmation of whether p.

(8) [Context: the speaker thought that their addressee was in Bucharest, but they appear at the speaker's doorstep in Pasadena]
You were going to fly to Bucharest, weren't you?

In this context, the speaker is understood to be second-guessing their commitment about the addressee's plans. Depending on how the addressee responds, the speaker may rescind their commitment about what the addressee's plans were.

The second kind of PRQs we call *pretense-questions*: The speaker makes the pretense of asking whether p, though it is clear they are committed to p.

(9) [Context: The addressee has just asked the speaker why they're watching a 40-minute Youtube video about the battle of Midway]
I'm a 40-year-old man, aren't I?

In this context, the speaker is not understood to be second-guessing their own age, but implying that the answer to the previous question should've been obvious.

Ideally, these different discourse effects would be derived from the interaction between discourse contexts and the semantics/pragmatics of PRQs.

2.1. Puzzle 1: Non-integrated sequences

As we have seen, non-integrated sequences are stringwise equivalent to PRQs, but prosodically and interpretively distinct. The intuition is that NISs involve a 'pause' in between declarative and interrogative, and have the marked interpretation that the speaker is second-guessing the commitment they just made. This gives the sense that the speaker is somehow retracting, or at least backing off from, their immediately prior claim. We represent the pragmatic oddness of this maneuver with #.

(10) a. Sarah can suplex a refrigerator. #Can't she?
b. You didn't turn off the stove. #Did you?

2.2. Puzzle 2: Polarity reversal

A hallmark of PRQs is PR. This turns out to be significant, because same-polarity tag questions exhibit sharply different effects from PRQs. Consider, for instance, a bi-clausal tag question in which the tag and anchor both have positive polarity (a 'positive-positive' question):

(11) You sent the envelope, did you?

Such questions are natural, but convey a meaning unlike either of the flavors of PRQs we have seen. Whereas PRQs generally involve some sense of commitment on the part of the speaker to the truth of the anchor *p*, positive-positive tag Qs convey roughly that the speaker is incredulous or skeptical that *p* is the case. For instance, (11) is naturally uttered in a context where the addressee claims they sent the envelope, but the speaker thinks they are lying.

Negative-negative tag Qs are, by stark contrast, sharply unacceptable, and virtually absent from English corpora (see e.g. Tottie and Hoffmann 2006).

(12) *You didn't send the envelope, didn't you?

Although many semantic theories of questions assign identical denotations to positive and negative questions (e.g. Hamblin 1973; Groenendijk and Stokhof 1984), the divergent behavior of tag questions depending on the relation of the polarity of the anchor and tag suggests that the differences in context update potential between positive and negative questions plays an important role in any account of the discourse effects of PRQs.

2.3. Summary and analytical desiderata

We aim to account for three aspects of PRQ meaning in this paper:

1. The range of discourse effects of PRQs, ideally **derived** from their form, general principles of context update, and general principles of pragmatic interpretation

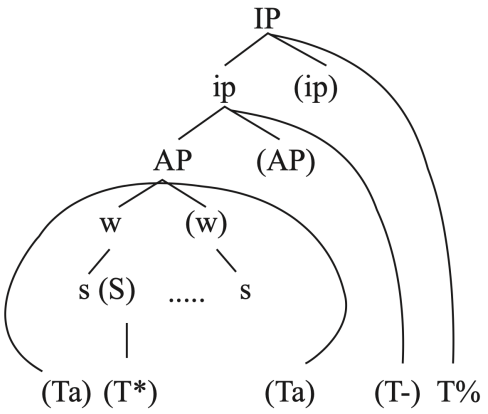
2. The NIS puzzle: NISs seem to indicate speaker changing their mind across two updates, but PRQs seem to comprise a single coherent update

3. The polarity reversal puzzle: why positive same-polarity tags are possible but interpretively distinct from PRQs, and why negative same-polarity tags are simply impossible

3. Form: Prosody

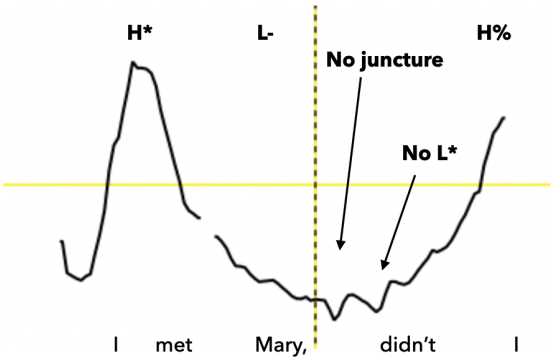
The crucial characteristic of PRQs distinguishing them from NISs is their prosody. We make the following assumptions about prosodic phonology (see Jun 2022 for an excellent overview). The maximal prosodic unit is the Intonational Phrase (IP). IPs delineate (prosodically) independent utterances and host terminal contours: a nuclear pitch accent (*), followed by a phrase accent (-) and boundary tone (%), plus optional leading or trailing tones.

(13) Intonation and the Prosodic Hierarchy (Jun 2022 ex.1)



As a consequence, IPs can be empirically identified both by intonation (presence of a terminal contour) and by prosody (separated from other IPs by a large juncture—Jun 2022 ex.2). By both diagnostics, integrated PRQs occupy a single IP:

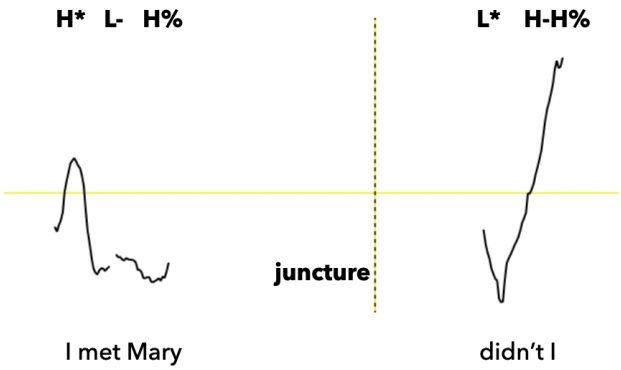
(14) Pitch track of ***I*** *met Mary, didn't I?*



PRQ intonation falls over the declarative anchor and rises over the interrogative tag, just like in ordinary independent falling declaratives and rising interrogatives. However, in integrated PRQs, there is just a single terminal contour: there is only an H* pitch accent in the first clause, and no L* pitch accent in second clause, which would be realized as a significant local minimum in pitch. In addition, there is no sizable juncture between clauses. Both diagnostics show that PRQs are prosodically "packaged" into a single IP. **PRQs comprise two sentences syntactically, packaged into one utterance prosodically.**

In the case of non-integrated sequences, we see the opposite; each sentence occupies a separate IP:

(15) Pitch track of ***I*** *met Mary. Didn't I?*



In addition to the obvious juncture separating the two clauses, we see evidence for two separate terminal contours: there is a L* pitch accent in the second clause, realized as a significant local minimum in pitch, in addition to the H* pitch accent in the first clause. NISs show a more standard relation between syntax and prosody: two sentences syntactically, packaged into two utterances prosodically.

4. Analysis step 1: IP as domain of update

Prior work on conventional discourse effects has sometimes (implicitly) assumed that the IP is the domain of context update. For instance, Farkas and Roelofsen (2017) propose that context update is enacted by an UTTERANCE function; in prosodic phonology, the IP is the prosodic domain of an independent utterance. And many works (e.g. Gunlogson 2001, 2008; Malamud and Stephenson 2015; Jeong 2018; Rudin 2022) have analyzed intonational tunes as modifying context update potential; this presupposes that context updates are packaged into IPs, as IPs are the hosts of the terminal contours to which these works attribute such effects. We make this assumption explicit: **the prosodic unit of the IP individuates context updates**. In other words, if you've got just one IP, then you've got just one context update.

We assume an utterance function UTT that maps sentences to their update potentials (Farkas and Roelofsen 2017), i.e. functions from contexts to contexts. It applies to IPs. Because IPs ordinarily host a single sentence, this will ordinarily work exactly the same as models on which context-update functions are applied to sentences, not to IPs. But we observed in the previous section that PRQs prosodically package two sentences into a single IP. So what happens if two syntactically distinct sentences are packaged into a single context update? A simple first-pass analysis: update function composition.

(16) $\text{UTT}(\text{IP}) = \text{UTT}(S_1) \circ \ldots \circ \text{UTT}(S_n)$, where $S_1, \ldots S_n$ is the sequence of sentences contained within IP[2]

UTT returns a single update potential: the result of composing the update potentials it assigns to each sentence in the ordered sequence of sentences within the IP. Calling this a "simple first-pass analysis" might pragmatically implicate that it is too simple, and must be tweaked. But in what follows, we argue that it does the job perfectly well.

[2]We define $\text{UTT}(S)$ for the relevant sentence types in (18) below.

5. Implementation: Table

To make our assumptions about the mechanisms of context update explicit, we couch our analysis in the Table model of discourse (Farkas and Bruce 2010). A context in the Table model is typically defined using four components, though two are primitive and two are derived:

(17) THE TABLE MODEL: a context $c = \langle DS_c, CG_c, T_c, PS_c \rangle$

a. INDIVIDUAL DISCOURSE COMMITMENTS
DS_c is the set of commitment states $DC_{X,c}$ for each interlocutor X in c
For any agent X, DC_{X_c} is the set of propositions X is committed to in c

b. THE COMMON GROUND
CG_c is the set of all propositions that all interlocutors are committed to
$(= \bigcap DC_c)$

c. THE TABLE
T_c is a stack of "Issues" (sets of propositions), the maximal element of which ($\text{MAX}(T_c)$) is the immediate Question Under Discussion (QUD) in c (Roberts 2012; Ginzburg 1996)

d. THE PROJECTED SET
PS_c is the set of all future Common Grounds that could result from adding an element of ($\text{MAX}(T_c)$) to CG_c
$(= \{\ CG_c + p : p \in \text{MAX}(T_c)\ \})$

Context update potentials for utterances are defined in terms of how they update the speaker's discourse commitments, and how they update the Table. Following Farkas and Bruce (2010), we assume that ordinary assertions (expressed by uttering a falling declarative p) add p to the speaker's discourse commitments and push a singleton QUD whose only resolution is p onto the Table (18). Note that this addition to the Table also results in a singleton projected set.[3]

(18) Where $[\![\textit{He ate the cake}]\!] = p$

$$\text{UTT}(\textit{He ate the cake}) = \lambda c. \begin{bmatrix} DC_{sp} & = & DC_{sp,c} + p \\ T & = & T_c + \{p\} \\ PS & = & \{CG + p\} \\ c' = c \text{ in all other respects} \end{bmatrix}^{c'}$$

Ordinary polar questions (expressed by uttering a rising interrogative p?) add nothing to the speaker's discourse commitments, but push the QUD $\{p, \neg p\}$ onto the Table (19).

(19) $$\text{UTT}(\textit{Did he eat the cake?}) = \lambda c. \begin{bmatrix} T & = & T_c + \{p, \neg p\} \\ PS & = & \{CG + p, CG + \neg p\} \\ c' = c \text{ in all other respects} \end{bmatrix}^{c'}$$

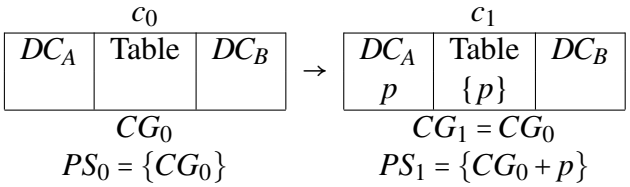
With these definitions in hand, we can now unpack the differences in context update between PRQs and NISs.

[3]Here we simply stipulate these update potentials, but they can be derived from a general definition of UTT + general assumptions about the semantics of declarative and interrogative clauses & general assumptions about the contributions of rising and falling intonation; see Farkas and Roelofsen (2017); Rudin (2022) for details. We do not analyze the semantic contribution of intonational tunes here.

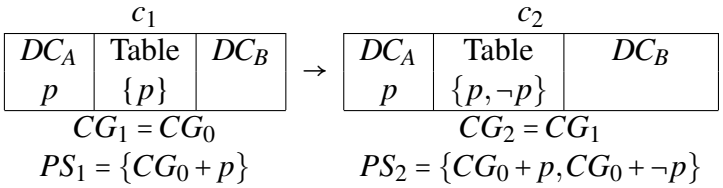
5.1. NISs and PRQs in the Table

NISs occupy separate IPs, and so will comprise separate updates. Specifically, the two-step sequence of an ordinary assertion followed by an ordinary polar question:[4]

(20) a. Utterance of *He ate the cake.* (= p)

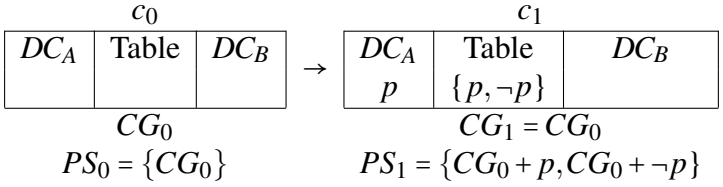


b. Subsequent utterance of *Didn't he (eat the cake)?*



Integrated PRQs occupy a single IP, and so will comprise a single update, derived by composing the updates either sentence would instantiate on its own into a single step:

(21) Utterance of *He ate the cake* ∘ utterance of *Didn't he (eat the cake)?*
= Utterance of *He ate the cake, didn't he?*



While (20) and (21) result in identical output contexts, they differ in the steps by which they arrive there. NISs represent an intermediary stage of the context in which the speaker has projected only $CG + p$, but PRQs represent no such intermediary stage. As we will see, given independently motivated assumptions about how comprehenders reason about speakers' doxastic states given the context update they've made, these two paths result in markedly different pragmatic effects in spite of yielding the same output context.

6. Analysis step 2: Table pragmatics

On the analysis pursued so far, context update potential is conventionalized. It's determined by the form of an utterance—syntactic clause typing, prosodic packaging, and so on. But not *everything* about discourse is conventionalized. Just as in truth-conditional semantics, we have to discriminate between the conventionalized and the pragmatic in the domain of context update. Figuring out the holistic effect of an utterance requires understanding both what the

[4]Though the Table is defined as a stack, we represent only the maximal element of the stack in these diagrams, as the presence of $\{p\}$ beneath $\{p, \neg p\}$ on the stack plays no role in our account. Any resolution of $\{p, \neg p\}$ will also resolve $\{p\}$, so its presence is immaterial.

conventional discourse effect of an utterance is, and what additional inferences are pragmatically licensed by observation that a speaker has updated the context using that discourse effect (Gunlogson 2001; Murray and Starr 2020; Rudin 2022; Scheffler and Malamud 2023 a.m.o.).

In the Table model, context updates involve incurring (or avoiding) speaker commitments, and including (or withholding) propositions within what is placed on the Table. To understand the overall space of inferences that an utterance gives rise to, we need to articulate the pragmatic principles governing the cooperativity of making such moves.

6.1. Maxims for commitment and projection

Here we assume Rudin's (2018; 2022) formalization of the underlying pragmatics of the Table model. Commitment-making is subject to a maxim[5] of SINCERITY (≈ Gricean QUALITY):

(22) SINCERITY:
Violated by any move that adds p to DC_{sp}, where $DOX_{sp} \subseteq p$

This maxim states that a cooperative agent X's public commitments (DC_X) should accurately reflect what they really believe (DOX_X).

Projecting CGs is subject to a maxim of VIABILITY:

(23) VIABILITY:
Violated by any move that adds a set including p to T, where $\bigcap DC_X \cap p = \varnothing$ for some interlocutor X, or $DOX_X \cap p = \varnothing$ for some interlocutor X

Adding propositions to the Table projects possible futures for the conversation in which that proposition has become common ground. This maxim states that a cooperative agent shouldn't project a possible future for the conversation that contradicts any interlocutor's commitments (or private beliefs), as that possible future state of the common ground would either be unreachable, as common ground is blocked by the incompatible commitment, or uncooperative, as it would not accurately reflect the beliefs of the interlocutors.

A corresponding pragmatic pressure, COMPREHENSIVENESS, compels agents to project as inclusive as possible a set of paths forward for the common ground, modulo VIABILITY:

(24) COMPREHENSIVENESS:
Violated by any move that adds a set P to T such that $\bigcup P$ does not include at least one world w such that $w \in \bigcap CG$ and $CG + \{w\}$ is viable

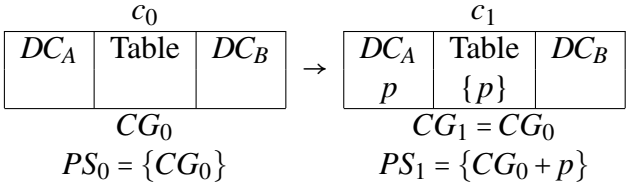
The set of propositions placed on the Table gives the set of possible future states of the common ground in which the QUD it raises has been successfully resolved. This maxim states that a cooperative agent shouldn't exclude worlds compatible with the common ground from the space of possible future states from the common ground unless those worlds are unviable.

[5]Rudin (2022) also discusses a maxim of PUBLICITY that obligates speakers to make relevant commitments if they can; this maxim won't be relevant to our purposes here.

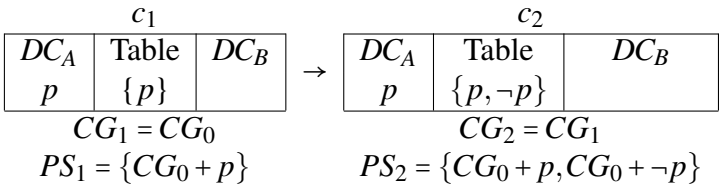
6.2. Application to NISs

Let's return to the non-integrated update sequence from above:

(25) a. Utterance of *He ate the cake.* (= p)



b. Subsequent utterance of *Didn't he (eat the cake)?*



In the first step of this sequence, the speaker moves to a state of the context in which the singleton set $\{p\}$ is on the Table, projecting only one possible future state of the conversation: one in which p has become Common Ground. In making this move, the speaker has excluded paths forward in which $\neg p$ becomes Common Ground. By COMPREHENSIVENESS, this is cooperative only if the speaker believes that $\neg p$ is not VIABLE.

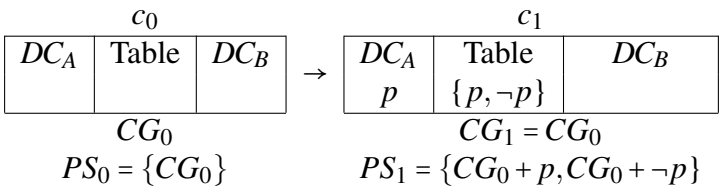
In the second step of this sequence, the speaker subsequently moves to a state of the context in which the dual set $\{p, \neg p\}$ is on the Table, projecting two possible future states of the conversation: one in which p has become Common Ground and one in which $\neg p$ has. This is only cooperative if the speaker believes that $\neg p$ is VIABLE.

The speaker's projection behavior suggests that they take $\neg p$ to be viable, and that they take $\neg p$ to be unviable: the two moves **express contradictory demands** on the maxim of VIABILITY. If the speaker thinks $\neg p$ is viable, then their first update is uncooperative. If the speaker thinks $\neg p$ is unviable, then their second update is uncooperative. There is no coherent way to reconcile both of the speaker's moves with the pragmatics of projection. Hence, the interpretation that the speaker has changed their mind and is backing off from the initial utterance: the only way to understand this update sequence as cooperative is if the speaker has changed their mind about the viability of $\neg p$ between the two updates.

6.3. Application to PRQs

Now let's consider the composed update, repeated here:

(26) Utterance of *He ate the cake* ∘ utterance of *Didn't he (eat the cake)?*
= Utterance of *He ate the cake, didn't he?*



In the composed update, the speaker never puts the context into a state projecting only $CG + p$. This means that, unlike in the NIS case above, the speaker never makes a move that is cooperative only if they take $\neg p$ to be unviable. So the fact that they've projected $\neg p$ does not result in the pragmatic incoherence of the non-integrated sequence, as contradictory demands have not been placed on the maxim of VIABILITY.

There is, however, a different sort of pragmatic phenomenon going on here. Though the speaker has not placed contradictory demands on the maxim of VIABILITY, they have committed an apparent violation of it: their own commitment to p renders the projected $CG + \neg p$ unviable. Here, rather than a sequence of moves that impose contradictory demands on one and the same maxim, we have a classic instance of clashing maxims: the speaker has set two maxims in tension with each other in order to productively generate inferences.

On the one hand, given SINCERITY, the speaker's commitment to p suggests that they are sure that p is true. On the other, given VIABILITY, the speaker's projection of $CG + \neg p$ suggests that they believe a shared commitment to $\neg p$ could be cooperatively reached. This tension could be resolved in one of two ways. Either the speaker is understood to signal less-than-complete confidence in p—their commitment isn't entirely SINCERE, in the technical sense, and could be walked back (q.v. Scheffler and Malamud 2023); or the speaker is understood to signal that there is only the PRETENSE of a question being asked, and the only acceptable answer is p—the projected $CG + \neg p$ is not VIABLE.

In other words, the pragmatics of PRQs can be resolved into either of the two categories outlined above:[6]

(27) **Legitimate question, less-than-full commitment:**
[Context: the speaker thought that their addressee was in Bucharest, but they appear at the speaker's doorstep in Pasadena]
You're were going to fly to Bucharest, weren't you?

(28) **Pretense-question, full commitment:**
[Context: The addressee has just asked the speaker why they're watching a 40-minute Youtube video about the battle of Midway]
I'm a 40-year-old man, aren't I?

Full commitment readings pose a challenge for accounts of PRQs that hard-code deficient speaker commitment into their update potentials, a category into which the entire prior literature of which we're aware falls (see discussion in introduction). But these readings fall out as one possible resolution of the SINCERITY/VIABILITY clash if bias is derived pragmatically,

[6]Note the similarity between these two interpretations and the "inner" and "outer" readings of high-negation polar questions discussed in the literature (Ladd 1981). This parallel may not be accidental: high-negation polar questions likewise involve a tension between asking a question and signaling a speaker's bias about the answer, which is likely highly conventionalized (Goodhue 2022).

not conventionally encoded. The contextual variability of the bias of PRQs supports a view on which at least some kinds of question bias are not fully conventionalized, but rather are the result of inferences derived from pragmatic reasoning about the non-canonical state into which a 'biased question' puts the discourse.

7. Analysis step 3: The polarity puzzle

The last remaining puzzle concerns the interpretation of same-polarity tags. In popular frameworks of question meaning like Alternative Semantics (Hamblin, 1973) and Partition Semantics (Groenendijk and Stokhof, 1984), positive and negative versions of the same polar question are denotationally equivalent. This assumption might lead us to expect tag questions to be interpreted identically regardless of tag polarity, but as we saw, this is not the case. We propose the polarity restriction of PRQs can be explained by the interaction of uttering positive vs. negative anchors with independently-required felicity requirements of negative polar questions. In what follows we remain agnostic about where these additional restrictions on negative polar questions come from.

7.1. Negative-negative tags

Recall from §2 that negative-negative tag Qs are outright incoherent, regardless of the position of negation in the tag (* here indicates systematic unacceptability, rather than ungrammaticality in any strict sense):

(29) a. *Geertje isn't coming, isn't she?
b. *Geertje isn't coming, is she not?

It is well-known that English polar questions with negation are **biased**, i.e., licit only in contexts with particular configurations of speaker beliefs and/or contextual evidence (Büring and Gunlogson 2000; Sudo 2013, a.m.o.). We propose that these requirements for both high- and low-negation tag Qs conflict with the requirements of uttering a negative declarative; thus, uttering a prosodically-integrated sequence of $\neg p, \neg p?$ results in systematically defective discourse updates, explaining the badness of (29).

High-negation tags. High-negation questions $\neg p?$ (*Isn't she coming?*) on their own are licensed iff the speaker has a private epistemic bias (approximately, a pre-existing belief) for the positive answer p (*She is coming*). While this bias is more or less universally agreed to be associated with English HNQs, there is considerable debate about its exact origin (see e.g. Romero and Han 2004; Sudo 2013; Frana and Rawlins 2019; Goodhue 2022; Tabatowski 2022). The derivation of such bias is outside the scope of our account, so we make no claims about the specific source of this bias, but assume that wherever it comes from, it is a conventional aspect of the meaning of HNQs.[7]

We take inspiration from a prominent prior analysis of HNQ bias on which a HNQ $\neg p?$ ex-

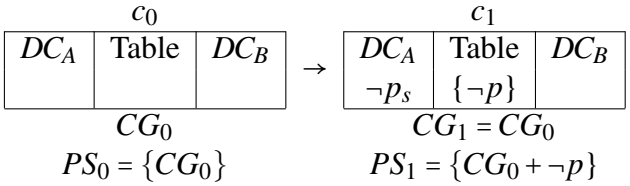
[7]Note that this bias is shared between "inner" and "outer" interpretations of HNQs (Ladd, 1981), so potential differences between them are moot; see Sudo (2013).

presses the speaker's certainty that p should be added to the Common Ground (Romero and Han 2004). We implement that notion in the Table model by making use of an independently-motivated distinction between speaker commitment as *source* vs. *dependent* (Gunlogson, 2008; Malamud and Stephenson, 2015). Sourcehood is a discourse-relative notion: a speaker commits to a proposition p as source if their commitment introduces evidence for p into the discourse; if their commitment is based on evidence introduced into the discourse by another source, including someone else's testimony, that commitment is dependent. Assertions of p often constitute source-commitments, unless they are reactions to the sudden appearance of evidence for p in the discourse context; commitments incurred by responding to someone else's assertion are often (though not necessarily) dependent. We annotate source and dependent commitments with subscript s and d, respectively.

We implement the analysis of HNQ bias as expressing the speaker's certainty that p should be added to the Common Ground by treating an HNQ $\neg p$ as presupposing that the speaker is committed to p as source (viz., $p_s \in DC_{Sp}$), this being a reasonable translation of that proposal into the Table model.[8] HNQs are otherwise semantically equivalent to corresponding positive polar questions. To see how this will deliver the infelicity of high-negation tags with negative-polarity anchors, consider the case of an update sequence of a negative declarative followed by an HNQ.

(30) a. He didn't eat the cake. #Didn't he eat the cake?

b. Utterance of *He didn't eat the cake* (delivers input context for *Didn't he eat the cake?*)



The speaker commits themselves to $\neg p$ in virtue of asserting the declarative $\neg p$. We this assume commitment is as source by default ($\neg p_s$), in the absence of a clear target for dependent commitment. (See below for discussion of contexts in which dependent commitment is licensed.) The output context of this update, c_1, is then the input context for the HNQ update. But the presupposition of the HNQ is not satisfied at c_1: the speaker is not committed to p as source. And the presupposition cannot be accommodated without contradiction: to add p_s to DC_A via presupposition accommodation would result in the speaker being committed as source to both p and $\neg p$, leveraging nakedly contradictory demands on their SINCERITY. So an HNQ update is simply not defined relative to a context updated by a corresponding negative declarative.

Because the composed single-step update instantiated by a prosodically incorporated tag question is determined by way of calculating the update sequence carried out by the anchor and tag in sequence, the single-step update carried out by the tag question version of (30), *He didn't eat the cake, didn't he?*, is likewise undefined. Because the presupposition of HNQs is fundamentally incompatible with having asserted $\neg p$, we get the systematic unacceptability of negative anchor + HNQ tag questions.

[8]While we believe it is theoretically desirable to derive the bias of biased questions from their form, namely from their 'high' contracted negation, we simply stipulate this as a presupposition for the purposes of this paper; see citations above for various compositional proposals.

Low negation tags. Low negation questions, by contrast with HNQs, do not require speaker epistemic bias for p. So why should low negation tags be incompatible with negative anchors? Observe that the canonical use case of an LNQ is to reconcile the conflict between evidence for $\neg p$ and a prior belief that p (e.g. Büring and Gunlogson 2000; Romero and Han 2004; Gyuris 2017). For instance, (31) is naturally uttered by a speaker whose prior belief is that it is snowing. But epistemic bias is not a strict precondition for felicitous use of LNQs (Romero and Han, 2004). What *is* crucial to license LNQs is a discourse context which supplies good evidence for $\neg p$ (Büring and Gunlogson, 2000; Romero and Han, 2004; Goodhue, 2022).[9]

(31) [To someone who is going outside in shorts and a tank top:]
Is it not snowing?

Just as we did for the commitment-as-source requirement of HNQs, we will treat the restriction that there be compelling evidence for $\neg p$ available in the discourse context as a presupposition of an LNQ, while leaving open the question of how precisely this presupposition is derived.[10]

This evidential requirement means that LNQ tags should not be compatible with negative anchors. To see why, recall that uttering the declarative $\neg p$ commits the speaker to $\neg p_s$. A following LNQ tag, in virtue of presupposing $\neg p$ is evident in the discourse context, will enforce alignment between the speaker's commitments and the context, namely that they converge on $\neg p$. But if the context and the speaker's private beliefs converge on $\neg p$, uttering an interrogative is always infelicitous, since from the speaker's perspective, any issue on the Table containing p is nonVIABLE from the get-go. Thus, there is no way to both satisfy the presupposition of the LNQ and project a consistent future common ground given the utterance of the negative anchor.

7.2. Positive-positive tags

In contrast to negative-negative questions, positive tag questions are compatible with positive anchors, albeit with a different interpretation than a similar PRQ:

(32) Ernie baked a cake, did he?

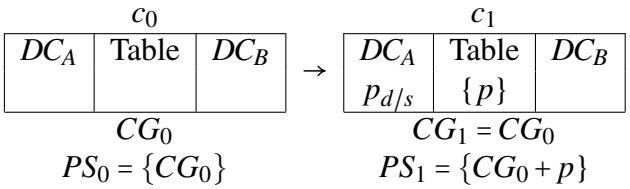
Informally, (32) most naturally evokes a context in which the speaker is expressing surprise at or skepticism of apparent evidence for the proposition *Ernie baked a cake*. We propose that this discourse effect arises via the pragmatic mechanism of antipresupposition inferences (Percus, 2006), deriving from competition between positive and high-negation tags. As analyzed above, an HNQ $\neg p$? presupposes that the speaker is committed as source to p. Given a principle like MAXIMIZE PRESUPPOSITION! (Heim 1991; Lauer 2016), a positive polar question will only be cooperative if the presupposition of its presuppositionally-stronger alternative is false. That is, a positive polar question p? is felicitous only if the speaker is not committed to p as source;

[9]This is a slight oversimplification: LNQs are licit not only in contexts for which there is 'evidence' for p per se, but also contexts in which the speaker has some particular interest in $\neg p$ itself, see van Rooy and Šafárová (2003); Romero and Han (2004); Sudo (2013).

[10]Note, anticipating the following section, that this predicts that positive questions will be felicitous only in the absence of compelling contextual evidence for $\neg p$, by virtue of MAXIMIZE PRESUPPOSITION!. We take this prediction to be unproblematic.

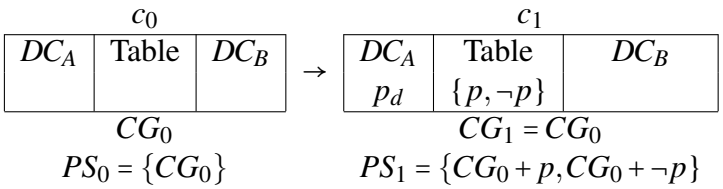
if they were, they should've chosen the presuppositionally-stronger HNQ. Consider the case of an update sequence of a positive anchor followed by a positive tag:

(33) a. Ernie baked a cake. Did he eat a cake?
b. Utterance of *Ernie baked a cake* (delivers input context for *Did he eat a cake?*)



As mentioned above, assertions often incur commitments as source, but not necessarily. In contexts where evidence for p has been entered into the discourse by another source—either the assertion of another interlocutor or the observation of a relevant event—an assertion of a declarative sentence can be construed as incurring dependent commitment. The notation $p_{d/s}$ above represents this ambiguity: prior to the positive polar question follow-up, the utterance of the declarative sentence can incur either dependent commitment or commitment as source, depending on the context. The antipresupposition of a positive polar question resolves this ambiguity, so that in the composed update the speaker's commitment is resolved as being necessarily dependent:

(34) a. Ernie baked a cake, did he?
b. Utterance of *Ernie baked a cake* ∘ utterance of *Did he (bake a cake)?*
= Utterance of *Ernie baked a cake, did he?*



By MAXIMIZE PRESUPPOSITION!, the positive polar question *did he?* is felicitous only if the speaker is not committed to p as source. By the speaker's utterance of the declarative anchor *Ernie baked a cake*, they are committed to p. If they're committed to p but not as source, it follows that they have a dependent commitment to p. The antipresuppositional inference associated with the positive tag forces a dependent interpretation of the commitment incurred by the anchor.

If the speaker's commitment is dependent, there must be something that it is dependent on. That is to say, positive-positive tag questions are only felicitous when the context supplies a source of evidence for p that the speaker's commitment can be dependent on. This may be an assertion of p by another party, to which the speaker is responding. Or it might be that the speaker's utterance is prompted by newly-encountered evidence in the **immediate discourse context**. In such cases, as predicted, positive-positive tags are felicitous, but positive-HNQs are not:

(35) [Context: Ernie is not known to be a baker. Speaker sees Ernie walking into a potluck with a homemade cake.]
Ernie baked a cake, did(#n't) he?

The fact that the speaker makes a commitment to p while still asking whether p sets up the same pragmatic tension discussed above in the case of PRQs, leading to similar inferences. The fact that the speaker's commitment is dependent in these cases opens up the possibility of an interpretation in which the speaker doesn't fully trust the information relative to which their dependent commitment is licensed, explaining the observation that one prominent use of positive-positive tag questions is the expression of skepticism.

8. Conclusion

PRQs wear their discourse effects on their sleeve. They are what they look like they are: an ordinary assertive declarative followed by an ordinary interrogative, prosodically packaged into a single context update. A range of facts about PRQs can be derived from a general treatment of the semantics-pragmatics interface on the level of context update. The variable interpretations of PRQs in different contexts arise from different ways of resolving a pragmatic clash between SINCERITY and VIABILITY. Differences between PRQs and non-integrated sequences result from different inferences generated by performing one composed context update vs two sequential context updates. The polarity restriction can be derived from how that composed context update interacts with the independent bias profile of negative questions.

Finally, though our formalization of prosodic integration is quite general, it is empirically evident that it is subject to some stringent syntactic and pragmatic constraints. For instance, English PRQs seem to require VPE in the tag, and auxiliary identity between the anchor and tag:

(36) a. *You're coming, aren't you coming?
b. *Belinda is able to waltz, can't she?

These frontiers are yet unexplored, including the cross-linguistic picture. That said, prosodic integration shows promise in explaining the discourse effects of other multi-sentential constructions, such as slifting (Roberts, 2023a).

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Cardinality and (in)definiteness[1]

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Abstract. In every language, numeral constructions (NCs) consistently exhibit a pattern of strong indefiniteness. Although they can also appear with an overt definite determiner, achieving definiteness in NCs in languages without articles typically necessitates the use of alternative markers, such as demonstratives (Jiang, 2012). This contrasts with bare nouns, which can freely take on definiteness in articleless languages, often attributed to a covert *iota* operator in the neo-Carlsonian approach. The prevailing view considers NCs to be predicative expressions of type $\langle e,t\rangle$, undergoing $\exists$ type-shifting in argument positions without overt determiners. Yet, it is unclear why the covert *iota* does not similarly apply to NCs in articleless languages, given their compatibility with the definite determiner in languages with articles. Taking up this puzzle, this study proposes that NCs primarily function as argumental expressions of type e, with their indefiniteness (via a choice function) stemming from a cardinal head residing within their structure. The proposal is grounded in an analysis of NCs in Turkish, an articleless language with an optional classifier, *tane*, and reinforced by data from Farsi.

Keywords: numeral constructions, optional classifiers, cardinality, (in)definiteness.

1. Introduction

Numeral constructions (NCs) can freely occupy argument positions and convey indefiniteness, even in languages like French, where overt determiners are required for nominal arguments. In languages with articles, NCs may also pair with the definite determiner, but in languages that lack articles, they generally require alternative overt markers, such as demonstratives, to convey a definite-like interpretation (Jiang, 2012). This property of NCs contrasts with bare nouns in articleless languages, which can be definite without overt marking, standardly assumed to be achieved through a covert *iota* operator in the neo-Carlsonian approach.

Since the seminal work of Link (1983), NCs are widely viewed as predicative expressions of type $\langle e,t\rangle$, defaulting to $\exists$ type-shift in argument positions in the absence of overt determiners (e.g., Partee 1987, Verkuyl 1993, Landman 2003, Ionin and Matushansky 2006, cf. Montague 1974, Bennett 1974, Barwise and Cooper 1981, Scha 1981, van der Does 1992, Dayal 2013). Under this view, it remains puzzling why the covert *iota* does not operate in a similar manner with NCs in articleless languages, especially considering their ability to combine with the definite determiner in languages that have articles. The puzzle gets more complicated with NCs in Turkish, which is an articleless language with an optional classifier system.

Counting systems vary across languages, and one aspect of divergence is the presence of an intervening item between the numeral and a (count) noun. For instance, languages like English, which systematically differentiate the unmarked and plural forms of nouns, use the plural form

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of a count noun with numerals other than 'one.' Crucially, count nouns directly combine with numerals, while mass nouns need a quantizing noun intervening between the two:

(1) a. three pens
b. three drops of water

Languages like Mandarin, which lack a systematic number marking system, use the unmarked form of the noun for all numerals. However, they require the mediation of an intervening item, generally known as a classifier, for all nouns, regardless of the ontological categorization of the noun as count or mass (Cheng and Sybesma 1999, p. 514; see also Jiang 2012 and Kim 2009, among others, for Mandarin, Japanese, and Korean):

(2) a. san *(zhi) bi
three CL pen
'three pens'

b. san *(ba) mi
three handful rice
'three handfuls of rice'

A less familiar system, as in Turkish NCs, shares features with these two types of languages. Turkish has a systematic number marking mechanism akin to English, but the unmarked form of nouns is used with all numerals. Furthermore, Turkish NCs involve an optional item between the numeral and a count noun. This item, i.e., *tane*, is also termed as 'classifier' in the literature (Underhill 1976, Schroeder 1992, Lewis 2000, Göksel and Kerslake 2005, Öztürk 2005):

(3) a. bir (tane) kitap
one CL book
'one book'

b. iki (tane) kitap(*-lar)
two CL book-PL
'two books'

Similar to the other types of languages, in Turkish, mass nouns require a mediating quantizing noun for counting, as demonstrated in (4a). However, both numerals and *tane* are selective for the count sense of the noun —they can directly combine with mass nouns only when there is an implicit universal packaging/sorting mechanism, similar to 'two waters' in English, as in (4b).

(4) a. iki *(damla) su
two drop water
'two drops of water'

b. iki (tane) su
two CL water
'two waters' (coerced)

Crucial for our purposes, Turkish NCs deviate from the cross-linguistic pattern of NCs in the absence of *tane*, freely allowing both definite and indefinite interpretations, whereas NCs with *tane* exhibit an exclusively indefinite behavior (Schroeder 1992; Öztürk 2005). As demonstrated in (5), both forms of NCs can be indefinite evidenced by their ability to introduce new discourse referents in the initial sentence. In contrast, only the form without *tane* can behave as a definite description referring to a unique/maximal entity introduced precedingly.

(5) Sevgi müzik festival-in-de iki (tane) şarkıcı ve bir gitarist-le tanış-tı.
Sevgi music festival-COMP-LOC two CL singer and a guitarist-with meet-PAST
İki (#tane) şarkıcı önümüzdeki hafta Taksim-de konser ver-ecek-miş.
two CL singer next week Taksim-LOC concert give-FUT-EVID
'Sevgi met with two singers and a guitarist in the music festival. Apparently, the two singers will give a concert next week in Taksim.'

Based on the pattern of Turkish NCs, we are faced with two key questions: (i) How does counting work in Turkish and what role does *tane* play in this? (ii) How does the presence/absence of *tane* affect interpretation, contributing to the exceptional status of the Turkish counting system?

While addressing these questions, I take the contrasting behavior of Turkish NCs as a means to identify the source of general indefinite characteristics of NCs. I propose that NCs primarily function as argumental expressions of type *e*, with their indefiniteness stemming from a cardinal head residing within their structure, via a choice function in the sense of Reinhart (1997). Predicative use of NCs (via Partee's *ident* operator) occurs only when structurally necessary —for instance, when they serve as arguments to determiners. This view implies that in articleless languages, where NCs cannot be definite without alternative markers, *iota* functions not as a covert D head but as a type-shifting operator. Assuming type-shifting occurs only with type mismatches, NCs do not undergo *iota* type-shifting (through *ident*) as they are in the appropriate type in the argument position of a verb.

However, I also argue that languages can accommodate inherently predicative NCs alongside default argumental NCs when they feature more than one form of the cardinal head. This enables definiteness with the predicative form by means of *iota* type-shifting in articleless languages. Analyzing *tane* as distinct from obligatory classifiers of Mandarin-like languages, I propose that Turkish utilizes both a covert and an overt cardinal head, with *tane* overtly realizing the default form with a built-in indefinite semantics. In contrast, the covert form lacks this indefinite force and results in inherently predicative NCs. I also illustrate that NCs in Farsi, an additional articleless optional classifier language, exhibit a mirror image of the Turkish pattern, enhancing the cross-linguistic strength of my proposal.[2]

The outline of this paper is as follows: Section 2 compares *tane* with obligatory classifiers. Section 3 presents the account of *tane* as an overt spell-out of the cardinal head. Section 4 discusses the indefiniteness associated with NCs and the divergent pattern observed in Turkish. Section 5 presents the core analysis. Section 6 discusses Farsi data. Section 7 concludes.[3]

2. Comparing *tane* with Obligatory Classifiers

In languages like Mandarin, all nouns, even those intuitively seen as count, need a classifier, as opposed to languages like English, where only mass nouns cannot directly combine with numerals (excluding 'packaging/sorting' coercions). The obligatory occurrence of classifiers in Mandarin-type languages has led scholars to treat all nouns as mass or mass-like kind terms in such languages, requiring a type-fixing/partitioning mechanism to enable counting, similar to mass nouns in English-like languages. Classifiers are thus posited as a counting aid in NCs. For example, Chierchia (1998) argues that classifiers return the atomic instances of the kind

[2]A note on terminology: The term 'classifier' is variably used in the literature, sometimes referring specifically to obligatory classifiers in languages like Mandarin, and other times more broadly to any 'quantizing' element in NCs and measure constructions. In this paper, 'classifier' is used descriptively for an element intervening between a numeral and a count noun in NCs. Hence, following this convention, *tane* will be referred to as a classifier, even though it is analyzed distinctly from classifiers in Mandarin-like languages.

[3]The Turkish data reflect the judgments of fifteen native speakers. For the Farsi data, ten native speakers have been consulted via informal conversations, including Amir Anvari and Masoud Jasbi. The examples of all the other languages are sourced from the literature.

to fix the type mismatch based on the view that counting operates on the predicative meanings of nouns. Likewise, in Krifka's (1989, 1995, 2003) view, classifiers *measure* the number of specimens, countable object units of a kind (cf. Borer 2005; Cheng and Sybesma 1999, a.o.).

The Turkish classifier is similar to classifiers in Mandarin-like languages as it appears between a numeral and an (ontological) count noun. However, *tane* fundamentally differs from these classifiers in being optional. The question is whether *tane* can still be analyzed similarly to obligatory classifiers in Mandarin-like languages. To address this, we must delve into the semantics of nominals in Turkish.

Sağ (2018, 2022) claims that Turkish aligns with English in its nominal semantics (see also Renans et al. 2017, 2020, Martí 2020, Scontras 2022, cf. Bliss 2004, Bale et al. 2010, Görgülü 2012). Unmarked nouns, such as *kitap* 'book,' are strictly singular in denoting a set of atomic entities, while plurals, such as *kitap-lar* 'books,' are number neutral in denoting a set inclusive of atomic entities and their pluralities, as illustrated in (6).[4]

(6) a. $[\![kitap]\!] = \{a,\ b,\ c\}$
b. $[\![kitap + PL]\!] = \{a,\ b,\ c,\ a \oplus b,\ a \oplus c,\ b \oplus c,\ a \oplus b \oplus c\}$

Moreover, both plurals and unmarked nouns can be used in kind-level statements, as shown in (7a), but only plurals can combine with distributive predicates applying to individual members of the species, such as *come from different regions*, as illustrated in (7b) (Sağ 2022: 755, 761).

(7) a. **Dinozor(-lar)** 250 milyon yıl önce evrimleş-miş-tir.
dinosaur-PL 250 million year ago evolve-PERF-GEN
'The dinosaur/Dinosaurs evolved 250 million years ago.'
b. **Ayı*(-lar)** bu hayvanat bahçesin-e farklı bölge-ler-den gel-di.
bear-PL this zoo-DAT different region-PL-ABL come-PAST
'Bears/*The bear came to this zoo from different regions.'

Following Chierchia's (1998) treatment of English plurals, Sağ analyzes Turkish plurals as kind terms derived via the *nom* operator ($^\cap$), a function from properties to functions from situations s to the maximal entity satisfying that property in that situation (Chierchia 1998, p. 351). For example, the plural kind term *dinozorlar* 'dinosaurs' in (7a) is interpreted as below:

(8) a. For any property P and world/situation s, where P_s is the extension of P in s

$$^\cap P = \begin{cases} \lambda s.\ \iota x.\ P_s(x), \text{ if } \lambda s.\ \iota x.\ P_s(x) \text{ is in } K, \text{the set of kinds} \\ \text{undefined, otherwise} \end{cases}$$

b. $[\![\text{(7a) with plural}]\!] = evolved(\lambda s.\ \iota x.\ dinosaur_s(x))$

The *pred* ($^\cup$) operator allows plural kind terms to be type-shifted to sets of object-level entities that instantiate the kind. More precisely, *pred* applies to the extension of the kind (i.e., extension in whatever world/situation it is interpreted relative to) and returns the set of singular and plural instantiations of the kind (in that world/situation) (Chierchia 1998, p. 350):

[4]In Turkish, like in English, plurals can have a 'one or more' interpretation in downward entailing contexts and questions, while they convey multiplicity elsewhere. Building on the analyses in Sauerland et al. (2005), Spector (2007), and Zweig (2009) for English plurals, Sağ proposes that the multiplicity interpretation of Turkish plurals emerges as a conversational implicature. Renans et al. (2017, 2020) provide experimental evidence for this view.

(9) Let d be a kind. Then for any world/situation s, where d_s is the plural individual that comprises all of the atomic members of the kind

$$^{\cup}d = \begin{cases} \lambda x.\ x \leq d_s, \text{if } d_s \text{ is defined} \\ \lambda x.\ FALSE, \text{ otherwise} \end{cases}$$

Turkish unmarked nouns have been analyzed as ambiguous between denoting an atomic set of ordinary object-level individuals, as shown in (10), and an atomic set of taxonomic individuals, as shown in (11a), following Dayal's (2004) view of English unmarked nouns. In their taxonomic use, unmarked nouns, depending on the context, can denote a singleton set containing a unique taxonomic kind individual (e.g., the dog kind), as in (38a), or an atomic set containing the sub-kinds of a kind individual (e.g., the bulldog, the poodle, etc.). Consequently, an unmarked noun in Turkish can be a definite description, referring to contextually salient unique object-level individual (e.g., *Fido*), or the unique dog kind through the covert *iota* operator.

(10) $[\![dog]\!] = \lambda x.\ dog(x) = \{Fido, Max, Tommy...\}$ $\langle e,t \rangle$

(11) a. $[\![dog_{K,c}]\!]$ = a singleton set containing the dog kind = $\{DOG\}$
b. $[\![dog_{K,c}]\!]$ = a set of subkinds of dog salient in a context c
= $\{BULLDOG,\ POODLE,\ GOLDEN.R, ...\}$ $\langle e_K, t \rangle$

In Dayal's view, singular kind terms denote impure atomic entities, analogous to group terms, such as *team*. While they hold a relation with the specimens at the conceptual level, singular kind terms differ from plural kind terms in not allowing type-shifting to sets of object-level entities via an operator like *pred*. This makes certain interpretations unavailable for unmarked nouns, in contrast to plural nouns, with one consequence being the incompatibility with distributive elements, as in (7b), which require access to sets of object-level instances of the kind.

Due to the type-shifting problem with singular kinds, Sağ (2018) argues that unmarked nouns in Turkish NCs denote atomic properties of object-level individuals, irrespective of *tane*. More precisely, *tane* cannot serve a type-fixing function on the kind-level denotation of nouns, unlike obligatory classifiers in languages like Mandarin. An alternative role for *tane*, aligning it with obligatory classifiers, could be to facilitate counting with mass nouns. As we have observed, *tane* selectively pairs with the count sense of the noun, similar to numerals, allowing combination with mass nouns only in contexts where they are coerced into a count denotation. This suggests that *tane* does not serve as a partitioning mechanism for mass nouns either. However, it is important to clarify where Turkish stands with respect to count vs. mass distinction.

Turkish grammatically distinguishes between the count and mass senses of nouns (Görgülü, 2010), aligning with English. This distinction becomes evident through several means, besides the direct combination of ontological count nouns with numerals, a feature not shared by ontological mass nouns. For instance, we observe differences in the form of quantifiers, as illustrated in (12). In contrast, Mandarin-like languages do not reflect the count vs. mass distinction beyond the choice of classifiers (Cheng and Sybesma, 1999).

(12) a. birkaç (tane)/ *biraz (tane) kedi
a.few CL a.little CL cat
'a few cats'

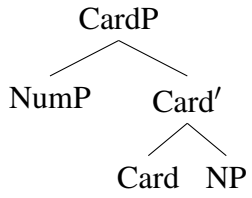
b. *birkaç (tane)/ biraz (*tane) kan
a.few CL a.little CL blood
'a little blood'

Considering these patterns, I analyze *tane* as a category separate from obligatory classifiers. In line with Sağ (2018), I argue that unmarked count nouns in Turkish NCs uniformly denote atomic properties of object-level individuals, thus eliminating the need for an intermediary element in counting.

3. The Cardinal Head

Having established an initial understanding of *tane* in Turkish NCs, in this section, I delve into the preliminary part of my analysis. Following Scontras (2022), I propose that NCs universally involve a cardinal head denoting a counting function, as illustrated in (13).

(13) Generalized Structure of NCs



Ionin and Matushansky (2006) argue that counting universally necessitates semantically singular form of the noun, a requirement satisfied by morphologically unmarked nouns in languages such as Turkish, while English NCs further involve plural agreement marked on the noun. Applying their view of numerals to it, I analyze the cardinal head (CARD) as an expression of type $\langle\langle e,t\rangle,\langle n,\langle e,t\rangle\rangle\rangle$ in English, as shown in (14). CARD takes an atomic property P and a number n, and returns a set of individuals x, where each x evaluates to the cardinality n, and the atomic parts of each x are in P (cf. Ionin and Matushansky 2006, p. 321):[5]

(14) The Semantics of CARD (to be revised):
$[\![\text{CARD}]\!] = \lambda P \lambda n \lambda x$: $\forall y\,[P(y) \rightarrow AT(y)]$. $\exists S\,[\prod(S)(x) \wedge |S| = n \wedge \forall s \in S\, P(s)]$
a. $\prod(S)(x) = 1$ iff S is a cover of x, and $\forall z, y \in S\,[z = y \vee \neg\exists a\,[a \leq_i z \wedge a \leq_i y]]$
b. A set of individuals C is a cover of an individual X iff X is the sum of all members of C: $\sqcup C = X$

Based on this view, a NC such as *two books* denotes a set of plural individuals x divisible into 2 non-overlapping individuals such that their sum is x and each non-overlapping part is a book. While *books* in *two books* is lexically singular, denoting a set of atomic individuals, the entire NC is semantically plural, and thus *-s* on the NP is a marker of this plurality.

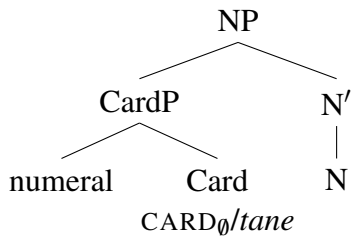
[5]Contrasting with Ionin and Matushansky's numeral semantics, the semantics of CARD diverges in one key aspect: In their view, numerals must combine with a property with individuals of the same cardinality, a criterion met by atomic properties in the case of simplex numerals. This requirement also enables the compositional derivation of complex numerals. For instance, the set denoted by *hundred books* (type $\langle e,t\rangle$) can be an argument to the numeral *two* (type $\langle\langle e,t\rangle,\langle e,t\rangle\rangle$) since the set of *hundred books* comprises plural individuals with equal number of atoms. However, rather than following this generalization, I directly impose an atomic property requirement on the cardinal head for both simplex and complex numerals. See fn 12 for the rationale behind this approach.

Turkish stands out not only due to the absence of plural agreement in NCs but also in the form of CARD it employs. While CARD is typically covert, as in languages like English, Turkish introduces both an overt and a covert variant of CARD, with the overt form realized as *tane*. The CARD heads in Turkish share the same semantics as CARD given in (14), with the exception that they combine with the numeral first, making them $\langle n, \langle\langle e,t\rangle, \langle e,t\rangle\rangle\rangle$ type expressions. This is shown in (15), where the atomicity presupposition is indicated by the subscripted AT in P_{AT}.

(15) The Semantics of CARD in Turkish (to be revised):
$[\![\text{CARD}]\!] = \lambda n \lambda P_{AT} \lambda x.\ \exists S\ [\prod(S)(x) \wedge |S| = n \wedge \forall s \in S\ P(s)]$

The difference in composition of the Turkish CARD heads is grounded in the structural configuration of Turkish NCs, which I take to be a nominal projection instead of a CardP, primarily due to the strict head-final characteristics of Turkish. As shown in (16), Turkish NCs involve CardP, where CARD combines with a numeral, functioning as a modifier to the noun (cf. von Heusinger and Kornfilt 2017). The covert form of the Turkish CARD is represented as $\text{CARD}_{\emptyset}$.

(16) The structure of Turkish NCs:

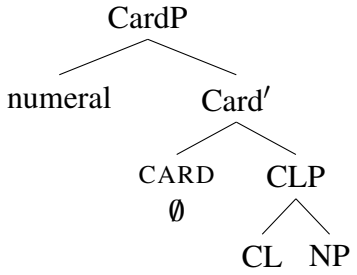


The optionality of an overt CARD head is not a universal feature. Some languages might always manifest CARD overtly.[6] Additionally, the overt or covert status of CARD can be subject to language-specific factors, as suggested by Scontras (2022) for Mayan languages like Chol and Mi'gmaq, where its realization varies with different numerals (see Bale et al. 2019).

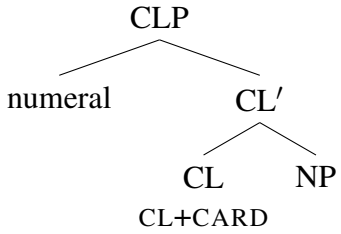
Given that we have posited a CARD head in NCs, a note on the structure of NCs in obligatory classifier languages is imperative. As discussed earlier, obligatory classifiers in Mandarin-like languages serve as a type-fixing/partitioning mechanism for nouns that would otherwise be uncountable. Along with the classifier, we then also predict a CARD head in NCs of these languages. CARD could be a covert head merged separately above the projection of the classifier, as in (17a). Alternatively, classifiers in Mandarin-type languages might have a more complex semantics than we think —their denotation might involve a cardinality function besides the partitioning function, and thus CARD might be viewed as fused with the classifier head, as shown in (17b). While both possibilities are viable, for simplicity, I assume the structure in (17a).

[6]This is possibly seen in Bangla, an obligatory classifier language with systematic plural marking, where CARD might be realized by the classifier *ta/to* (cf. Dayal 2014, Saha 2023). Analyzing *ta/to* as CARD instead of a Mandarin-type classifier, is supported by its ability to co-occur with partitioning quantizing nouns: *du(-to) bosta caal* 'two-CL sack rice' (p.c., Ankana Saha).

(17) a. CARD as a separate head



b. CARD as part of CL's denotation



To summarize, *tane* represents the overt form of a cardinal head, which I propose to be an obligatory element of NCs, typically realized covertly across languages. The nominal argument of this cardinal head is semantically singular, although some languages obscure this with plural number agreement in their NCs.

4. Numeral Constructions and (In)definiteness

We have examined the optional appearance of *tane* in Turkish NCs. We will now explore the inherently indefinite characteristics of NCs across languages and the distinctive behavior of Turkish NCs: in the absence of *tane*, they allow both definite and indefinite interpretations.

4.1. Cross-linguistic Interpretation of NCs

The widely accepted view due to Link (1983) posits that NCs have an inherent predicative nature. As $\langle e,t \rangle$ type expressions, NCs can function as arguments for determiners, including definite, demonstrative, and quantificational determiners, and can occupy predicate positions, as exemplified below for English:

(18) a. These three students didn't submit their homework.
b. The first gift that I received this year was two books.

Under this view, NCs are assumed to undergo existential type-shifting in argument positions when not accompanied by an overt determiner, i.e., when they serve as bare arguments. As a result, NCs exhibit a strong indefinite behavior, with free scope-taking abilities:

(19) Three students are not standing but three are. (Dayal 2013, p. 22)

Jiang (2012) highlights that in languages where bare nominal arguments are disallowed, such as French, NCs can still occupy the argument position of a verb without an overt determiner.

In these languages, when NCs are used as bare arguments, they convey only a strong indefinite interpretation. Generally, in languages with articles, NCs require combination with the definite article or a demonstrative to function as a definite description, as shown for French below:

(20) Jean a acheté deux chiens et deux chats. *(Les)/ *(ces) deux chats sont coûteux.
John has bought two dogs and two cats the/these two cats are costly
'John bought two dogs and two cats. The/these two cats are very expensive.'
(Jiang 2012, p. 95)

According to the neo-Carlsonian approach, bare nominal arguments in articleless languages can be definite through their association with the covert *iota* operator, which is either assumed to be inserted under a covert D head or function as a type-shifting operator. However, in languages with definite articles, the covert application of ι is unavailable due to the Blocking Principle, given in (21), which requires the use of overt determiners instead for reasons of economy.

(21) Blocking Principle (Chierchia, 1998):
For any type shifting operation ϕ and for any X: $*\phi(X)$ if there is a Determiner D such that for any set X in its domain, $D(X) = \phi(X)$.

The Blocking Principle explains why in languages with articles, NCs cannot be definite without the overt definite determiner (or a demonstrative). However, in languages without articles, the scenario is strikingly alike. While bare nouns can acquire definite meanings via the covert ι operator, such a mechanism does not appear to apply to NCs. Jiang (2012) bases this generalization on Mandarin and Russian NCs. Additionally, Dayal (2013) notes that Hindi NCs cannot have definite interpretations freely; they require an overt marking, such as a demonstrative:[7]

(22) do bacce kamre meN the. *(ve) do bacce khel rahe the
two kids room in were those two kids play PROG PAST
'Two kids were in the room. Those two kids were playing.' (p.c. Veneeta Dayal)

Compelling evidence that NCs resist definiteness through the covert ι operator is found in Yi, an obligatory classifier language that also has a definite article. In Yi, bare nouns can be definite in the absence of the overt definite determiner, which suggests that the Blocking Principle might not be applicable in this language (see Jiang 2018 though). However, even with this flexibility for bare nouns, NCs necessitate the definite article to convey definite interpretations:

(23) sse-vo nyip ma *(su) dza dzu ndʑɔ.
boy two CL DEF rice eat PROG
'The two boys are having meal.' (Jiang 2012, p. 334)

Drawing from these patterns, we see that NCs naturally lean towards indefiniteness. For NCs to attain definite interpretations, the covert application of the ι operator falls short; overt markers such as a definite article, or in its absence, demonstratives, are necessary. This resistance of NCs to covertly convey definiteness in articleless languages is particularly perplexing, if they are of inherently predicative nature. It remains an open question why, unlike with bare nouns, ι does not consistently apply to NCs in argument positions in these languages.

[7]Hindi NCs can alternatively be definite if the numeral is inflected with the particle *-no*: *do-no bacce khel rahe the* 'The two kids were playing.' Although the nature of this particle remains elusive, it is only compatible with certain numerals and cannot combine with bare nouns. This precludes a potential analysis of the particle as a definite determiner (p.c. Veneeta Dayal).

Exploring Turkish NCs reveals a more complex scenario. NCs with *tane* adhere to the typical constraint of being restricted to indefiniteness. However, NCs without *tane* exhibit a unique flexibility, permitting both definite and indefinite interpretations, which we turn to next.

4.2. Turkish NCs and (In)definiteness

Indefinites are distinct from other quantifiers in exhibiting unusual scope-taking abilities. Besides their ability to show scope ambiguities, akin to, for instance, universal quantifiers, indefinites can also take exceptional scope out of islands (e.g., Fodor and Sag 1982). Additionally, indefinites are known to be capable of receiving intermediate scope interpretations (Ruys 1992, Abusch 1993, Farkas 1981).

Just like indefinites and NCs in other languages, both forms of Turkish NCs display the general indefinite characteristics (for Turkish indefinites, see Zidani-Eroğlu 1997 and Kelepir 2001, a.o.). For example, in a scenario where three out of six students wrote comments on two (potentially different) books, (24) holds true, indicative of the narrow scope interpretation of the NC. Alternatively, (24) is also true in a situation where more than half the students commented on two books, provided these two books are the same ones chosen by half the students, reflecting the wide scope interpretation of the NC. Similar to English, (24) can also gain a distributive reading when the NC is interpreted in a wide scope context: There exist two books, each receiving comments from exactly half of the students.

(24) Öğrenci-ler-in tam olarak yarısı iki (tane) kitab-a yorum yaz-dı.
student-PL-GEN exactly half two CL book-DAT comment write-PAST
'Exactly half of the students wrote comments on two books.'
(**exactly half > two, two > exactly half**)

The exceptional scope-taking ability of Turkish NCs is shown in (25), which could be true in two distinct situations. In the first one, (25) entails that my receiving funding is contingent upon the selection of any two of my projects, where the NC takes scope inside the antecedent of the conditional. In the second one, where the NC takes scope outside of the island, the selection of two particular projects is required for funding. Yet, differing from (24), the wide scope reading necessitates a collective selection of two projects, paralleling the pattern in English.

(25) Eğer iki (tane) proje-m seçil-ir-se, ödenek
if two CL project-1SGPOSS select-PASS-AOR-COND, funding
al-abil-eceğ-im.
take-ABIL-FUT-1SG
'If two of my projects are selected, I will receive funding.' (**if > two, two > if**)

Finally, (26) exemplifies the intermediate scope reading of NCs. It is felicitous in a scenario, where each linguist awards an A to every student, provided they respond to two specific questions consistent for all students under a single professor.

(26) Çoğu dilbilimci iki (tane) soru-ya yanıt ver-en her öğrenci-ye A ver-di.
most linguist two CL question-DAT answer-REL every student-DAT A give-PST
'Most linguists gave an A to every student that answered two questions.'

Building on these patterns, we can conclude that both NCs with and without *tane* can be indefinite. However, central to the discussion in this paper, NCs without *tane* differ in also functioning as a definite description, as first illustrated in Section 1 (Schroeder 1992; Öztürk 2005). We have seen this in (5) through the ability of NCs without *tane* to refer back to a unique or maximal entity previously established in the context. NCs with *tane*, though, can gain a definite-like reading only when they co-occur with a demonstrative, as further exemplified below:

(27) Polis beş (tane) hemşire-nin ölüm-ün-ü araştır-ıyor.
police five CL female.nurse-GEN death-3SGPOSS-ACC investigate-IMPERF
Edinilen bilgilere göre, **beş (#tane) kadın**-ın/ **bu beş (?tane)**
gathered information according.to five CL woman-GEN this five CL
kadın-ın ellili yaş-lar-da ol-duğ-u tahmin ed-il-iyor.
woman-GEN fifties age-PL-LOC be-NMLZ-3SGPOSS predict-PASS-IMPERF
'The police is investigating the death of five nurses. Based on the information gathered, it is predicted that the/these five women were in their fifties.'

The contrast between the two forms of NCs is also evident in situational contexts involving reference to a familiar and unique/maximal entity. For instance, in a context where Sevgi has three apples only and this is known by both the speaker and the addressee, the NC without *tane* can refer to these three apples, unlike the NC with *tane*, as shown in (28). However, in a context where Sevgi has four apples, both forms of NCs can refer to three of these apples, as in (29), indicating partitive specificity. These patterns further demonstrate that only NCs without *tane* can receive definite interpretations, while both forms are compatible with indefiniteness.

Context: Sevgi has three apples only, familiar to the interlocutors.

(28) Sevgi-nin üç (#tane) elma-sın-ı Merve-ye ver-di-m.
Sevgi-GEN three CL apple-3SGPOSS-ACC Merve-DAT give-PAST-1SG
'I gave Sevgi's three apples to Merve.'

Context: Sevgi has four apples, not necessarily familiar to the addressee.

(29) Sevgi-nin üç (tane) elma-sın-ı Merve-ye ver-di-m.
Sevgi-GEN three CL apple-3SGPOSS-ACC Merve-DAT give-PAST-1SG
'I gave three of Sevgi's apples to Merve.'

Our objective is to explain why NCs manifest obligatory indefiniteness when *tane* is present, but this limitation seems to dissolve in the absence of *tane*.

5. Associating the Cardinal Head with Indefiniteness

The indefiniteness associated with NCs has been addressed within an ambiguity-based approach in Jiang (2012). In this view, numerals are considered ambiguous: they can either be modifiers of type $\langle\langle e,t\rangle,\langle e,t\rangle\rangle$ or modifiers of type $\langle\langle e,t\rangle,e\rangle$ with a built-in choice function variable à la Reinhart (1997) (cf. Fodor and Sag 1982, Winter 1997, and Kratzer 1998). NCs with the first variant have a predicative denotation of type $\langle e,t\rangle$, which can occupy the predicate position or serve as an argument to a determiner. NCs with the second variant, however, are argumental expressions of type e. The choice function variable in their denotation requires

∃-closure, which in Reinhart's system, can occur at any level of composition, ensuring exceptional and intermediate scope properties of indefinites. Moreover, the absence of distributive readings with NCs in exceptional scope scenarios is explained, as such readings emerge from a Quantifier Raising (QR) analysis of indefinites, which Reinhart's theory does not support.

In the following, I semi-formally demonstrate how a NC is interpreted with respect to an island within the choice function theory.

(30) If two of my projects are selected, I will receive funding.
   a. Narrow Scope Reading (**if** > **two**):
   $[\exists f\ [CH(f) \wedge\ be.selected(f([\![two\ projects]\!]))] \rightarrow funding]$
   I will get funding if there is a choice function and the two projects that it selects are selected (by the committee).
   b. Wide Scope Reading (**two** > **if**):
   $\exists f\ [CH(f) \wedge [be.selected(f([\![two\ projects]\!])) \rightarrow funding]]$
   There is a choice function such that if the two projects that it selects are selected (by the committee), I will get funding.

Differing from Jiang (2012), I claim that the inherent indefiniteness in NCs stems from CARD. In other words, NCs are typically argumental expressions across languages due to CARD being hard-wired with a choice function variable. The structural composition of NCs in a language determines the type of CARD, which can be $\langle n, \langle\langle e,t\rangle, e\rangle\rangle$ type, as in Turkish, or $\langle\langle e,t\rangle, \langle n,e\rangle\rangle$ type, as in English, differing only in the order of the arguments taken by CARD. Illustrated below is the cross-linguistic semantic representation of CARD, modeled on the English version, where the subscript f on CARD_f represents the argumental nature of the cardinal head.[8]

(31) The cross-linguistic semantics of CARD (final) $\langle\langle e,t\rangle, \langle n,e\rangle\rangle$
$[\![\text{CARD}_f]\!] = \lambda P_{AT} \lambda n.\ f(\lambda x\ \exists S\ [\prod(S)(x) \wedge |S| = \wedge\ \forall s \in S\ P(s)])$

Following Dayal (2013), predicative use of NCs is derived only when structurally necessary —when NCs merge with overt determiners, which require an $\langle e,t\rangle$ type expression as an argument, or when they are used in the predicate position as a complement to the copula. Given that NCs are inherently *e*-type expressions, the shift to a predicate type is assumed to occur through Partee's (1987) *ident* operator, as shown below:

(32) a. *ident*: $\lambda x \lambda y.\ y = x$
   b. *ident*($[\![\text{two books}]\!]$) = $\lambda y.\ y = f(\lambda x\ \exists S\ [\prod(S)(x) \wedge |S| = 2 \wedge \forall s \in S\ book(s)])\ \langle e,t\rangle$

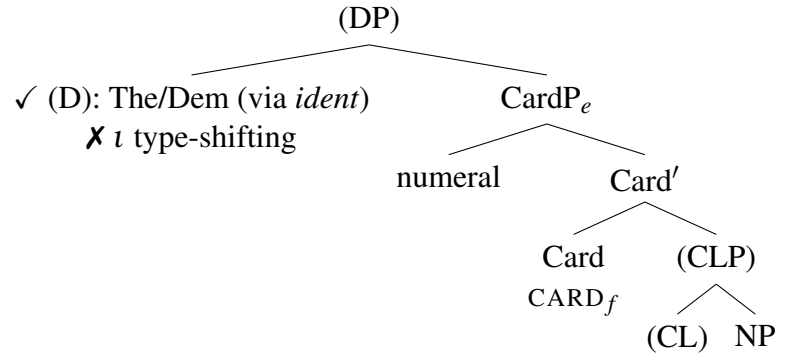
In languages lacking articles, where the definite interpretation of NCs requires alternative overt markers, *iota* must operate as a type-shifting mechanism rather than acting as a covert D head. This hinges on the premise that type-shifting is necessitated only when there is a type mismatch in the composition. Consequently, NCs in the argument position of a verb do not undergo *iota* type-shifting, as this would require the initial triggering of *ident* type-shifting. In other words, since NCs are already of the appropriate type in their composition with a verb, *ident* type-shifting is not justified, thus hindering the subsequent application of ι. If the ι operator were to be inserted under a silent D head, it is expected that this covert D head would function similarly

[8]The selection of English as the basis for CARD is not pivotal to the analysis; it is made to align with the general structure of NCs given in (33).

to an overt D head. Specifically, a covert definite determiner would initiate *ident* type-shifting due to type mismatch, paralleling the behavior seen with an overt definite determiner.[9]

In languages where there is only one form of CARD (typically covert), such as French, English, Russian, Hindi, and presumably Mandarin, I analyze NCs to have the generalized structure in (33), ignoring potential structural variations. The parentheses enclosing the DP indicate two interpretative possibilities for an argumental type NC: First, it can directly fill an argument position of a verb as a CardP. Alternatively, it may act as a complement to a D category, such as definite and demonstrative determiners, leading to *ident* type-shifting to rectify the type mismatch. Conversely, as explained above, *iota* type-shifting is not an available option.

(33) The Generalized Structure of NCs



I further argue that languages can integrate inherently predicative NCs in addition to the standard argumental NCs, particularly when they exhibit multiple forms of the cardinal head. If the language at issue lacks articles, definiteness is expected to be possible with the predicative form of NCs through covert *iota* type-shifting. Turkish, being an exemplar of such languages, features NCs with *tane* as the typical indefinite form, reflecting the general construal in cardinal semantics. However, the covert CARD lacks the choice function, thus leading to a predicative denotation of NCs, as demonstrated below.

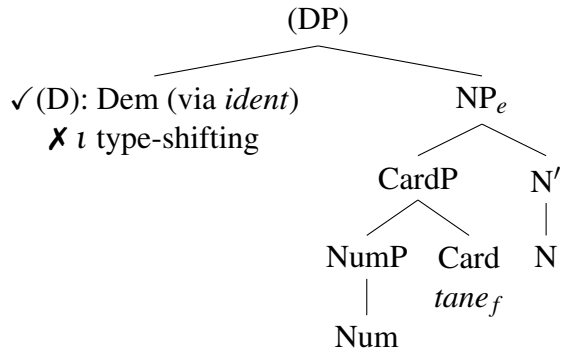
(34) a. The Semantics of the overt CARD in Turkish $\langle n, \langle\langle e,t\rangle, e\rangle\rangle$
$[\![tane_f]\!] = \lambda n \lambda P_{AT}.\ f(\lambda x\ \exists S\ [\prod(S)(x) \wedge |S| = n \wedge \forall s \in S\ P(s)])$

b. The Semantics of the covert CARD in Turkish $\langle n, \langle\langle e,t\rangle, \langle e,t\rangle\rangle\rangle$
$[\![\text{CARD}_\emptyset]\!] = \lambda n \lambda P_{AT} \lambda x.\ \exists S\ [\prod(S)(x) \wedge |S| = n \wedge \forall s \in S\ P(s)]$

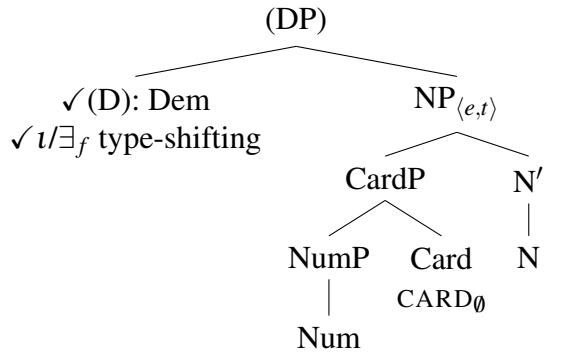
As expressions of type $\langle e,t\rangle$, NCs with the covert CARD can directly occupy the predicate position or merge with an overt D. They can also undergo covert *iota* type-shifting or $\exists$ type-shifting through the choice function, as shown in (36). This allows them to receive not only indefinite but also definite interpretations without demonstratives. In contrast, NCs with *tane* mirror the intrinsic indefiniteness seen in NCs of other languages, as illustrated in (35).

[9]The possibility remains open that in some articleless languages, ι may be introduced within a covert DP projection rather than functioning as a type-shifting operation. In line with the analysis offered in this study, such languages are expected to allow definiteness in NCs via ι. For Turkish, I align with the views of Öztürk (2005) and Bošković and Şener (2014), who argue against the existence of a D projection in the absence of an overt definite article (cf. Arslan-Kechriotis 2009; von Heusinger and Kornfilt 2017, a.o.).

(35) NCs with *tane*$_f$



(36) NCs with CARD$_\emptyset$



It is essential to highlight that the ∃ type-shift of NCs with CARD$_\emptyset$ via the choice function is not expected to be impeded by NCs with *tane*. This is because the choice function is introduced through separate mechanisms in these constructions —as a lexical item in one case and as a covert type-shifting operation in the other —at different syntactic levels, thereby eliminating the possibility of a blockage effect.

To wrap up the discussion so far, the fundamental reasoning supporting the view that NCs are predominantly argumental expressions across different languages is grounded in the exceptional pattern observed in Turkish NCs. Viewing NCs as consistently of the predicative type fails to account for the resistance of NCs with *tane* and NCs in languages without articles to *iota* type-shifting for definite interpretations, a resistance not observed in NCs lacking *tane*. However, the existence of intrinsically predicative NCs must also be recognized to explain the availability of definite interpretations for NCs without *tane*, unlike their counterparts with the classifier. In short, this distinction in Turkish NCs hints at the existence of two distinct types of NCs: the typical argumental type and a less common predicative type, the latter perhaps existing alongside inherently indefinite NCs within the same language. The analysis of Farsi NCs, which we turn to next, will shed more light on this point.

6. The Mirror-image Pattern in Farsi NCs

We have seen that in Turkish, NCs with the overt CARD are the default form with a built-in indefinite semantics, whereas NCs with the covert CARD have a predicative denotation. I will now demonstrate that Farsi exhibits an opposite pattern compared to Turkish NCs.

Farsi is an optional classifier language with a systematic number marking system and lacks an overt definite article, similar to Turkish (Ghomeshi 2003, 2016, Gebhardt 2009, Mache 2012, Krifka and Modarresi 2016, Sağ 2019, a.o.). Not surprising at this point, NCs in Farsi can be indefinite irrespective of the classifier *tā*, as demonstrated by their ability to introduce new discourse referents in the initial sentence of (37). However, Farsi diverges from Turkish by also allowing plural marking in NCs, which results in definiteness.[10] Without plural marking, NCs can only convey indefinite interpretations. Crucially, plural marking is exclusively applicable to NCs with *tā*, suggesting that a definite interpretation is possible only in this form. In contrast, NCs without *tā* can only display a definite-like behavior if accompanied by a demonstrative, as the contrast in the follow-up sentence in (37) illustrates (cf. with the Turkish (27)):

(37) Polis dar h*ā*l-e barrasi-e marg-e **se (t*ā*) moallem-e zan-(*h*ā*)** ast.
police in investigation-EZ death-EZ three CL teacher-EZ female-PL is
Ras*ā*ne-h*ā*-ye mahali migooyand **se *(t*ā*) zan-h*ā*/ #(in) se (t*ā*) zan** ke
channel-PL-EZ local say three CL woman-PL this three CL woman that
dar daheye panjah-e zendegi-e khod budand.
in fifties-EZ life-EZ themselves were.
'The police are investigating the death of three female teachers. Local channels report that *the three women/ these three women* were in their fifties.'

I propose that, similar to the case in Turkish, *tā* is the overt form of CARD and in the absence of *tā*, Farsi NCs feature a covert CARD. However, in Farsi, the covert CARD is associated with the choice function, and the overt CARD results in predicative NCs.

Building on the proposals in Ionin and Matushansky (2019) and Alexiadou (2019), I analyze plural marking in Farsi NCs as a form of number agreement, which, unlike plural agreement in English NCs, is constrained by definiteness (see also Smith-Stark, 1974; Corbett, 2000).[11] As *e* type expressions, NCs without *tā* cannot receive definite interpretations due to the unavailability of ι type-shifting. Consequently, we do not witness plural agreement on the lexical NP in the absence of *tā*. Similar to the case of Turkish NCs with *tane*, NCs without *tā* can combine with a demonstrative through the *ident* operator, triggered as a result of the type-mismatch arising when the NC is a complement to the D head. In contrast, NCs with *tā*, as predicative expressions of type $\langle e,t\rangle$, allow for ι type-shifting, which results in plural agreement.[12]

[10]The plural marking does not necessarily yield definiteness when marked on nouns in Farsi. Farsi plural nouns can denote non-specific narrow scope existential readings, similar to English bare plurals: In ruzh*ā*, gorbe-h*ā* be b*ā*gh-e-man nemi*ā*yand. 'These days, cats are not coming to my garden.' (no cats, # some cats > not)

[11]Ionin and Matushansky (2019) and Alexiadou (2019) propose an agreement-based analysis for Western Armenian NCs, which differ from Farsi NCs in exhibiting plural marking with specific indefinite and definite NCs (cf. Sigler 1996, Bale et al. 2010, Martí 2020, Kalomoiros 2021, Scontras 2022, a.o.). In Sağ (2024), I also analyze Western Armenian NCs within the proposal offered in this paper.

[12]Regarding complex numerals, as indicated in fn. 5, Ionin and Matushansky (2006, 2019) suggest a compositional derivation. In their framework applied to the current analysis, complex numerals would involve multiple cardinal heads: [[three CARD] [hundred CARD apples]] (cf. Rothstein 2017). However, this approach is incompatible with argumental (*e* type) NCs, where CARD needs a property as its argument, thereby precluding iterative CARD heads. This is confirmed in Turkish argumental NCs, where the *tane* is non-iterative and only follows the numeral closest to the noun (e.g., *üç (*tane) yüz (tane) elma* 'three hundred apples'). Similarly, in Farsi predicative NCs with *tā*, CARD cannot be repeated within a numeral complex (e.g., *si (*tā) sad (tā) sib* 'three hundred apples'). Therefore, I have imposed an atomic property requirement on CARD, diverging from Ionin and Matushansky's view. Predicative NCs like *sad tā sib* 'hundred apples,' not being atomic properties, cannot combine with an

This pattern of interpretation in Farsi NCs, mirroring what we observed in Turkish, demonstrates that Turkish is not unique in permitting both predicative and argumental NCs. It also emphasizes that the determination of which CARD head assumes an indefinite or predicative role is language-specific and not linked to the morphological form of CARD itself.

7. Conclusion

This study has explored the inherent indefiniteness of NCs across languages, focusing on the patterns that emerge in languages with and without articles. We have seen that while NCs can pair with overt definite determiners to achieve definiteness, in articleless languages they often require alternative markers for a definite interpretation, a divergence from the behavior of bare nouns, with which definiteness is possible through a covert *iota* operator. Aiming to understand why in articleless languages, the covert *iota* does not universally apply to NCs for definiteness, our investigation has centered on the optional classifier system in Turkish NCs. A key focus of this study has been the influence that the presence or absence of *tane* exerts on the interpretation of NCs. Notably, we have discovered that definiteness, unattainable when *tane* is present, becomes available in NCs in the absence of *tane*.

I have proposed that across languages, NCs function primarily as argumental expressions of type *e* with their indefiniteness derived from a cardinal head via a choice function. This proposal, which posits that the predicative use of inherently argumental type NCs is contingent upon structural necessities, challenges the traditional view of NCs as inherently predicative expressions and reveals the role of *iota* in articleless languages as a type-shifting operator, rather than a covert D head. The seemingly exceptional pattern of Turkish NCs has further led to the conclusion that languages can feature inherently predicative NCs alongside default argumental ones, particularly when multiple forms of the cardinal head are present. Turkish, with its use of both a covert and an overt cardinal head, the latter realized as *tane*, exemplifies this phenomenon. The analysis of Farsi NCs further corroborates these findings, providing a cross-linguistic perspective that solidifies my proposal. The subsequent challenge involves investigating the broader issue of why cardinality is intrinsically linked with indefiniteness.

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additional CARD head in our model. I propose that complex numerals are formed by covert arithmetic operators (multiplication and addition) yielding a complex number that feeds the argument slot of the cardinality function.

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Responsible drivers and good passengers: the influence of non-intersective modification on nouns[1]

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Abstract. A noun modified by a non-intersective adjective is standardly said to denote a subset of the unmodified noun's extension; ⟦skillful surgeon⟧ is a subset of ⟦surgeon⟧ (Siegel, 1976; Kamp and Partee, 1995). I argue that many non-intersective adjective-noun combinations actually denote a subset of the modifier's extension (e.g. ⟦skillful surgeon⟧ is a subset of ⟦skillful⟧). I define *quality adjectives* — adjectives that describe goodness or character traits specifiable by an identity — as a subclass of non-intersective modifiers and provide data to suggest these modifiers are centrally predicated while the nouns they modify restrict their context. I derive these cases from a dyadic generic quantifier over Kratzerian situations that situates the nominal in its restrictor and the adjective in its nuclear scope. This accounts for three novel generalizations regarding how certain quality modifiers influence nouns: quality modifiers alter the temporal properties of nouns, suppress the second argument of relational nouns, and resist nouns that reference species and natural classes.

Keywords: modification, adjectives, non-intersective, genericity, relational nouns, stage-level, individual-level, situations

1. Introduction

Adjectives can be classified as intersective or non-intersective (Siegel 1976; Kamp and Partee 1995; Larson 1998). An intersective adjective ascribes a property to an individual, and its denotation is not informed by the modified noun. For example, if Floyd is a blonde linguist and a singer, it is entailed that Floyd is a blonde singer, shown in (1). On the other hand, the meanings of non-intersective adjectives hinge on the head noun they modify. However, if Bertha is a skillful linguist and a singer, this does not entail that she is a skillful singer, shown in (2). In *skillful linguist*, the meaning of *skillful* is informed by *linguist*.

(1) Floyd is a blonde linguist.
Floyd is a singer. *(intersective)*
$\rightarrow$ Floyd is a blonde singer

(2) Bertha is a skillful linguist.
Bertha is a singer. *(non-intersective)*
$\not\rightarrow$ Bertha is a skillful singer.

Intersective adjectives can be assigned an interpretation via Heim and Kratzer 1998's Predicate Modification rule. In example (1), *blonde* and *linguist* would each apply to *Floyd* without influencing the meaning of one another. However, a denotation for non-intersective adjectives is less straightforward. It is unclear how *skillful* can access the meaning of *linguist*—compositionally or pragmatically—and either way, what its denotation would need to look like.

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There are many flavors of non-intersective adjectives that have different semantic effects and require different analyses (see Morzycki 2016 for an overview). This research focuses on a subclass of non-intersective modifiers which I will call 'quality adjectives'. These include adjectives that fall on a scale of goodness or badness like in (3). They do not specify the dimension on which this property holds, but this can be informed by the noun it modifies.

(3) Howard is a { good / great / bad / horrible } skateboarder.

Quality adjectives also include modifiers that reference a character trait specifiable by an identity, shown in (4).

(4) Bertha is a { kind / strict / fair / caring } teacher.

One diagnostic to identify a quality adjective is whether it fits into the frame: *x is ADJ in the way x is a NOUN*. This is shown in examples (5) and (6) below.[2]

(5) Howard is { good / great / bad / horrible } in the way he is a skateboarder.

(6) Bertha is { kind / strict / fair / caring } in the way she is teacher.

Quality adjectives are also ambiguous — they allow non-intersective and intersective interpretations (Siegel, 1976; Larson, 1998). Larson presents the example *beautiful dancer*, shown in (7a). This has the meaning that Bertha is *pretty and a dancer* (intersective) as well as the

[2]There's admittedly an oddness to the examples in (5). I attribute this to competition with the phrase *skateboards well* for example. Importantly, though, the sentences in (5) sound more natural in this frame than standardly intersective modifiers do, as in (ia) and other types of non-intersective modifiers — such as temporal (Gehrke and McNally, 2015), privative (Partee and Borschev, 1998), and relational (McNally and Boleda, 2004) adjectives — do, as in (ib).

(i) a. Howard is { tall / blonde / Canadian } in the way he is a skateboarder.

b. Howard is { occasional / pretend / professional } in the way he is a skateboarder.

The awkwardness of the quality modifiers in (5) compared to those in (6) is nonetheless notable and perhaps suggests a further grammatical distinction between the two. I treat them as one category for now as they share the same effects on nominals, as is to be discussed in this paper, though exploring this distinction is a fruitful area for future research.

interpretation that she *dances beautifully* (non-intersective). Martin (2018) provides the additional example *good thief*, shown in (7b). This has the interpretation that Bertha is a moral thief (intersective) and the interpretation that she is good at stealing (non-intersective).

(7) a. Bertha is a beautiful dancer.
b. Bertha is a good thief.

Prior analyses of the ambiguity of non-intersective modifiers fall into two main classes: analyses that place weight on the noun (N-analysis) and analyses that place weight on the adjective (A-analysis). Larson (1998) influentially presents an N-analysis: *beautiful* maintains its meaning across both interpretations. *Dancer* is represented with dancing events. The ambiguity of the expression hinges on whether *beautiful* applies to an individual (intersective) or an event (non-intersective). Therefore, a non-intersective modifier's ability to be accessed by its head noun is enabled by a more complex representation of the head noun, as opposed to the adjective. Maienborn (2021), on the other hand, argues that the ambiguity lies within the representation of the adjective. *Dancer* remains a nominal property under both interpretations, while the denotations for *beautiful* and other quality adjectives serve as predicate modifiers with the use of tropes (Moltmann, 1997) and pragmatic context. Both of these frameworks have laid crucial groundwork for ways to think about this puzzle, but the data presented here require a closer look at the empirical picture. As opposed to honing in on the case of *beautiful dancer*, namely the ambiguity of *beautiful*, I examine on a broader level how all quality modifiers influence the interpretations of their head nouns. I introduce into the analytical picture three novel observations. Non-intersective quality adjectives...

- alter the temporal properties of nominals.
- facilitate a sortal interpretation of relational nouns.
- lack ambiguity when modifying class nouns.

On the backbone of these empirical observations, I present an analysis that ultimately treats *beautiful dancer* as *beautiful as a dancer* via a silent operator, AS. In line with Larson, it uses a genericity operator to account for the influence on stage-level nouns and relational nouns. At the heart of this analysis is the idea that non-intersective quality adjectives are not actually non-intersective–at least not in the way that has been previously discussed. Rather than *beautiful dancer* denoting a subset of dancers, I propose that *beautiful dancer* narrows the context of an individual's being beautiful.

2. Temporal properties

When a stage-level noun is modified by an individual-level quality adjective, the full NP is individual-level. I adopt Chierchia (1995)'s definition of stage- and individual-level predicates, which builds upon Kratzer (1995). Stage-level predicates contain existentially bound eventuality variables that reference spaciotemporal properties. Meanwhile individual-level predicates contain generically bound eventuality variables, thus they hold of an individual regardless of location or time. A stage-level noun like *passenger*'s extension hinges on the external situation

of the individual it applies to, shown in example (8).

(8) Floyd is a passenger. *(only holds while Floyd is a passenger on a particular voyage)*

Meanwhile, many quality adjectives such as *polite* and *annoying* are individual-level because they hold of an individual over time. If a stage-level noun is modified by an individual-level quality adjective, the full NP will be individual-level, taking on the properties of the adjective, as shown in (9).

(9) Floyd is a { good / annoying / polite } passenger.
(can hold when Floyd is not a passenger on a particular voyage)

Quality adjectives can also alter the generic readings of nouns. Many nouns entail that an individual performs an action professionally or at least habitually. In the sentences in (10), *dancer*, *singer*, and *photographer* are most naturally taken to reference a career or a regular hobby that the individual has.

(10) a. Floyd is a dancer.
→ Floyd dances professionally or often.
b. Clyde is a singer.
→ Clyde sings professionally or often.
c. Bertha is a photographer.
→ Bertha takes photos professionally or often.

However, this entailment is lost when these nouns are modified by quality adjectives. Instead it is the adjective that is habitual or generic. The noun then serves as a restriction for the adjective. It is possible to be a beautiful dancer without professionally or regularly dancing, shown in (11a). This effect especially surfaces when the quality adjective is negative. If someone is a clumsy dancer, then it's likely that they don't dance regularly, shown in (11b).

(11) a. Ellie is a { beautiful / great } dancer. It's a shame she doesn't dance more.
b. Bruce is a { bad / clumsy } dancer. No wonder he doesn't dance often.

This effect also enables using certain agentive nominals under quality modification, which would independently be infelicitous like the examples in (12a) and (12b) or have drastically different meanings like the sentence in (12c). While *good listener* and *good kisser* are common phrases, the meaning of *listener* or *kisser* is less clear, especially without supporting context. Meanwhile, describing someone as a *driver* unmodified suggest this is their career, while a *bad driver* can easily describe anyone who has ever driven, regardless of their career.

(12) a. Floyd is a ?? ({ good / bad / thoughtful }) listener
b. Clyde is a ?? ({ good / bad / passionate }) kisser.

c. Bertha is a ?? $\left(\left\{ \begin{array}{l} \text{good} \\ \text{bad} \\ \text{fast} \end{array} \right\} \right)$ driver.

Maienborn (2021) brings up *fair loser* as counter-evidence to Larson (1998). A *fair loser* is not someone who loses fairly, but who acts in a fair or polite manner when they lose. Furthermore, these phrases do not classify an individual as a 'loser' at all. Rather they classify the individual as *fair*, the adjective, while *loser* contextualizes its dimension. The sentence in (13a) does not entail that Floyd is a loser or regularly loses. *loser* merely establishes context for situations in which Floyd acts *fair*. Like the examples in (12), the meaning of *loser* also drastically shifts without quality modification, shown in (13b). It either means Floyd is a unsuccessful person (likely derived from a *habitually loses* interpretation) or there is unspecified contexts that eliminate the generic interpretation (e.g. *Floyd is a loser of the game we played*).

(13) a. Floyd is a fair loser.
b. Floyd is a loser.

This effect also surfaces in the verbal domain. Larson highlights that *beautiful dancer* can be paraphrased as *dances beautifully*. While I ultimately argue these phrases are not fully truth-conditionally equivalent, he raises the important point that *dances* parallels the restrictor behavior of *dancer*. *Dances* in examples (14a) and (15a) encodes habitual dancing events. Thus follow-up sentences that contradict this habituality sound strange. However, *dances beautifully* does not entail habitual dancing events—it only means that when an individual dances, their dancing is beautiful. Thus the sentences in (14b) and (15b) sound natural.

(14) a. ??Floyd dances. It's a shame he doesn't dance more.
b. Floyd dances beautifully. It's a shame he doesn't dance more.

(15) a. ??Wow, Clyde dances! I can't believe he's never tried dancing before.
b. Wow, Clyde dances beautifully! I can't believe he's never tried dancing before.

A summary of the data so far is: if a stage-level noun is modified by an individual-level quality adjective, the full NP will be individual-level. If a noun entails a habitual or professional action, modification by a quality adjective may eliminate this entailment—instead the adjective will have a habituality entailment. A common theme among these effects is that the properties of the quality adjectives survive while those of the noun are suppressed.

3. Relational nouns

Quality modifiers facilitate a sortal interpretation of relational nouns. Some relational nouns sound most natural with both of their arguments pronounced. The sentence in (16c) isn't necessarily ungrammatical, but it's odd to say out of the blue—especially on the intended *brother of someone* reading.

(16) a. Clyde is Floyd's brother.
b. Clyde is a brother of Floyd's.
c. #Clyde is a brother.

With quality modification, these relational nouns sound more natural without their second argu-

ment pronounced. The sentence in (17) does not require special context—it's a normal way to describe an individual, and it maintains a generic interpretation that the Clyde is a good brother *to someone*.

(17) Clyde is a { good / responsible / caring / kind } brother.

Furthermore, if a second argument is to be introduced with quality modification, the preposition changes. Unmodified, brother's second argument is introduced with genitive *of*, shown in (18a). However, to introduce a second argument to *kind brother*, using *to*, shown in (18b). This is also notably a preposition that *kind* selects for independently, shown in (19).

(18) a. Floyd is a brother { of / ??to } Floyd

b. Clyde is a kind brother { ??of / to } Floyd

(19) Clyde is kind to Floyd.

The generic influence of quality modifiers on relational nouns also extends beyond kinship terms. For example, Partee and Borschev (1999) analyze nominals modified by *favorite* as relational, as they require a possessor. The meaning of *favorite* inherently links a favored individual *to* a second individual. As a result, *favorite movie* sounds odd without an overt possessor (20). Furthermore, the easiest accommodation of the form without the second argument is that *Back to the Future* is a favorite movie of a certain person/around here, which eliminates a generic interpretation and contains a specific implicit possessor.

(20) *Back to the Future* is { ??a / Floyd's } favorite movie.

However, when *favorite movie* is modified by a quality adjective, it easily allows for an unpronounced second argument, which clearly has a generic reading. The sentence in (21) means that *Back to the Future* is a good/bad/valid favorite movie for someone *to have* in general. There is no specific possessor mapped onto the nominal.

(21) *Back to the Future* is a { good / bad / valid } favorite movie.

A final point of relevance touches again on the parallel between nominals modified by adjectives and habitual verbs modified by manner adverbials. Relational nouns have long been compared to transitive verbs as they share a two-place argument structure (e.g., Partee and Borschev, 1999). Like relational nouns, a generic reading of a two-place predicate, such as *kiss*, with only one pronounced argument sounds strange without strong contextual support. *Floyd kisses* sounds odd on its own (22a), just as *Floyd is a brother* does. However, modifying *kisses* with a manner adverbial, such as *passionately*, eases the interpretation, shown in (22b).

(22) a. ??Floyd kisses.

b. Floyd kisses $\left\{ \begin{array}{l} \text{passionately} \\ \text{badly} \\ \text{sloppily} \end{array} \right\}$.

The effects seen here also resemble Condoravdi (1989)'s observation about middle constructions. She notes that middles without adverbial modification sound strange, as in (23). Meanwhile manner adverbs improved the accessibility of their readings, shown in (24). The effect of these adverbs led her to hypothesize that the adverbs serve as the main predication in the clause; not the verb.

(23) a. #This book reads.
b. #This bread cuts.

(24) a. This book reads easily.
b. This bread cuts well.

Though I ultimately argue that agentive nouns, such as *kisser*, and habitual verbs, such as *kisses* are not truth conditionally equivalent, their influence under adjectival and adverbial modification show striking parallels in their interpretations, especially with an unpronounced second argument, which would suggest some overlap in their semantic analyses.

4. Class nouns

As discussed in the introduction, quality adjectives have intersective and non-intersective interpretations. In example (25), *good thief* could mean *moral thief* or *good at stealing*. However, quality modifiers are not ambiguous in every context. In example (26), *good person* is not ambiguous. There is no crisp distinction between the meanings of *good and a person* and *good as a person*.

(25) Bertha is a good thief.
a. Bertha is a good person and a thief. *(intersective)*
b. Bertha is good at being a thief. *(non-intersective)*

(26) Bertha is a good person.
a. Bertha is a good person and a person. *(intersective)*
b. Bertha is good at being a person. *(non-intersective)*

This observation extends to the generalization that nouns that involve specific actions or functions allow non-intersective modification by quality adjectives. Meanwhile, nouns that reference species or inherent classes do not allow for a non-intersective interpretation of quality adjectives. This remains relevant in exceptional cases when *good as a person* has a distinguished meaning from the intersective interpretation. For example, a coercible non-intersective interpretation of the sentence in (26) is that Bertha is an alien or robot who resembles a person well.[3] This is the case because *person* in this context no longer references Bertha's species, but rather a role that she is imitating as a non-person.

[3]The predicate *makes* especially encourages this interpretation, as shown in (i).
(i) Bertha makes a good person.

This contrast between nominals parallels observations in Zobel (2017)'s discussion of role nouns: *Class nouns* are defined by their inherent characteristics (e.g. *person*, *cactus*) while *role nouns* have actions associated with them (e.g. *thief*, *dancer*). This analytical intuition is supported by empirical observations that interface with modification. For example, Zobel highlights that in languages such as Dutch and German, many role nouns occur without indefinite determiners in predicative position.[4] This is seen in examples (27) and (28) for German.

(27) Floyd ist (*ein) Architekt.
Floyd is architect
'Floyd is an architect'

(28) Floyd ist *(ein) Mann.
Floyd is (INDF.DET) man
'Floyd is a man'

Furthermore, the interpretation of class nouns without a determiner classifies the individual as having characteristics aligning with properties of the nominal predicate, as opposed to belonging to its inherent class. For example, predicating *Mann* without an indefinite determiner means that Floyd acts like a stereotypical man as opposed to merely biologically being one.

(29) Floyd ist Mann.
Floyd is man
'Floyd is manly/Floyd acts like a man.'

(30) Floyd ist ein Mann.
Floyd is INDF.DET man
'Floyd is a man.'

The contrast between *ist Mann* and *ist ein Mann* maps well onto the intersective and coerced non-intersective (i.e. alien) reading of *good person*. In German, there exists a grammatical distinction in predicative position between being biologically classified as a man and resembling one. The former is expressed with a determiner, while the latter is expressed as a bare noun. In English, this same 'role' or resemblance interpretation of a class noun like *person* can be brought out with a quality modifier like *good*. While intersective modifiers like in (31) do not provide context that an individual resembles the traits of the head noun (rather, that inherently possessing them), quality modifiers allow a conceivable context in which the individual's skill level at resembling the nominal is expressed, as shown in (32).[5]

(31) Greta is/*makes a { tall / blonde / young } person. *entails: Greta is a person*

(32) Greta is/makes a { good / bad / decent } person. *Greta could be a robot imitating a person.*

This observation extends to the modification of artifacts. Zobel gives the sentence in (33) as an example of inanimate objects potentially being able to be represented with roles. The piece of wood is not prototypically a paddle, but it functions as one in the context provided. I observe that a crucial component of this interpretation is the modifier *good*. Without it, the sentence sounds odd and *paddle* loses its function interpretation, shown in (34).

[4]The general pattern of certain nominals lacking determiners in predicative position is cross-linguistically robust beyond German and Dutch. However, the exact constraints are lexically idiosyncratic. See De Swart et al. (2007); Geist (2014) for additional data and discussion.

[5]*Makes* is also infelicitous when the following nominal is only intersectively modified, as shown in (31). Though the semantics of *makes* is beyond the scope of this paper, it appears to only be licensed under certain quality modifiers, pointing to a further compositional difference between the two adjective types.

(33) Unfortunately, we only had a piece of wood to steer the boat. It was a **good paddle**, though.

(34) Unfortunately, we only had a piece of wood to steer the boat. ??It was a **paddle**, though.

Zobel (2017) additionally discusses the importance of restrictive role *as*-phrases, building on research from Landman (1989) and Moltmann (1997). She observes that only role nouns can occur in *as*-phrases with the interpretation *in their role as*. For example, in sentence (35) *as a man* can mean *because he is a man*, but it lacks the interpretation that Floyd earns this amount by fulfilling his role as a man. This contrasts *as a judge* in sentence (36), which can mean that Floyd makes 3000 Euros through being a judge.

(35) #Floyd makes 3000 Euros as a(n) { man / person / adult }.

(36) Floyd makes 3000 Euros as a { janitor / teacher / judge }.

Makes 3000 Euros functions well as a predicate that selects for certain roles because earning money requires a career, thus it is most compatible with restrictive role *as*-phrases that contain a career-denoting nominal or one that can be coerced as such. Quality adjectives also function well as predicates that select for roles under Zobel's framework. For example, *kind*, can be related to a specific identity one holds, as shown in (37). Conversely, *tall*, an intersective modifier, sounds odd with restrictive role *as*-phrases, as in (38).

(37) Greta is kind as a { sister / teacher / judge }.

(38) ??Greta is tall as a { sister / teacher / judge }.

Quality modifiers like *kind* followed by restrictive-role *as*-phrases have a similar, if not truth-conditionally equivalent, meaning to the non-intersective interpretation of a noun attributively modified by the same adjective. For example, a paraphrase of the non-intersective interpretation of *kind judge* is *kind as a judge*, as has been noted by e.g. Landman (1989); Moltmann (1997).

Though my analysis does not commit to role variables in the ontology as Zobel 2017's does, this overlap in data between role nouns and modification illustrates the importance of the context the nominal provides in these structures. While Zobel focuses on the properties of these nominals, I highlight the overlap of 'role-sensitive' predicates and quality adjectives — both are only compatible with certain nominals.

5. Data summary

I have shown that quality adjectives grammatically influence the nominals they modify. Firstly, they alter the temporal properties of the noun. If the noun is stage-level and the quality adjective is individual-level, the full NP will be individual-level, as in the case of *good passenger*. If the noun entails a habitual action, quality modification can eliminate this entailment, as *clumsy*

does for *clumsy dancer*. Next, quality adjectives facilitate a sortal interpretation of relational nouns. If a relational noun sounds odd without its second argument pronounced, quality modification will make this reading more salient, as *kind* does in *kind brother*. Lastly, they lack a non-intersective interpretation when modifying 'class nouns' — nouns that denote biological classes or species. Thus *good person* only has a salient non-intersective interpretation if the individual it applies to is not a person but instead good at resembling one.

These data points suggest an analysis for quality adjectives that shifts the modified noun's semantics to discount its temporal and argument structure information. I ultimately situate the nominal in the restrictor clause of a generic operator to account for this effect, but first discuss prior literature in this domain.

6. Prior research

Earlier work analyzing quality adjective *beautiful* in *beautiful dancer* generally falls into two categories: one that establishes the link between the nominal and modifier by decomposing the nominal and maintaining the denotation of the adjective across both interpretations (an N-Analysis Larson, 1998) and one that links the modifier to the nominal by representing non-intersective *beautiful* differently across the two interpretations while maintaining the meaning of *dancer* (an A-Analysis Maienborn, 2021).

A caveat to this discussion is that quality adjectives are not a well-established sub-category of non-intersective modification. Thus, the authors discussed handle in part quality adjectives but aim to account for different, wider sets of non-intersective adjectives in their ultimate proposals. For example, Larson (1998) extends his analysis to *old friend*, which is not an example of quality modification. Maienborn (2021) handles *trained* in her analysis, which also is not a quality modifier. Both cases fail the *way* diagnostic, shown in (39).

(39) a. #Floyd is old in the way he is a friend.
b. #Eloise is trained in the way she is a dancer.

6.1. N-Analysis

Larson (1998) teases apart the ambiguity of *beautiful dancer* by decomposing *dancer* as an agent of dancing events that are typical in a context, C (40). There is an event variable, e, accessible as well as an individual variable, x; both can be modified by *beautiful*.

(40) $[\![\text{dancer}]\!] = \lambda x\,.\,\text{GEN}^{C} e[\textbf{dance}(x)(e)]$

Beautiful can apply to events as well as individuals, shown in (41).

(41) $[\![\text{beautiful}]\!] = \lambda\alpha\,.\,\textbf{beautiful}(\alpha)$
$\alpha \in x, e$

Intersective *beautiful* applies to the individual, x, shown in (42a), while non-intersective *beautiful* applies to the event, e, shown in (42b). *Beautiful* maintains its meaning across both readings, while the ambiguity is enabled by breaking down the representation of *dancer*.

(42) a. $[\![\text{beautiful dancer}]\!]_{\text{INT}} = \lambda x\ .\ \text{GEN}^C e[\textbf{dance}(e)(x) \wedge \textbf{beautiful}(x)]$
b. $[\![\text{beautiful dancer}]\!]_{\text{NI}} = \lambda x\ .\ \text{GEN}^C e[\textbf{dance}(e)(x) \wedge \textbf{beautiful}(e)]$

The merits of this analysis are firstly its simplicity. It avoids polysemy while aligning with the intuition and morphological evidence that *beautiful dancer* comes close to the meaning *dances beautifully*. I additionally argue the use of a generic operator is significant beyond binding the event variable in *dancer*. Incorporating genericity into the denotation of non-intersective modification supports its influence on stage-level predicates as well as its parallels in behavior with generic verb forms. This analytical choice supports, for example, the individual-level interpretation of *passenger*. Under a generic operator, instead of an existential quantifier, *passenger* would not be linked to a specific context.

While it is a less commonly referenced part of his paper, Larson (1998) additionally discusses the merits of situating the noun *dancer* in the restrictor clause of the operator, while the adjective *beautiful* occurs in the nuclear scope, as shown in (43b).

(43) a. $[\![\text{beautiful dancer}]\!]_{\text{INT}} = \lambda x\ .\ \textit{GEN}^C e[\textbf{dance}(e)(x) \wedge \textbf{beautiful}(x)]$
b. $[\![\text{beautiful dancer}]\!]_{\text{NI}} = \lambda x\ .\ \textit{GEN}^C e[\textbf{dance}(e)(x)][\textbf{beautiful}(e)]$

This analytical move extends the parallels between non-intersectively modified agentive nominals, such as *beautiful dancer* and their morphological counterparts of habitual verbs modified by adverbials, such as *dances beautifully* beyond their shared lexical roots. The positioning of *beautiful(ly)* in the nuclear scope of the quantifier while *dance(r)* serves as the restrictor points at a deeper connection in the grammar — in both cases, the main predicate applied to the individual is the predicate modifier, *beautiful(ly)*, while the noun and verb, *dance(r)*, serve to establish supplementary context. Such a compositional structure will also come to bear relevance on the influence of quality modifiers on stage-level and relational nouns, as discussed in Sections 2 and 3.

At the same time, Larson himself acknowledges that this analysis struggles to extend to nominals without morphologically transparent relations to verbs or conceptually clear notions of events. For example, *just king* is an example of non-intersective modification, but there is no morphologically transparent verbal form of *king* or adverbial form of *just*. Defining *king* events present conceptual challenges, as this notion is less well defined in our world than *dance* events.

(44) a. Floyd is a just king.
b. ??Floyd kings justly.

Maienborn (2021) also raises issues of a mismatch in meaning between quality modified deverbalized nouns and their verbal counterparts modified by adverbs. To be a *fair loser* is not truth-conditionally equivalent to *loses fairly* (45). The meaning of the quality adjective in this context relates more closely to the characterization of the individual as a loser, as opposed to merely their losing events. Thus even deverbalized nouns modified by adjectives do not always fully map in meaning to their adverbially modified verbal counterparts.

(45) Floyd is a fair loser. $\neq$ Floyd loses fairly.

I push this argumentation a step further: even *beautiful dancer* and *dances beautifully* are not semantically equivalent. While the non-intersective interpretation of *beautiful* prevents it from modifying an individual's physically appearance overall, it can modify an individual's

physical appearance related to their identity as a dancer. For example, *beautiful dancer* can refer to someone who looks beautiful in a dance costume but who does not necessarily dance beautifully, shown in (46a), while *dances beautifully* exclusively refers to dancing events, hence the oddness of the dialogue in (46b).[6]

(46) a. A: Bertha looks so stylish in that dance costume.
B: I know, she's such a beautiful dancer!
b. A: Bertha looks so stylish in that dance costume.
B: ??I know, she dances so beautifully!

This distinction can be seen more clearly with quality modifiers that are morphologically derived from subject-oriented adverbials, such as *responsible/responsibly.*[7] A *responsible driver* can refer to someone who registers their license on time or changes their oil regularly without actually involving their driving events as in (47a). Meanwhile, in *drives responsibly*, the adverbial is restricted to modifying driving events, not events associated with a driver identity that do not involve actual driving, shown in (47b).

(47) a. Clyde already registered his license. He's such a responsible driver.
b. ??Clyde already registered his license. He drives so responsibly.

Ultimately, Larson's N-Analysis of non-intersective modification illuminates important connections within the English grammar between the modification of the NP and VP, including genericity and restrictor/nuclear scope relations under quantification. However, his analysis cannot distinguish subtle differences in meaning between quality adjectives and adverbials.

6.2. A-Analysis

On the other end of the spectrum is Maienborn (2021)'s analysis which teases apart the ambiguity of *beautiful dancer* in the representation of *beautiful*. She starts off with the crucial assumption that there are no 'non-intersective' adjectives, in the sense that neither representation of *beautiful dancer* requires a compositional breakdown of the noun, as Larson's representation did. While 'non-intersective' *beautiful* modifies the individual's dancing, 'intersective' *beautiful* modifies the individual's physical appearance. Both of the modified nouns (physical appearance and dancing) are 'properties' of the individuals. To cash this out, Maienborn uses tropes (Moltmann, 1997), which Maienborn defines as particularized properties within their bearer (the individual). Under both interpretations of *beautiful dancer*, *beautiful* applies to a trope, r, of an individual, x. The denotation in (48) essentially says that a property r of an individual x is beautiful.

(48) $[\![\text{beautiful}]\!] = \lambda x_{\text{ENTITY}} \,.\, \textbf{bearer}(x, r_{\text{TROPE}}) \wedge \textbf{beautiful}(r)$

Acknowledging some merits of Larson's analysis, she represents deverbalized nouns, such as

[6]When *beautiful* describes physical appearance, it is naturally associated with an intersective interpretation (i.e. *x is beautiful and x is a dancer*). I argue however, that the context described is a usage of non-intersective *beautiful* because the individual's physical beauty is constrained to their dancing identity.

[7]I define subject-oriented adverbs as adverbs that are sensitive to properties of the subject and give rise to entailments involving it, as discussed by e.g. McConnell-Ginet (1982); Jackendoff (1972); Wyner (1994); Morzycki (2016).

dancer, with an event variable e that is related to a trope variable r via a function **manifest**. The definition of this trope is represented as the property of being a dancer.

(49) $[\![\text{dancer}]\!] = \lambda x\ .\ \exists r \text{GEN} e[\textbf{bearer}(r',x) \wedge \textbf{manifest}(r',e) \wedge \textbf{dance}(e) \wedge \textbf{agent}(e,x)]$

The trope of the individual that comes to be modified by *beautiful* (e.g. physical appearance, being a dancer) is pragmatically informed by the discourse context. For intersective *beautiful dancer*, *beautiful*, the individual's trope, r is set to the physical appearance of x, shown in (50a). In the case of 'non-intersective' *beautiful dancer*, *beautiful* applies to the dancing role established as a trope within x, shown in (50b). However, neither denotation is truly non-intersective. In both cases, *beautiful* applies to a trope of the individual regardless. Whether or not it is a dancer trope is not compositionally informed.

(50) a. $[\![\text{beautiful dancer}]\!]_{\text{INT}} = \lambda x \text{GEN} e[\textbf{bearer}(r',x) \wedge \textbf{manifest}(r',e) \wedge \textbf{dance}(e)$
$\wedge\ \textbf{agent}(e,x) \wedge \textbf{bearer}(r,x) \wedge \textbf{beautiful}(r) \wedge r = \textbf{phys-appearance}(x)]$

b. $[\![\text{beautiful dancer}]\!]_{\text{NI}} = \lambda x \exists r' \text{GEN} e[\textbf{bearer}(r',x) \wedge \textbf{manifest}(r',e) \wedge \textbf{dance}(e)$
$\wedge\ \textbf{agent}(e,x) \wedge \textbf{beautiful}(r')]$

Maienborn's trope analysis for 'non-intersective' *beautiful* modifies a property related to the dancing events without directly modifying the dancing events, which accounts well for the interpretation of subject-oriented modifiers, such as *fair loser*. However, its reliance on pragmatics fails to account for the grammatical influence of non-intersective modifiers on different nominals. For example, the representations of *beautiful dancer* in (50a) and (50b) do not predict that only the intersective interpretation would entail a habitual reading of *dancer*, while the non-intersective interpretation could be said if the individual did not dance regularly. The only difference between 'non-intersective' *beautiful dancer*, and intersective *beautiful dancer* is the final conjunct, and neither relates to the regularity of the dancing events. This analysis also does not predict the facilitated interpretation of relational nominals with an unpronounced second argument. Ultimately I argue for an analysis guided more heavily by patterns and less reliant on pragmatics than Maienborn, while adding to the complexity of Larson's account for subtle differences in meaning between deverbalized nouns and their verbal counterparts using situations.

7. Analysis

I use situations as a framework (Kratzer, 2007). Nominal and adjectival predicates apply to an individual and a situation variable, which represents a part of a world at a time.

(51) a. $[\![\text{dancer}]\!] = \lambda x \lambda s\ .\ \textbf{dancer}(x)(s)$

b. $[\![\text{beautiful}]\!] = \lambda x \lambda s\ .\ \textbf{beautiful}(x)(s)$

To link quality adjectives to nouns, I propose a dyadic generic quantifier with a distinct restrictor and nuclear scope. This is achieved with an operator, $[\![\text{AS}]\!]$.[8] In the restrictor, the nominal applies to a minimal situation s and an individual x. In the nuclear scope, a second minimal situation variable s' is existentially introduced, extending s to which the adjective applies. Typ-

[8] I do not intend this as a general denotation for the English word 'as', though my data on class-denoting nouns overlaps with work by Zobel (2017) on *as*-phrases and role nouns, thus this is a fruitful area for future research.

ically, for minimal situations s in which x is a dancer, there is a minimal situation s' in which x is beautiful, and s minimally extends to s'.

(52) $[\![\text{AS}]\!] = \lambda P_{\langle e,st\rangle}\lambda Q_{\langle e,st\rangle}\lambda x$. GEN $s[P(x)(s)][\exists s'[Q(x)(s') \wedge s \leq_{\min} s']]$

The intersective interpretation of quality adjectives lack an AS operator and is derived by Heim and Kratzer (1998)'s Predicate Modification rule. The nominal and adjectival situations are not connected to one another.

(53) $[\![\text{good thief}]\!]_{INT} = \lambda x$. GEN $s[s \in C][\textbf{thief}(x)(s)] \wedge$ GEN $s'[s' \in C][\textbf{good}(x)(s')]$

Meanwhile, under the non-intersective interpretation, the nominal situations minimally extend to the adjectival situations.

(54) $[\![\text{good AS thief}]\!]_{NI} = \lambda x$. GEN $s[\textbf{thief}(x)(s)][\exists s'[\textbf{good}(x)(s') \wedge s \leq_{\min} s']]$

Responsible driver can describe someone who registers their license or fills their gas tank responsibly because driver situations encompass contexts that do not involve driving events. Therefore, these situations are able to restrict an individual's situations of being responsible.

(55) $[\![\text{responsible AS driver}]\!] = \lambda x$. GEN $s[\textbf{driver}(x)(s)][\exists s'[\textbf{responsible}(x)(s') \wedge s \leq_{\min} s']]$

Meanwhile, under a standard Davidsonian representation, *drives responsibly* only includes event modification. *Responsible* modifies an individual's driving — not the way in which they are a driver.

(56) $[\![\text{drives responsibly}]\!] = \lambda x$. $\exists e[\textbf{drive}(e,x) \wedge \textbf{responsible}(e)]$

The application of AS to nominals that would be stage-level unmodified in predicative position, also accounts for their individual-level interpretation. Chierchia (1995) analyzes stage-level nouns using eventuality variables that are existentially bound via a higher functional head. I adapt his analysis to situations, shown in (57).

(57) $[\![\text{Floyd is a passenger}]\!] = \exists s[\textbf{passenger}(\textbf{Floyd})(s)]$

However, when *passenger* is modified by a quality adjective, like *good*, the AS operator binds its situation variable with a generic quantifier, thus there is no need (or opportunity) for existential quantification. Under a generic quantifier, *good passenger* will have an individual-level interpretation, shown in (58).

(58) $[\![\text{good AS passenger}]\!] = \lambda x$. GEN $s[\textbf{passenger}(x)(s)][\exists s'[\textbf{good}(x)(s') \wedge s \leq_{\min} s']]$

The situation of the nominal predicate in the restrictor clause also accounts for the changed interpretation of *dancer* under quality modification, such as *beautiful* or *bad*. As discussed earlier, the sentence in (59a) entails that Floyd is a dancer in some capacity, while the example in (59b) does not and even discourages contexts in which he is. If Floyd is a bad dancer, he probably is not a professional or regular dancer.

(59) a. Floyd is a dancer.
b. Floyd is a bad dancer.

Without the AS operator, *dancer* is an individual-level predicate. In the spirit of Kratzer (1995)'s analysis, I represent it with generically bound situations, shown in (60). This holds in

contexts where Floyd is regularly a dancer. Under a quality modifier, such as *clumsy* in (61), AS applies to *dancer*. While the situation *dancer* applies to is still generically quantified over, it is situated in the restrictor clause. Dancer situations are not typical—they provide context for situations of x being clumsy.

(60) $[\![\text{Bruce is a dancer}]\!] = \text{GEN } s[s \in C][\mathbf{dancer}(\mathbf{Bruce})(s)]$

(61) $[\![\text{Bruce is clumsy AS a dancer}]\!] = \text{GEN } s[\mathbf{dancer}(\mathbf{Bruce})(s)][\exists s'[\mathbf{clumsy}(\mathbf{Bruce})(s') \wedge s \leq_{\min} s']]$

Positioning the nominal function in the restrictor of the quantifier also accounts for the relative naturalness of a generic interpretation of *brother* without a second argument. Following Partee and Borschev 1999, I assume *brother* with an unpronounced argument has an existentially bound variable, as shown in (62).

(62) $[\![\text{brother}]\!] = \lambda s \lambda x.\exists y[\mathbf{brother}(y)(x)(s)]$

I argue *good brother* sounds more natural because the nominal is located in the restrictor clause. Conceptually, the nuclear scope is the main predicate, while the restrictor provides additional context. Thus, it follows that the omission of one of *brother*'s arguments is less salient in this position.

(63) $[\![\text{good AS brother}]\!] = \lambda x.\text{GEN } s[\exists y[\mathbf{brother}(y)(x)(s)]][\exists s'[\mathbf{good}(x)(s') \wedge s \leq_{\min} s']]$

This pattern is observable in additional generic contexts that *brother* occurs in. Generic *brother* with an unpronounced second argument is also facilitated as the subject of characterizing sentences, such as that in (64). In such a context, *brother* would also be analyzed to occur in the restrictor of the denotation (Carlson, 1989).

(64) $[\![\text{A brother shares his toys}]\!] = \text{GEN}x \;\; \text{GEN}s \; [\exists y[\mathbf{brother}(y)(x)(s)]]$
$[\mathbf{shares.his.toys}(x)(s)]$ *representation adapted from Carlson and Pelletier (1995)*

The proposed denotation also accounts for the general resistance of species-denoting terms from quality modification. I assume that all situations of x are *person* situations of x. Being a person is not defined by actions but inherent traits. If Floyd is a person, then all situations that he is in would be situations of him being a person. For this reason, *person* is a trivial restrictor, and the consequences of the truth conditions of (65) and (66) do not clearly differ.

(65) $[\![\text{good person}]\!]_{INT} = \lambda x.\text{GEN } s[s \in C][\mathbf{person}(x)(s)] \wedge \text{GEN } s'[s' \in C][\mathbf{good}(x)(s')]$

(66) $[\![\text{good AS person}]\!]_{NI} = \lambda x.\text{GEN } s[\mathbf{person}(x)(s)][\exists s'[\mathbf{good}(x)(s') \wedge s \leq_{\min} s']]$

In contexts where quality adjectives coerce role interpretations of class nouns, situations can be taken to be defined by function rather than inherent traits. Thus, it yields an *acts like* or *functions as* interpretation.

(67) $[\![\text{good AS paddle}]\!] = \lambda x.\text{GEN } s[\mathbf{paddle}(x)(s)][\exists s'[\mathbf{good}(x)(s') \wedge s \leq_{\min} s']]$

8. Taking stock

I have argued for an analysis of quality modification that centralizes novel data points related to how they influence the interpretation of the nominals they modify. Quality adjectives alter temporal properties of the nominal they modify, and they allow for a reading of relational nominals with an unpronounced second argument, and they are unable to modify species-denoting terms. I have proposed a silent operator (AS) that links the meaning of the nominal to adjective if their contexts are compatible. The use of a genericity operator and the nuclear scope/restrictor relation between the adjective and noun allow for the influence of quality modification on nominals in the ways mentioned above.

The novel data I have presented supports many components of Larson's (1998) analysis. By using a genericity operator, he accounts for the individual-level interpretation of stage-level predicates, as it binds the eventuality variable of the nominal. His additional mention of the nuclear scope/restrictor relation between *beautiful* and *dancer* touches on the crucial parallels between verbal and nominal predicates that are borne out across a wide variety of data and account for truth conditions observed about the habituality of events and situations. However, by using situations and applying the adjectival function to the individual variable in addition to the situation, my analysis predicts the subject-oriented interpretation of structures such as *fair loser* and *responsible driver*. Maienborn's (2021) analysis crucially introduces a wider variety of data into the picture. Her A-Analysis accounts for the breadth of non-intersective adjectives she examines and their truth conditions, but its lack of compositionality and reliance on pragmatics fails to predict the grammatical influence of non-intersective adjectives on the nominals they modify. My analysis incorporates the strengths of these two analyses while additionally accounting for the novel data I presented.

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On the meaning and use of *okay* in spoken German[1]

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Abstract. We present an account of the meaning and use of *okay* in spoken German based on a conversation analytic study of the Berlin-Map-Task-Corpus, focusing on three uses: *pure acknowledgment*, *acceptance*, and *undecidedness marking*. Semantically, we propose that *okay* denotes a truth predicate. This allows for a uniform semantics: The different uses of *okay* can be derived from that meaning in connection with the meanings of prosodic contours which we take here to indicate stance marking. Pragmatically, we propose that the basic function of *okay* is to indicate uptake. For simplicity and lack of space, our proposal will be approximated in terms of a three-valued propositional multi-agent model, in which *okay* is taken to denote a constant function from formulas to the truth value *true*.

Keywords: *okay*, truth predicate, uptake, acceptance, undecidedness, speech acts

1. Introduction

The particle *okay* has barely received any attention in formal semantics and pragmatics. This is surprising, as it is omnipresent in our everyday lives, be that at conferences, doctor's visits, in court, but also at the breakfast table and in gossiping with friends. This is reflected in the large body of work in conversation analysis on *okay*, which does not just show that *okay* is used in many different settings, but also that *okay* is used for performing different kinds of actions. These range from such familiar uses as accepting a proposal, offer, and so on, to actions such as transitioning between tasks and topics, but also closings of interactions. Also, it can be found in different languages, where it is used similarly, if not even identically (for an overview and references see Betz et al., 2021).

In Krifka (2013), *okay* has been addressed shortly. *Okay* is said to react to the speech act as opposed to the proposition of an antecedent clause. Further, *okay* itself does not commit the *okay*-speaker to the propositional content of the speech act. For instance, if Alice asserts that p and Bob says *okay*, then Bob does not become committed to p. According to Krifka, Bob indicates compliance with Alice' assertion, which he considers to mean that Bob's *okay* indicates that Bob accepts integration of p into the common ground (see Krifka, 2013: 10–11). An overall similar proposal has been made in Krifka (2022).[2]

In Venant and Asher (2015), *okay* is used as a natural language example that illustrates acknowledgments. They discuss acknowledgments that only indicate that the *okay*-speaker has understood their interlocutor, and others that actually lead to grounding of the content of the speech act the *okay*-speaker is reacting to. The latter entails commitments by the *okay*-speaker

[1]I would like to thank Manfred Krifka and Mingya Liu for reading, commenting, and discussing an earlier draft. Many thanks go to the SPAGAD Group and the EEL Group for discussion of the material as well as the participants of Sophie Repp's colloquium in Cologne. I would like to thank the anonymous reviewers of the original abstract for their comments (which I hope to address in detail at another occasion). Last but not least, many thanks to the organizers for putting together the conference. Part of this work was supported by the ERC Advanced Grant 787929 "Speech Acts in Grammar in Discourse" (SPAGAD).

[2]We lack space to discuss this in more detail, but the reader will see that our analysis of the meaning of *okay* differs substantially from Krifka (2013) and Krifka (2022).

to the propositional content of the speech act they are reacting to. We will encounter examples of both types in this article.

While the literature is sparse, it is presumably a common place within the research community that *okay* contrasts with particles such as English *yes* or German *ja* in the context of polar interrogatives that receive a question interpretation (as opposed to say, a request or offer interpretation).[3] While saying *okay* in response to questions is judged off, replying *yes* or *ja* is totally acceptable.

Example 1. (*okay* in the context of polar interrogatives: analogous for German; ↓= final fall)
A: Is it raining? B: Yes↓./#Okay↓.
A: Shall we go to the Italian restaurant? B: Yes↓./Okay↓.
A: Can you pass me the salt? B: Yes↓./Okay↓.

The first question seeks information about the weather and while *yes* can be used to provide that sort of information, *okay* appears to be unable to do so. However, when a polar interrogative becomes interpretable as an offer or proposal (second case), or as a request or search for help (third case), *okay* becomes felicitous. These are speech acts which pose action-coordination problems and *okay* indicates compliance in such cases. The same goes for *yes* (again, this is alike for German).

We want to suggest that *okay* cannot be used to perform the speech act of answering information seeking questions, because *okay* conveys epistemic ignorance (see also Oloff (2019) for German, and Lindström (2018) for Swedish). Answering, however, seems to indicate knowledgability. On the other hand, if an interrogative can be interpreted as a proposal, offer, request or similarly, what can be taken at stake is whether the addressee is willing to undertake certain commitments. Thus, these interpretations do not (primarily) concern the knowledge of the addressee, but their current and future actions. In general, *okay* seems to be able to indicate acceptance rather than actual determining an action in these cases. The *okay*-speaker cannot be understood as claiming authority over the future actions of the interactants. Thus, the *okay*-speaker simply adopts the agenda proposed by their interlocutor. An in-depth study of *okay* in the context of interrogatives is planned for the future.

This article zooms in on three responsive *okay* uses, which we call *acceptance*, *pure acknowledgment*, and *undecidedness marking*, where the last kind of uses have not been discussed in the literature yet. We argue that *okay* semantically denotes a truth predicate and that pragmatically, *okay* is used to perform uptake. In combination with prosodic contours, different kinds of responses can be realized. For lack of space and for the sake of simplicity, we will approximate this idea in terms of a three-valued propositional multi-agent system.

2. Some uses of *okay* in spoken German

Our proposal is based on a large conversation analytic study of the *okay* tokens appearing in the video material of the L1-subcorpus (release 2.1) of the Berlin-Map-Task Corpus (BeMaTaC, Sauer (2013); on conversation analysis see for instance Schegloff (2007) and more generally Sidnell and Stivers (2013)). The map task corpus was interesting for our purposes, because the

[3] See also Krifka (2013) on *okay* in the context of questions.

setting constructs a joint project which requires coordination of knowledge. In a map task, we have a person with the full map, and a person who needs to copy the path from a dedicated starting point to a dedicated end point. The map contains pictures around which the path moves. In this particular map task experiment, each round has exactly one mismatch in pictures. Participant pairs perform the task twice with a role swap and a different map. The participants of the map task cannot see each other nor each other's sheet. This forces communication to be exclusively verbal and it creates an epistemic asymmetry. This provides a context in which words like *okay* are useful, because they can signal acknowledgments, acceptances, but they can also be used to manage the interaction via transition indication or indication of closings.[4]

The L1 sub-corpus provides around 66 minutes of video material. The recordings show a third-person perspective of the drawing person, which (in principle) allows to see what they are drawing, when they are drawing, etc. The video material contains 133 particle *okay* tokens. The tokens showcase many different uses of *okay*, ranging from transitional *okay*s, to acceptance marking *okay*s, undecidedness marking *okay*s, to auto-reflexive uses and uses that indicate the end of some activity. For lack of space, we will only illustrate transitional *okay*s.

Example 2. (Transitional *okay*, see BeMaTaC 2012-10-31-D, 00:00:00–00:00:15)
(The instructor and the instructee are seated and are waiting to start the map task. Then the door gets closed by the experimenters.)
Instructor: Okeh. Also du fängst auch unten links beim Startpunkt an. (*Okay, so you also begin in the bottom left corner at the starting point.*)
Instructee: Ja, den seh ich sowieso. (*Yes, I can see that anyway.*)

Here, the *okay* token is used to indicate a transition in activity. The closing of the door is an event that clearly indicates that the preparations for the map task have been completed and the participants in the sound proof booth can therefore start with the task. Since this is the agenda of the participants, this is inferrable from their common ground and it is clear that this is what is projected to happen. Indeed, participants work actively into that direction: The *okay* is being followed by the first instruction or a proposal for how to get started (a strategy proposal, so to speak). In terms of a truth predicate analysis of *okay*, the *okay*-speaker adds the fact that an event has ended to their representation of the situation, which formally is taken to be a set of formulas to which they add a new formula in a truth predicate. We propose that prosody is used to indicate that speakers have more to say, which thereby also indicates that more is to come. In all cases, prosody has been judged by ear. A detailed analysis is needed in the future.

In the following, we will further decontextualize the simplified corpus examples by referring to the interlocutors as *Alice* and *Bob* respectively, where the first turn in an example gets allocated to Alice. This is for convenience only.

2.1. Acceptance marking

The exchange in Ex.3 illustrates a typical case of acceptance marking:

Example 3. (Acceptance marking; BeMaTaC 2012-01-19-A; 00:00:18–00:00:21; ↓= final fall)
Alice: Hast du einen Stift? (*Do you habe a pen?*)

[4]On *okay* in joint projects see for instance Bangerter and Clark (2003).

Bob: Ja. (*Yes.*)
Alice: Okeh↓. Also du musst jetzt vom Startpunkt . . . (*Okay. So, you have to move now from the starting point . . .*)

Alice asks Bob whether he has a pen. Without a pen, Bob cannot copy the path. Bob answers affirmatively. Then, Alice responds using an *okay* token with a final falling intonation. This is followed by a turn that implements an instruction for Bob to now draw a line form the starting point to some point not specified in the example.[5]

Alice's question publicly conveys that she is ignorant about Bob's pen-ownership (cf. Heritage, 2012). Thus, this is not common ground among the two. It is common ground among them that Bob can perform the map task only if he has a pen. This also means that it is common ground that Bob can only perform drawing instructions if he has a pen. Now, from Alice's instruction, we can infer that she assumes that Bob has a pen. Thus, the instruction in connection with Bob's answer gives us that both consider this true. Further, this can become common ground among the two, for both can infer that the other can reason that way. This is because both know that only under that assumption are instructions of that kind reasonable (the instruction is meant to be carried out now, not at a later point). Therefore, the instruction indicates that Bob's pen-ownership can be considered common ground at this point. Importantly, the instruction is presented as a conclusion from the information available to Alice at the point of instruction giving (the import of *also*). Therefore, that Bob has a pen is assumed by Alice prior to the instruction. Her question suggests that she did not assume that he has a pen prior to the instruction (in that case, she could just have made the instruction). Her assuming so is best seen a consequence of Bob's answer. But to get from his answer to assuming that he has a pen, she must do more than acknowledging his claim, she has to align with it: she has to consider it true that he has a pen. Prior to the *okay*, we cannot infer so because of her question and lack of display of uptake. After the *okay* token, it is already assumed as a premise for the instruction making. Thus, the *okay* token is the only option left for situating this inference such that it is publicly accessible. As a consequence, we get that this *okay* can be used to make Bob's pen-ownership common ground, because it publicly indicates a change in knowledge.

2.2. Undecidedness marking

Undecidedness markings look similar to acceptance markings in terms of position, however, they are non-aligning actions, yet they acknowledge what others have said:

Example 4. (Undecidedness marking; BeMaTaC 2011-12-14-A, 00:01:36–00:02:05; ↑= final rise)
Alice: Du hast keine Nägel? (*You don't have nails?*)
Bob: Mhmh. (*Uhuh.*)
Alice: Okeh↑? (*Okay?*)
Bob: Ich habe einen Schornsteinfeger. (*I've got a chimney sweeper.*)
Alice: Okeh↓. Dann sind das aber nicht so ganz gleiche Bilder. (*Okay. But then the pictures aren't exactly the same.*)

[5]The end point of the line is inessential to the analysis so we cut off the turn at that point.

The displayed sequence is preceded by an instruction of Alice which turns out to be problematic. The instruction asks Bob to draw the line to a picture that is not part of Bob's sheet. Bob makes overt his confusion by initiating repair, which gets responded to by Alice asking whether he doesn't see the picture in question. Bob states that he has no such picture. Then, the above situation occurs.

Given the context, Alice's question is readily understood as a confirmation seeking question. This check is confirmed by Bob (*Mhmh.*) and responded to by Alice using an *okay* token, the item of interest here. The token has final rising intonation and occurs in the same kind of position as the token from Ex.3. This case differs though. Naturally, Alice assumes that they have matching pictures (they did not know of the mismatches prior to this encounter). That assumption and Bob's information do not go together. If one is true, the other must be false. While the *okay* token indicates acknowledgment of Bob's answer and understanding of it, we cannot infer from it that Alice treats Bob's answer true, nor can we infer that she treats it false. What she said up to that point does not decide between these options and this includes the contribution of the *okay* turn. Bob's subsequent turn allows for an interpretation where the intonation is interpreted as indicating trouble: *What to do now? How to continue?* His turn can be taken to contribute to this issue. That scenario does not entail though that Alice takes Bob to say the truth necessarily (she may still think that maybe he has overseen the picture, or something else). In any case, it seems clear that his claim of having a chimney sweeper picture is best understood as an alternative picture to the pictures of nails Alice was referring to. It is the response to that turn which allows us to infer that Alice' issue of inconsistent information has been resolved. The second *okay* token in the example is clearly an acceptance marking *okay*, which can be argued for again via the subsequent conclusion drawing. After this *okay* token Alice publicly concludes that they must have different pictures in at least a few cases. It is only here that we can indeed infer that she considers Bob's answer true and her initial assumption false. Because the first *okay* token does not allow for an inference to a classical truth value, we call this kind of *okay* an *undecidedness marking okay*.

2.3. Acknowledging without accepting

A case along the lines of Ex.5 has been suggested by an anonymous reviewer of the original abstract, and it goes in the direction of acknowledgments discussed in Venant and Asher (2015), where we do not find alignment. We are unaware of such cases in the BeMaTaC corpus.

Example 5. (Pure acknowledgment)
Alice: Sag mir was du über Charlie weißt. (*Tell me what you know about Charlie.*)
Bob: Charlie kommt aus Hamburg. (*Charlie is from Hamburg.*)
Alice: Okeh↓, das ist falsch. Charlie kommt aus Homburg. (*Okay, that's wrong. Charlie is from Homburg.*)

This case contrasts with the acceptance marking case. Here, Alice asks Bob to tell her what he knows about Charlie. Bob starts by saying that Charlie is from Hamburg. Alice responds to this by using an *okay*-token with a final falling intonation (at least that is the premise of the constructed case). Given the general idea that *okay* denotes a truth predicate, this may be taken to mean that Alice considers it true that Charlie is from Hamburg. If we assume so, we will

have to conclude that Alice is inconsistent. Semi-formally, this means that we have $True(p)$ and $False(p)$, which is a contradiction. However, we are not forced to this logical form of the interaction. Bob saying that Charlie is from Hamburg can be taken to introduce a commitment by him to the truth of Charlie being from Hamburg. If we represent this by the formula $C_B p$, we now get $True(C_B p)$ for Alice' *okay*-response which is consistent with $False(p)$. In fact, this line of thought mirrors that of Venant and Asher (2015) and Krifka (2013), just in terms of truth predicates as opposed to commitments.

Contrasting this case and the acceptance marking case suggests that the final fall introduces an implicature: unless it is indicated otherwise, an acknowledging *okay* seems to be interpreted as also aligning. This reading is indeed available if we leave aside any opposing material:

Example 6. (Acknowledgment without denial)
Alice: Sag mir was du über Charlie weißt. (*Tell me what you know about Charlie.*)
Bob: Charlie kommt aus Hamburg. (*Charlie is from Hamburg.*)
Alice: Okeh↓. (*Okay.*)

We can interpret Alice as accepting what Bob says, but we are not forced to. We may be doubtful about Alice's own stance on this, for instance, if this were some kind of interrogation. With Venant and Asher (2015) we can say that Alice's discourse move is ambiguous.

Overall, cases like Ex.5 seem to differ from acceptance marking *okay*s (Ex.3) only in the inferences they sanction. We want to stress that this is a constructed example and it is thus indispensable to study natural occurring cases which also allow for prosodic studies. We suspect such cases to occur frequently in argumentative settings, where it can be relevant to acknowledge without aligning.

3. The meaning of intonational contours

Our proposal assumes a division of labor between *okay*'s semantics and the meaning of final intonational contours in the derivation of illocutionary force. In particular, we have proposed that final rising contour has a meaning that indicates that the speaker cannot provide a classical truth value judgment for the propositional content of the locution. The final fall has instead been taken to contribute an implicature that as long as it can be assumed to be applicable will lead to alignment.

The literature on the meaning of prosodic contours in the context of declaratives made similar observations for both German and English.[6] With regard to final rises, a common idea is that they do not add commitments (for German, see for instance Truckenbrodt (2006): 271–272; for English see for instance Rudin (2022): 358–359, Goodhue (2021): 960–964) The commitment proposal for final rises translates quite neatly to our truth value proposal. From the lack of commitment, we cannot infer a commitment to the contrary (such requires additional assumptions). Thus, the speaker cannot be taken to be committed to the proposition being true, nor to it being false. This is essentially what we call undecidedness.

[6]We note that this literature is more sophisticated than the presentation here. For instances, different kinds of rises are distinguished. Such is not the case here. This should be addressed in the future.

Final falls have been seen in different lighting. Both Truckenbrodt and Rudin take final falls to indicate commitment. Thus, a declarative sentence such as *It is raining* with a final falling contour will be understood as committing the speaker to the propositional content of the sentence (see Truckenbrodt (2006): 271–272 and Rudin (2022): 358–359, respectively). Goodhue sees final falls as unmarked defaults that indicate speakers have not indicated lack of commitment. Thus, in saying *It is raining*, the speaker is taken to not have indicated lack of commitment and thus by pragmatics is considered to actually undertake a commitment (see Goodhue, 2021: 960–964).[7]

Our proposal is thus alike to Goodhue's semantics for final rises and falls in that rises are taken to indicate lack of a definite truth value judgment and the final fall is taken to implicate a definite truth value judgment, which in the responsive *okay* uses discussed earlier leads to alignment.

4. *okay* as a truth predicate and marker of uptake

In this section we state our proposal for the semantics of *okay*. This is argued for on two grounds. First, it is consistent with our earlier examples and allows for a uniform semantics of *okay* in the three cases. Differences are allocated to prosody. Second, other similar particles are reasonably taken to be about matters of truth. Thus, the truth predicate idea seems a reasonable general account for these kinds of particles. What are truth predicates though?

4.1. Truth predicates

Truth predicates, say T, are predicate symbols of (usually) a first-order language, which are read as *is true*. Thus, they apply to terms. For instance, we can say "2+2=4 is true", which can be rendered by $T(\ulcorner 2+2=4 \urcorner)$. Here $\ulcorner 2+2=4 \urcorner$ is a term denoting the closed formula $2+2=4$. Typically, $\ulcorner 2+2=4 \urcorner$ denotes the Gödel number of the formula $2+2=4$ (so, there is a coding device assumed which derives names for formulas). A basic desideratum for truth predicates is that they satisfy instances of the truth scheme $T(\ulcorner \phi \urcorner) \leftrightarrow \phi$ (see Tarski (1944)). For further details on truth predicates see Leitgeb (2007).

4.2. Truth and uptake as the common elements

In Ex.3, 4, and 5, we found that the *okay*-speaker is taking up what the interlocutor says. This can be formally expressed in a very succinct way: The *okay*-speaker adds facts to their knowledge base, a set of formulas.[8] In a way, this is a simple model of memory, where formulas are stored as well as information about their truth values. Adding facts means adding a formula that is considered true. In a propositional setting this means that the assignment for the database

[7]Other commitment-based accounts of the meaning of prosodic contours along the same or similar lines as Truckenbrodt (2006), Rudin (2022), and Goodhue (2021) have been made in, for instance, Gunlogson (2003), Farkas and Roelofsen (2019), and Jeon (2018), and many others exist.

[8]The notion is familiar in computer science and artificial intelligence in the context of databases and knowledge representation. The commitment stores of table models can be thought of in that way.

must be such that the new fact is true under the assignment. In the first order case, any models of the database must make the newly added fact true. With truth predicates, this can be directly encoded in the language, $T(\ulcorner\phi\urcorner)$.

More concretely, let us assume Alice asserts p. Let us represent this using the propositional letter q. Assume now that Bob reacts by saying *okay*. Our claim is that *okay* is used to add q as a fact to Bob's representation of what is going on, i. e., he updates his knowledge base with the formula $T(\ulcorner q\urcorner)$. Put simply, Bob believes that Alice asserted p and this is expressed by saying *okay*. In doing so, Bob has taken up what Alice is doing (an assertion) and what the content of that doing is (p). Hence, we can analyze uptake in terms of knowledge base updates utilizing truth predicates. Similar ideas on uptake have been proposed in connection with commitments, where to understand is taken to mean to have a commitment to your interlocutor having a commitment to a proposition (see for instance Schlöder et al., 2019).

The differences between the three uses can either be related to the meaning of the (final) intonational contour, which gives us the split fall versus rise, or that difference can be related to the availability of non-monotonic inferences (implicatures), which gives us the difference of pure acknowledgments versus acceptance markings. The meaning of the final fall could then, roughly at least, be stated as an integrity constraint in the context of logic programming. The idea is that when $T(\ulcorner q\urcorner)$ is satisfied, and it is not the case that cooperativity is doubtful, then Bob should adopt Alice's stance on p, thus, we call for an update with $T(\ulcorner p\urcorner)$ for Bob's knowledge base. If cooperativity is doubtful, this inference is no longer licensed, and the update call $T(\ulcorner p\urcorner)$ will not happen.[9] Final rises could be taken to denote a special predicate U which is true of a term $\ulcorner\phi\urcorner$ if neither T nor F are true of it relative to a database. We can call U an *undecidedness predicate*; F reads *is false*. The exact details are for another occasion.

4.3. Okay and other particles

The following is intended not as a firm result of conducted research, but initial glimpses of potential future work. German possesses particles such as *ja*, *genau*, and *richtig*, which are evidently about matters of truth:

Example 7. (Response particles indicating truth value judgments)
Alice: Charlie hatte heute seine Verteidigung. (*Today was Charlie's thesis defense.*)
Bob: Ja↓./ Richtig↓./ Genau↓./ Okeh↓. (*Yes./ Right./ Exactly./ Okay.*)

We have Alice asserting that Charlie's thesis defense was today. From that, we can infer (non-monotonically) that Alice considers this true. Likewise, any response option displayed for Bob does the same. When Bob responds using *ja*, he will be taken to consider it true that Charlie's thesis defense was today. The same goes in case of *richtig* or *genau*. From that viewpoint, it makes sense to have such expressions denoting truth predicates. We observe that an *okay* response allows for similar inferences (if Bob is cooperative). Thus, it makes sense to group them together and treat them uniformly.

Of course, there are differences among these expressions. When Bob responds by saying *okay*

[9] On logic programming see Doets (1994). On integrity constraints in this dynamic sense, see Kowalski (1995). See also van Lambalgen and Hamm (2005) for application in formal semantics.

instead of *ja*, *richtig*, or *genau*, he may only perform an acknowledgment move. Such is not possible when saying *ja*, *richtig*, or *genau* with final falling intonation. With the latter expressions, he cannot be considered as non-aligning with Alice, even in non-cooperative settings like an argument. This consequence may be due to another factor though. All expressions considered here convey an epistemic stance in assertoric contexts. For instance, when Bob responds by saying *genau*, he will not be understood as being ignorant, instead, he is not just aligning, but confirming. The same is true of *richtig* and *ja*. This stance may provide to further entailments from the resulting logical form, because Bob conveys to know already what Alice is telling him, thus, he must consider the propositional content of her locution true already. However, *okay* does not convey knowledgability (see also Oloff (2019) on German *okay*, and Lindström (2018) on Swedish *okay* in this regard). This is clear from Ex.3, where *okay* is used to integrate information. It does not convey that Alice was knowledgeable (such would be incoherent in fact). As a consequence, we may say that all these expressions are devices for indicating uptake (they all do so in fact).[10] But *ja*, *richtig*, and *genau* have meanings that add to that, while *okay*'s meaning is too weak to do so. Implicatures may strengthen its meaning to an acceptance marker though.

The general idea then is that all these expressions denote truth predicates (which allows to perform uptake explicitly). They differ in the epistemic stances they can convey, which also contributes to differences in possible illocutionary force. The differences allow for fine-tuning of epistemic claims conveyed by epistemic stances, a matter that is known to be of high interactional significance (see for instance Heritage (2013) on the interactional significance of knowledge and knowledge claims).

5. A propositional discourse model

We present a propositional multi-agent model as an approximation of the idea that *okay* semantically denotes a truth predicate and is used to indicate uptake. In that model, *okay* is taken to denote a constant function mapping propositional letters to the truth value 1 from the set of truth values $\mathbb{T}_3 := \{u, 0, 1\}$.

5.1. Truth value judgments and interpretation of truth values in Strong Kleene Logic

An appropriate choice for approximating our truth predicate proposal in a propositional setting is Strong Kleene Logic (Kleene, 2000), though we will only utilize the interpretation of truth values underlying the logic at this point. Formally, we will assume a countably infinite set of propositional letters Φ, no connectives will be used.[11] We will use functions $v_{a_j}^{a_i,t}$ that map formulas $\phi \in \Phi$ to a set of truth values, $\mathbb{T}_3 = \{u, 0, 1\}$, where a_i, a_j are agents and t is a point in time. The functions $v_{a_j}^{a_i,t}$ will be finite.

Strong Kleene Logic is interesting for our purposes because the truth value u, conceptually at

[10] Not every utterance indicates uptake, and thus the indication of uptake is non-trivial. Repairs concerning uptake are non-uptake indicating.

[11] Extensions of the model using Strong Kleene Logic proper are possible. The chosen size is for definiteness only; finite sets work just as well and in applications they suffice.

least, is not considered a proper truth value (Kleene (2000); see also Feferman (1984)). It is used to encode that no classical truth value could be found given some procedure. Thus, truth value judgments are seen as values of partial functions, and u is used to represent them as total functions.

In conversing, agents are faced with decision making such as whether to align or disalign with others, but also communicating whether they are knowledgeable as in when they get asked a question. Much of this can be represented in terms of truth value judgments as in the case of assertions. There, we can say that to assert means to judge true (at least such is made public; agents can lie). To not know can be taken to not be able to judge true or false. In fact, these points are reflected in our undecidedness marking case (Ex.4): While the first *okay* indicates that the speaker has not been able to resolve the issue, and thus has not found a classical solution, the second *okay* makes clear that the issue has been resolved and a classical solution has been found. In that connection, we note that because u is not a truth value in the sense of 1 and 0, formulas that are judged u can be judged 1 or 0 subsequently as a monotone update of the model. This property is of more general importance for conversing. In case of ignorance, we do not perceive others as revising a definitive point of view on the world, but instead as reaching such a point of view, which is a monotone update. Overall, these properties make Strong Kleene Logic a reasonable choice for current purposes.

5.2. Agents, contexts, and speech acts

We provide a simple yet for current purposes sufficient multi-agent system for modeling speech acts as context changing functions.

We will fix a set of propositional letters $\Phi := \{p_n : n \in \mathbb{N}\}$ as well as an index set $\mathscr{A} = \{a_1, \ldots, a_n\}$, the set of agents. Further, we let time range over the natural numbers, thus $\mathscr{T} := \mathbb{N}$. The addition of time is for convenience at this point. For $a_i, a_j \in \mathscr{A}$, $i, j \in \{1, \ldots, n\}$, $t \in \mathscr{T}$, and $X \subset \Phi$ a finite subset of formulas, we define *judgment functions* $v_{a_j}^{a_i,t} : X \to \mathbb{T}_3$. Judgment functions allow us to represent perspectives. For instance, if Alice (a) asserts at t that ϕ, we take this to add a judgment $(\phi, 1)$ to Alice's judgment function $v_a^{a,t}$. If Alice asserts at t that ϕ is false, we would instead add $(\phi, 0)$ to $v_a^{a,t}$. And if Alice would publicly express her ignorance about p at t, we would represent this by adding (ϕ, u) to $v_a^{a,t}$. On the other hand, if Bob (b) asserts at t that q and Alice uptakes Bob doing so, we can represent this by adding $(q, 1)$ to $v_b^{a,t}$, where this function represents Alice's perspective on Bob's judgments. We make this idea formally precise by defining *agent contexts*, where an agent context is a tuple of judgment functions $C_{a_i,t} := (v_{a_1}^{a_i,t}, \ldots, v_{a_i}^{a_i,t}, \ldots, v_{a_n}^{a_i,t})$ for $a_i \in \mathscr{A}$. Conceptually, we distinguish judgments to 1 and 0 from such that assign u as value. The former are properly thought of as judgments, for they deliver a result for a computation, whereas the latter in fact are not really judgments; assignment of u reflects that no judgment could be made. This is the import of Strong Kleene Logic's conceptual interpretation of $0, 1$, and u.

Given a set of agents $\mathscr{A}$, we define contexts $\mathscr{C}_t$ at t as tuples of agent contexts $(C_{a_1,t}, \ldots, C_{a_n,t})$. While agent contexts are local representations of a conversation (they encode an agent's total perspective at t), a context $\mathscr{C}_t$ is really the global representation of the conversation at t: it contains all information about each agent's judgments as well as what they think others have

judged at and up to t. A context here is really an abstraction of the analyst that allows to judge what is indeed happening, while it is not a perspective conversational agent's can necessarily obtain (Alice may have false beliefs about Bob's beliefs).

We use contexts for modeling conversations by modeling changes within agent contexts, where changes are induced by illocutionary acts, which we call here for simplicity speech acts. Speech acts are functions from a context $\mathscr{C}_t$, an agent a_i, and a formula ϕ to a context $\mathscr{C}_{t+1}$. Thus, they also induce changes in time: no events, no flow of time. Depending on the speech act, different effects occur. For instance, if agent a_i asserts ϕ at t, we want that the agent context of a_i at t changes in such a way that $v_{a_i}^{a_i,t}$ is updated or revised to $v_{a_i}^{a_i,t} \cup \{(\phi,1)\}$. We will therefore deal now with updates and revisions of judgment functions $v_{a_i}^{a_i,t}$.

Given the interpretation of truth values in Strong Kleene Logic different kinds of updates are intelligible. One kind of update consists in adding the result of a judgment of a proposition not considered so far:

Definition 1. (+-update of judgment functions) Let $\phi \in \Phi$ be a formula, $v_{a_j}^{a_i,t}$ be a judgment function, and $\tau \in \mathbb{T}_3$ be a truth value. We set:

$$v_{a_j}^{a_i,t} + (\phi,\tau) := \begin{cases} v_{a_j}^{a_i,t+1} := v_{a_j}^{a_i,t} \cup \{(\phi,\tau)\} & \text{if } \neg\exists \tau' \in \mathbb{T}_3.(\phi,\tau') \in v_{a_j}^{a_i,t} \\ \text{undefined} & \text{else} \end{cases}$$

Example 8. Consider the function $v_{a_i}^{a_i,t} := \{(p,1),(q,0)\}$. The formula r has not been judged explicitly yet. Thus, we can perform the update $v_{a_i}^{a_i,t} + (r,1)$, which results in the function $v_{a_i}^{a_i,t+1} = \{(p,1),(q,0),(r,1)\}$. We cannot perform updates with p, because of $(p,1) \in v_{a_i}^{a_i,t}$.

If a judgment procedure has not yielded u as result, we may later update u to a classical result:

Definition 2. ($\uparrow$-update of judgment functions) Let $\phi \in \Phi$ be a formula, $v_{a_j}^{a_i,t}$ be a judgment function. We set

$$v_{a_j}^{a_i,t} \uparrow (\phi,\tau) := \begin{cases} v_{a_j}^{a_i,t+1} := (v_{a_j}^{a_i,t} \setminus \{(\phi,u)\}) \cup \{(\phi,\tau)\} & \text{if } (\phi,u) \in v_{a_j}^{a_i,t}, \tau \in \{0,1\} \subset \mathbb{T}_3 \\ \text{undefined} & \text{else} \end{cases}$$

Example 9. Consider $v_{a_i}^{a_i,t} := \{(p,1),(q,1),(r,u)\}$. We can perform $v_{a_i}^{a_i,t} \uparrow (r,1) = v_{a_i}^{a_i,t+1} = \{(p,1),(q,1),(r,1)\}$, and $v_{a_i}^{a_i,t} \uparrow (r,0) = v_{a_i}^{a_i,t+1} = \{(p,1),(q,1),(r,0)\}$, but not $v_{a_i}^{a_i,t} \uparrow (p,\tau), \tau \in \{0,1\}$, since $(p,u) \notin v_{a_j}^{a_i,t}$.

Besides updates, conversations contain revisions. For instance, assume Bob learns from Alice about an event he was ill-informed about. Bob will then adjust his judgments to fit the new information. A very general and naive revision function consists in keeping everything as is besides the item that is to be revised:

Definition 3. (Revision *RE*) Let $\phi \in \Phi$ be a formula, $v_{a_j}^{a_i,t}$ be a judgment function, and $\tau \in \mathbb{T}_3$ be a truth value. Then:

$$v^{a_i,t} RE(\phi,\tau) := \begin{cases} v_{a_j}^{a_i,t+1} := (v_{a_j}^{a_i,t} \setminus \{(\phi,\tau')\}) \cup \{(\phi,\tau)\} & \text{if } \tau' \in \{0,1\}, (\phi,\tau') \in v_{a_j}^{a_i,t}, \tau \neq \tau' \\ \text{undefined} & \text{else} \end{cases}$$

We have defined revisions as operations altering truth values 1 or 0 to any other value in $\mathbb{T}_3$. This reflects the conceptual point that u is not a proper truth value. Revisions are non-monotonic changes of proper judgments, thus changes with respect to 1 and 0.

To obtain simpler definitions of speech acts we will define an operation $\sqcup$ that selects among $\uparrow, +$, and *RE* or else only increments time (the final option in the definition):

Definition 4. ($\sqcup$-update of judgment functions) Let $\phi \in \Phi$ be a formula, let $v_{a_j}^{a_i,t}$ be a judgment function, and let $\tau \in \mathbb{T}_3$ be a truth value. We define:

$$v_{a_j}^{a_i,t} \sqcup (\phi,\tau) := \begin{cases} v_{a_j}^{a_i,t} \uparrow (\phi,1) & \text{if } \tau \in \{0,1\}, (\phi,u) \in v_{a_j}^{a_i,t} \\ v_{a_j}^{a_i,t} + (\phi,\tau) & \text{if } \neg\exists \tau' \in \mathbb{T}_3((\phi,\tau') \in v_i) \\ v_{a_j}^{a_i,t} RE(\phi,\tau) & \text{if } (\phi,\tau') \in v_{a_j}^{a_i,t}, \tau' \in \{1,0\}, \tau \neq \tau' \\ v_{a_j}^{a_i,t+1} \text{ with } v_{a_j}^{a_i,t+1} = v_{a_j}^{a_i,t} & \text{if } \exists \tau' \in \mathbb{T}_3(\tau = \tau', (\phi,\tau') \in v_{a_j}^{a_i,t}) \end{cases}$$

The last option which makes $\sqcup$ into an identity function that increments time (the elements of the set stay the same, but the index t increments by 1) is in place to account for redoings. A simple case is when an agent repeats an assertion again at another occasion. In the current system, this is but a redoing, thus time increments, because there is an event, but the event is redundant and thus the effect will not distinguish the state at t and the state at $t+1$.

As before, we will assume a fixed set of propositional letters Φ and a fixed index set $\mathscr{A}$. We define a positive assertion operation (*ASSERT-P*) and a negative one (*ASSERT-N*) since we lack negation in our object language:

Definition 5. (Assertion) Let $\mathscr{C}_t = (C_{a_1,t}, \ldots, C_{a_i,t}, \ldots, C_{a_n,t})$, $a_i \in \mathscr{A}$, and $\phi \in \Phi$ be given. *ASSERT-P*$(\mathscr{C}_t, a_i, \phi) := \mathscr{C}_{t+1}$ with $\mathscr{C}_{t+1} = (C_{a_1,t+1}, \ldots, C_{a_i,t+1}, \ldots, C_{a_n,t+1})$, $C_{\ell,t+1} = C_{\ell,t}$ for $\ell \in \mathscr{A} \setminus \{a_i\}$, and $C_{a_i,t+1} = (v_{a_1}^{a_i,t+1}, \ldots, v_{a_i}^{a_i,t} \sqcup (\phi,1), \ldots, v_{a_n}^{a_i,t+1})$ with $v_\ell^{a_i,t+1} = v_\ell^{a_i,t}$ for $\ell \in \mathscr{A} \setminus \{a_i\}$.

ASSERT-N$(\mathscr{C}_t, a_i, \phi)$ is defined alike, but we have the pair $(\phi, 0)$ instead of $(\phi, 1)$.

Example 10. Assume Alice (a) tells Bob (b) about the Elden Ring lore.[12] She asserts at t that Queen Marika and Radagon are the same person (p). Assuming that we are in the context $\mathscr{C}_t$ with $C_{a,t} = (v_a^{a,t} = \emptyset, v_b^{a,t} = \emptyset)$ and $C_{b,t} = (v_a^{b,t} = \emptyset, v_b^{b,t} = \emptyset)$ the assertion results in $\mathscr{C}_{t+1}$ with $C_{a,t+1} = (v_a^{a,t+1} \sqcup (\phi,1), v_b^{a,t+1})$, $v_b^{a,t+1} = v_b^{a,t}$, where $v_a^{a,t+1} \sqcup (\phi,1) = v_a^{a,t+1} + (\phi,1) = \{(\phi,1)\}$. We have $C_{b,t+1} = C_{b,t}$.

Next, we define an operation, *COPY*, which serves to register what others did. It is an integral part of our account of uptake and the pragmatics of *okay*:

Definition 6. (Copy) Let $\mathscr{C}_t = (C_{a_1,t}, \ldots, C_{a_i,t}, \ldots, C_{a_n,t})$, $a_i \in \mathscr{A}$, and $\phi \in \Phi$ be given.

$$\textit{COPY}(\mathscr{C}_t, a_i, \phi) := \begin{cases} \mathscr{C}_{t+1} & \text{if } \exists x \in \mathscr{A} \exists \tau \in \mathbb{T}_3.(\phi,\tau) \in v_x^{x,t} \\ \text{undefined} & \text{else} \end{cases}$$

where $\mathscr{C}_{t+1} := (C_{a_1,t+1}, \ldots, C_{a_i,t+1}, \ldots, C_{a_n,t+1})$, $C_{\ell,t+1} = C_{\ell,t}$ for $\ell \in \mathscr{A} \setminus \{a_i\}$, and $C_{a_i,t+1} := (v_{a_1}^{a_i,t+1}, \ldots, v_x^{a_i,t+1}, \ldots, v_{a_n}^{a_i,t+1})$ with $v_\ell^{a_i,t+1} = v_\ell^{a_i,t}$ for $\ell \in \mathscr{A} \setminus \{x\}$; $v_x^{a_i,t+1} := v_x^{a_i,t} \sqcup (\phi,\tau)$

Thus, this operation copies a judgment from another agent. Note that this operation is factual. Thus, our agents will not have false representations. This is just a convenient choice at this point.

Example 11. Returning to Alice and Bob, let us assume that Bob heard and understood what Alice said. In that case, we may assume that Bob adjusted his representation of what Alice is

[12] Elden Ring is an action role-playing video game developed by FromSoftware.

committing to and is believing, by adding $(p,1)$ to Alice' judgment function. Thus, we have an update of the context $\mathscr{C}_{t+1} = (C_{a,t+1}, C_{b,t+1})$ to $\mathscr{C}_{t+2} = (C_{a,t+2}, C_{b,t+2})$ with $C_{a,t+2} = C_{a,t+1}$, and $C_{b,t+2} = (v_a^{b,t+2} \sqcup (p,1) = \{(p,1)\}, v_b^{b,t+2})$ with $v_b^{b,t+2} = v_b^{b,t+1}$. Later, we will say that Alice and Bob have secured uptake of p, because they have shared interpretations of Alice's judgment of p (see Def.15).

Assertions can be reacted to in different ways. They may be accepted:

Definition 7. (Acceptance) Let $\mathscr{C}_t = (C_{a_1,t}, \ldots, C_{a_i,t}, \ldots, C_{a_n,t})$, $a_i \in \mathscr{A}$, and $\phi \in \Phi$ be given.

$$ACCEPT(\mathscr{C}_t, a_i, \phi) := \begin{cases} \mathscr{C}_{t+1} & \text{if } \exists x \in \mathscr{A} \exists \tau \in \{0,1\} \subset \mathbb{T}_3.(\phi,\tau) \in v_x^{x,t}, (\phi,\tau) \in v_x^{a_i,t} \\ \text{undefined} & \text{else} \end{cases}$$

where $\mathscr{C}_{t+1} := (C_{a_1,t+1}, \ldots, C_{a_i,t+1}, \ldots, C_{a_n,t+1})$, $C_{a_i,t+1} := (v_{a_1}^{a_i,t+1}, \ldots, v_{a_i}^{a_i,t+1}, \ldots, v_{a_n}^{a_i,t+1})$ with $v_\ell^{a_i,t+1} = v_\ell^{a_i,t}$ for $\ell \in \mathscr{A} \setminus \{a_i\}$ and $C_{\ell,t+1} = C_{\ell,t}$ for $\ell \in \mathscr{A} \setminus \{a_i\}$; $v_{a_i}^{a_i,t+1} := v_{a_i}^{a_i,t} \sqcup (\phi,\tau)$.

To accept means to align with the judgment of others. This motivates restricting τ to either 0 or 1, because u is not a proper truth value. We note that the definition requires that someone made a judgment, thus agents cannot mistakenly accept jugdments without there having been a judgment that can be accepted. This reflects the anaphoric nature of accepting, but also incorporates a factual element, which is again a convenient choice.

Another response type available in the context of assertions is that of a (strong) rejection. Here, the speaker takes an opposing point of view:

Definition 8. (Rejection) Let $\mathscr{C}_t = (C_{a_1,t}, \ldots, C_{a_i,t}, \ldots, C_{a_n,t})$, $a_i \in \mathscr{A}$, and $\phi \in \Phi$ be given.

$$REJECT(\mathscr{C}_t, a_i, \phi) := \begin{cases} \mathscr{C}_{t+1} & \text{if } \exists x \in \mathscr{A} \exists \tau \in \{0,1\} \subset \mathbb{T}_3.(\phi,\tau) \in v_x^{x,t}, (\phi,\tau) \in v_x^{a_i,t} \\ \text{undefined} & \text{else} \end{cases}$$

where $\mathscr{C}_{t+1} := (C_{a_1,t+1}, \ldots, C_{a_i,t+1}, \ldots, C_{a_n,t+1})$, $C_{a_i,t+1} := (v_{a_1}^{a_i,t+1}, \ldots, v_{a_i}^{a_i,t+1}, \ldots, v_{a_n}^{a_i,t+1})$ with $v_\ell^{a_i,t+1} = v_\ell^{a_i,t}$ for $\ell \in \mathscr{A} \setminus \{a_i\}$ and $C_{\ell,t+1} = C_{\ell,t}$ for $\ell \in \mathscr{A} \setminus \{a_i\}$; $v_{a_i}^{a_i,t} := v^{a_i,t} + a_i \sqcup (\phi, 1-\tau)$

Similar comments apply here as with acceptance. The reader should note that the rejection operation emulates the semantics of classical negation via $1-\tau$ and the restriction $\tau \in \{0,1\}$.

Assertions may also simply be acknowledged:

Definition 9. (Acknowledgment) Let $\mathscr{C}_t = (C_{a_1,t}, \ldots, C_{a_i,t}, \ldots, C_{a_n}, t)$, $a_i \in \mathscr{A}$, and $\phi \in \Phi$ be given. $ACKNOWLEDGE(\mathscr{C}_t, i, \phi) := COPY(\mathscr{C}_t, i, \phi)$

Thus acknowledgments are defined in terms of the copy operation. Equating acknowledgments with registering of others' judgments is not a conceptual claim though. Acknowledgments are illocutionary acts, whereas registering is a cognitive task or result thereof. However, given that we do not model locutionary acts here, we cannot distinguish these phenomena in our model (unless we introduce primitive propositional formulas whose intended meaning can be provided in first-order or higher-order logic). Acknowledgments, *qua* illocution, could be made dependent on the occurrence of an appropriate locution. In that way, we could make acknowledgments indeed a publicly accessible action, and registrations (the operation represented by our *COPY*-operation) would be distinguishable as a cognitive process, which may not find a public display.

A simple representation for polar interrogatives can be provided:

Definition 10. (Questions) Let $\mathscr{C}_t = (C_{a_1,t}, \ldots, C_{a_i,t}, \ldots, C_{a_n,t})$, $a_i \in \mathscr{A}$, and $\phi \in \Phi$ be given. $\mathit{QUESTION}(\mathscr{C}_t, a_i, \phi) := \mathscr{C}_{t+1}$ where $\mathscr{C}_{t+1} = (C_{a_1,t+1}, \ldots, C_{a_i,t+1}, \ldots, C_{a_n,t+1})$ with $C_{\ell,t+1} = C_{\ell,t}$ for $\ell \in \mathscr{A} \setminus \{a_i\}$, and $C_{a_i,t+1} = (v_{a_1}^{a_i,t+1}, \ldots, v_{a_i}^{a_i,t} \sqcup (\phi, u), \ldots, v_{a_n}^{a_i,t+1})$ with $v_\ell^{a_i,t+1} = v_\ell^{a_i,t}$ for $\ell \in \mathscr{A} \setminus \{a_i\}$.

The idea is that polar interrogatives express that there is an open issue regarding the truth value of a formula ϕ. This can be represented by taking ϕ to be undecided. This comes close to notions of inquisitiveness, where a state neither entails ϕ nor $\neg\phi$.

We define new operations, *ANSWER-P* and *ANSWER-N*, which are used to perform positive and negative answers respectively. Similar comments apply as with assertions:

Definition 11. (Answers) Let $\mathscr{C}_t = (C_{a_1,t}, \ldots, C_{a_i,t}, \ldots, C_{a_n,t})$, $a_i \in \mathscr{A}$, and $\phi \in \Phi$ be given.

$$\mathit{ANSWER\text{-}P}(\mathscr{C}_t, a_i, \phi) := \begin{cases} \mathscr{C}_{t+1} & \text{if } \exists x \in \mathscr{A}.(\phi, u) \in v_x^{x,t}.(\phi, u) \in v_x^{a_i,t} \\ \text{undefined} & \text{else} \end{cases}$$

where $\mathscr{C}_{t+1} := (C_{a_1,t+1}, \ldots, C_{a_i,t+1}, \ldots, C_{a_n,t+1})$, $C_{a_i,t+1} := (v_{a_1}^{a_i,t+1}, \ldots, v_{a_i}^{a_i,t+1}, \ldots, v_{a_n}^{a_i,t+1})$ with $v_\ell^{a_i,t+1} = v_\ell^{a_i,t}$ for $\ell \in \mathscr{A} \setminus \{a_i\}$ and $C_{\ell,t+1} = C_{\ell,t}$ for $\ell \in \mathscr{A} \setminus \{a_i\}$; $v_{a_i}^{a_i,t+1} := v_{a_i}^{a_i,t} \sqcup (\phi, 1)$.

ANSWER-N$(\mathscr{C}_t, a_i, \phi)$ is defined similarly, but we have the pair $(\phi, 0)$ instead of $(\phi, 1)$.

Example 12. (Question-answer sequence) Continuing with Alice and Bob, assume Bob asks Alice a question about the Elden Ring lore, say, whether Queen Rennala is a demi-god (q). Thus, given the context $\mathscr{C}_{t+2} = (C_{a,t+2}, C_{b,t+2})$ with $C_{a,t+2} = (v_a^{a,t+2} = \{(p,1)\}, v_b^{a,t+2} = \emptyset)$ and $C_{b,t+2} = (v_a^{b,t+2} = \{(p,1)\}, v_b^{b,t+2} = \emptyset)$, Bob's question results in the new context $\mathscr{C}_{t+3} = (C_{a,t+3}, C_{b,t+3})$ with $C_{a,t+3} = C_{a,t+2}$ and $C_{b,t+3} = (v_a^{b,t+3} = \{(p,1)\}, v_b^{b,t+3} \sqcup (q,u) = \{(q,u)\})$. Assuming that Alice was attentive and understood what Bob said, we get the context $\mathscr{C}_{t+4} = (C_{a,t+4}, C_{b,t+4})$ with $C_{a,t+4} = (v_a^{a,t+4} = \{(p,1)\}, v_b^{a,t+4} = \{(q,u)\})$ and $C_{b,t+4} = C_{b,t+3}$. Alice can now proceed to answer Bob's question. She answers negatively, yielding the context $\mathscr{C}_{t+5} = (C_{a,t+5}, C_{b,t+5})$ with $C_{a,t+5} = (v_a^{a,t+5} = \{(p,1)\} \sqcup (q,0) = \{(p,1),(q,0)\}, v_b^{a,t+5} = \{(q,u)\})$ and $C_{b,t+5} = C_{b,t+4}$. If Bob takes up on this, he may accept this answer which leads him to judge q false as well. This would lead to making common ground that q is false (see Def.16).

5.3. *okay* and intonational contours

We proposed that *okay* is combined with prosody to perform different kinds of speech acts. Particularly, we claimed that when *okay* combines with a final rise, it is used to perform undecidedness marking. The final rise is used to convey speaker's stance, in this case that they cannot assign a classical value to the formula in question. Thus, a final rise conveys a sense of inquisitiveness. The *okay* token, we proposed, is used to perform an acknowledgment of what the prior speaker said. In this way, *okay* is used to perform or indicate uptake:

Definition 12. (*okay* meaning) Let $\mathscr{C}_t = (C_{a_1,t}, \ldots, C_{a_n,t})$ and $\phi \in \Phi$ be given.

$$\mathit{OKAY}(\mathscr{C}_t, \phi) := \begin{cases} (\phi, \tau) & \text{if } \exists x \in \mathscr{A} \exists \tau \in \mathbb{T}_3.(\phi, \tau) \in v_x^{x,t} \\ \text{undefined} & \text{else} \end{cases}$$

The *if*-clause is used to reflect the anaphoric nature of *okay*, though we want to note that *okay* is applicable in contexts where an agent has made a private inference, because we do not ask for a different agent in the test (this also applies with the other definitions). Such is especially the case with *okay*s that are used to indicate the (approaching) ends of tasks, transitional *okay*s, but also auto-reflexive *okay*s which are used in individual thought processes within multi-agent settings.[13] Our definition allows for such cases by not having constraints on agents.

We define the meaning of the final rise as a constant function mapping formulas to u:

Definition 13. (Final rise meaning) Let $\mathscr{C}_t = (C_{a_1,t}, \ldots, C_{a_n,t})$ and $\phi \in \Phi$ be given.
$FR(\mathscr{C}_t, \phi) := (\phi, u)$

Final rising *okay*s can be represented as a primitive composition of the meanings of *okay* and the final rise, which together implement an illocutionary act: $OKAY(\mathscr{C}_t, \phi) + FR(\mathscr{C}_t, \phi) := QUESTION(COPY(\mathscr{C}_t, a_i, \phi), a_i, \phi)$.

We treat $+$ as a primitive symbol here. The intended meaning is that it combines the two meaning contributions which then feeds into illocutionary force ascription and results in the expression on the right side of the identity symbol. The *okay* as an anaphoric expression picks up on what has been said (or thought) and registers this contribution, i. e., *okay* is used to register a judgment, commitment, whatever you have. On the other hand, the final rise adds an ignorance stance with respect to what has been said, here a formula ϕ. For the future a formal account of illocutionary force ascription is desirable (ideally in a type-free system so as to utilize truth predicates; on type-free systems see Feferman (1984)).

Our discussion of final falls suggests that they can be taken to contribute an implicature. Now, for the sake of simplicity, we will not attempt to add implicatures to the current propositional model. Instead, we will assume that only in the cooperative cases does the final fall make a meaning contribution. Therefore, we will assume that only for such cases exists a lexical entry and in non-cooperative cases, the fall is simply meaningless, i.e., non-cooperative final falls do not provide a meaning contribution.

Definition 14. (Final fall meaning) Let $\mathscr{C}_t = (C_{a_1,t}, \ldots, C_{a_n,t})$ and $\phi \in \Phi$ be given.

$$FF_{coop}(\mathscr{C}_t, \phi) := \begin{cases} (\phi, \tau) & \text{if } \exists x \in \mathscr{A} \exists \tau \in \{0,1\} \subset \mathbb{T}_3 . (\phi, \tau) \in v_x^{x,t} \\ \text{undefined} & \text{else} \end{cases}$$

Our definition treats final falls as anaphoric. In fact, it differs only slightly from the semantics of *okay*. We do so, because we wish to model it as a stance aligning device. This is a responsive action, thus it needs a relatum.

The acceptance marking reading of *okay* can then be rendered by $OKAY(\phi) + FF_{coop}(\mathscr{C}_t, \phi) := ACCEPT(COPY(\mathscr{C}_t, a_i, \phi), a_i, \phi)$, with a_i the speaker. Here the *okay* token is used to uptake and provide a context for an aligning stance. Thus, the illocutionary contribution of *okay* needs to apply first. And the purely acknowledging use of *okay* boils down to $OKAY(\mathscr{C}_t, \phi) := COPY(\mathscr{C}_t, a_i, \phi)$, with a_i the speaker.

[13] Two constructed examples using English (they work like that in German too): Bob carries a box to the car. Reaching the car and while putting the box down, Bob says: "Okay." ($\Rightarrow$ Completion of task *okay*) Bob: "Does this say that I have to pay them \$100?" Alice: "Let me see ... Okay. It says you have to pay \$100, but ..." ($\Rightarrow$ Auto-reflexive *okay*)

Given the above, we can now model our undecidedness marking example Ex.4:

Example 13. (Undecidedness marking) We assume for simplicity an initially empty context $\mathscr{C}_0 = (C_{a,0}, C_{b,0})$ with $C_{a,0} = (v_a^{a,0} = \emptyset, v_a^{b,0} = \emptyset), C_{b,0} = (v_a^{b,0} = \emptyset, v_b^{b,0} = \emptyset)$. Alice asks Bob a question, which yields $\mathscr{C}_1$ with $C_{a,1} = (v_a^{a,1} = \{(p,u)\}, v_a^{b,1} = \emptyset)$ and $C_{b,1} = (v_a^{b,1} = \emptyset, v_b^{b,1} = \emptyset)$. Bob uptakes on Alice' question and answers it subsequently. This gives us $\mathscr{C}_2$ in which uptake occurs, with $C_{a,2} = C_{a,1}$ and $C_{b,2} = (v_a^{b,2} = \{(p,u)\}, v_b^{b,2} = \emptyset)$. The *COPY*-operation provides the context for negatively answering, which is $\mathscr{C}_3$ with $C_{a,3} = C_{a,2}$ and $C_{b,3} = (v_a^{b,3} = \{(p,u)\}, v_b^{b,3} = \{(p,0)\})$. Alice responds to Bob using an undecidedness marking *okay* resulting in the context $\mathscr{C}_5$ resulting from a *COPY*-operation and a *QUESTION*-operation, with $C_{a,5} = (v_a^{a,5} = \{(p,u)\}, v_a^{b,5} = \{(p,0)\})$ and $C_{b,5} = C_b^4 = C_b^3$. We note that Alice re-asks her question on this analysis. Then, Bob makes an assertion, which gets accepted by Alice in next position. This gives us first the context $\mathscr{C}_6$ with $C_{a,6} = (v_a^{a,6} = \{(p,u)\}, v_a^{b,6} = \{(p,0)\})$ and $C_{b,6} = (v_a^{b,6} = \{(p,u)\}, v_b^{b,6} = \{(p,0)\})$ in which Bob uptakes Alice' response. Next, $\mathscr{C}_7$ results from Bob's assertion with $C_{a,7} = (v_a^{a,7} = \{(p,u)\}, v_a^{b,7} = \{(p,0)\})$ and $C_{b,7} = (v_a^{b,7} = \{(p,u)\}, v_b^{b,7} = \{(p,0),(q,1)\})$, followed by Alice' uptake and acceptance yielding $\mathscr{C}_9$ with $C_{a,9} = (v_a^{a,9} = \{(p,u),(q,1)\}, v_a^{b,9} = \{(p,0),(q,1)\})$ and $C_{b,9} = (v_a^{b,9} = \{(p,0)\}, v_b^{b,9} = \{(p,0),(q,1)\})$. Finally, we have Alice resolving the issue p by aligning with Bob, yielding $\mathscr{C}_{10}$ with $C_{a,10} = (v_a^{a,10} = \{(p,0),(q,1)\}, v_a^{b,10} = \{(p,0),(q,1)\})$ and $C_{b,10} = C_{b,9}$. This alignment is made public via an assertion (here a negative assertion).

Ex.3 is rendered this way:

Example 14. (Acceptance marking) We assume again an initially empty context $\mathscr{C}_0$ with $C_{a,0} = (v_a^{a,0} = \emptyset, v_b^{a,0} = \emptyset)$ and $C_{b,0} = (v_a^{b,0} = \emptyset, v_b^{b,0} = \emptyset)$. Alice asks Bob a question yielding the context $\mathscr{C}_1$ with $C_{a,1} = (v_a^{a,1} = \{(p,u)\}, v_b^{a,1} = \emptyset)$ and $C_{b,1} = (v_a^{b,1} = \emptyset, v_b^{b,1} = \emptyset)$. After uptake, Bob answers affirmatively, yielding the context $\mathscr{C}_3$ with $C_{a,3} = C_{a,2} = C_{a,1}$ and $C_{3,b} = (v_a^{b,3} = \{(p,u)\}, v_b^{b,3} = \{(p,1)\})$. Then, Alice uses an acceptance marking *okay* resulting in the context $\mathscr{C}_5$ with $C_{a,5} = (v_a^{a,5} = \{(p,1)\}, v_b^{a,5} = \{(p,1)\})$ and $C_{b,5} = (v_a^{b,5} = \{(p,u)\}, v_b^{b,5} = \{(p,1)\})$.

This contrasts with the formal modeling of Ex.5:

Example 15. (Pure acknowledgment) We assume again an initially empty context $\mathscr{C}_0$ with $C_{a,0} = (v_a^{a,0} = \emptyset, v_b^{a,0} = \emptyset)$ and $C_{b,0} = (v_a^{b,0} = \emptyset, v_b^{b,0} = \emptyset)$. Alice instructs Bob to tell her every-thing about Charlie resulting in the context $\mathscr{C}_1$ with $C_{a,1} = (v_a^{a,1} = \{(p,1)\}, v_b^{a,1} = \emptyset)$ and $C_{b,1} = (v_a^{b,1} = \emptyset, v_b^{b,1} = \emptyset)$.[14] After uptake and acceptance, Bob makes an assertion, yielding the context $\mathscr{C}_4$ with $C_{a,4} = C_{a,3} = C_{a,2} = C_{a,1}$ and $C_{b,4} = (v_a^{b,4} = \{(p,1)\}, v_b^{b,4} = \{(p,1),(q,1)\})$. Alice acknowledges Bob's assertion using an *okay* token resulting in the context $\mathscr{C}_5$ with $C_{a,5} = (v_a^{a,5} = \{(p,1)\}, v_b^{a,5} = \{(p,1),(q,1)\})$ and $C_{b,5} = C_{b,4}$. Then, Alice rejects Bob's answer resulting in $\mathscr{C}_6$ with $C_{6,a} = (v_a^{a,6} = \{(p,1),(q,0)\}, v_b^{a,6} = \{(p,1),(q,1)\})$ and $C_{b,6} = C_{b,5}$.

Finally, a polar interrogative case for illustration purposes. We proposed that *okay* tokens cannot be used to answer questions. To some extend this is represented in our formal rendering of such cases.

[14] Note that we simplify instructions to assertions here.

Example 16. (*okay* in context of polar interrogative) Assuming an initially empty context $\mathscr{C}_0$ with $C_{a,0} = (v_a^{a,0} = \emptyset, v_b^{a,0} = \emptyset)$ and $C_{b,0} = (v_a^{b,0} = \emptyset, v_b^{b,0} = \emptyset)$, assume that Alice asks a question, yielding the context $\mathscr{C}_1$ with $C_{1,a} = (v_a^{a,1} = \{(p,u)\}, v_b^{a,1} = \emptyset)$ and $C_{b,1} = C_{b,0}$. Further, assume Bob uptakes on Alice' question using an *okay*-token. We have then $\mathscr{C}_2$ with $C_{a,2} = C_{a,1}$ and $C_{b,2} = (v_a^{b,2} = \{(p,u)\}, v_b^{b,2} = \emptyset)$. If Bob uses an *okay* token with final rise, then this additionally leads to ignorance stance marking. In that case, we get $\mathscr{C}_3$ with $C_{a,3} = C_{a,2}$ and $C_{b,3} = (v_a^{b,3} = \{(p,u)\}, v_b^{b,3} = \{(p,u)\})$. However, if Bob uses an *okay* token with final falling intonation in a cooperative setting, then this cannot be comprehended as implementing an acceptance marking *okay*, because the presupposition of the final fall is not satisfied. A proper judgment is required. And in a non-cooperative setting, *okay* with final falls only implement acknowledgment. Thus, on this analysis, *okay* with final falls cannot be used to provide an answer, because they cannot be used to express judgments on their own. This offers an alternative explanation to the suggestion made in the introduction.

5.4. Uptake and Common Ground

We finish off with uptake and common ground. We take both to be states of a multi-agent system here, thus properties of a context $\mathscr{C}_t$:

Definition 15. (Uptake) Let $\mathscr{C}_t = (C_{a_1,t}, \ldots, C_{a_n,t})$ be a context, $\phi \in \Phi$ be a formula, and $G \subseteq \mathscr{A}$ be a group of agents. We say that ϕ has been taken up in $\mathscr{C}_t$ among agents of G if and only if $\exists x \in G \exists \tau \in \mathbb{T}_3 \forall y \in G.(\phi, \tau) \in v_x^{y,t}$.

Thus we have that a formula ϕ has been taken up in a group of agents if and only if someone in the group has judged ϕ or expressed ignorance regarding ϕ and everyone else in the group has registered this. This is a fair approximation of uptake.

It is easy to see that on our analysis, *okay* is an expression that can lead to uptake by means of implementing acknowledgments (see for instance Ex.11).

Definition 16. (Common Ground) Let $\mathscr{C}_t = (C_{a_1,t}, \ldots, C_{a_n,t})$ be a context, $\phi \in \Phi$ be a formula, and $G \subseteq \mathscr{A}$ be a group of agents. We say that ϕ is common ground in $\mathscr{C}_t$ among agents of G if and only if $\exists \tau \in \{0,1\} \subset \mathbb{T}_3 \forall x, y \in G((\phi, \tau) \in v_x^{x,t} \wedge ((\phi, \tau) \in v_x^{y,t}))$.

We can see that common ground presupposes uptake, which means that we require shared understanding of what others have done (represented here in terms of truth value judgments). However, we do not have that if a formula is taken up, that such is common ground. We also observe that only acceptance uses of *okay* can lead to common ground. Pure acknowledgment uses do not add a judgment of the *okay*-speaker that can lead to grounding, and undecidedness markings indicate that the *okay*-speaker is not in a position currently to provide a classical judgment. Consequently, our formal representations do behave correctly with respect to our empirical findings.

6. Conclusion

This article contributes a first substantial study of the meaning and use of *okay* in formal semantics and pragmatics. Other studies have considered *okay* either as an aside, or as just a linguistic example of another more general phenomenon. Besides, they have operated on extremely small samples. The current study is informed by a large conversation analytic study of *okay* in spoken German and zoomed in on three specific uses. We proposed that *okay* denotes a truth predicate, which provides a precise account of the semantics of *okay*. Pragmatically, we said, *okay* is essentially used to mark uptake by implementing acknowledgments. For ease of exposition and lack of space, we have spelled out these ideas in a propositional model based on the interpretation of truth values in Strong Kleene Logic. Clearly, the idea of *okay* denoting a truth predicate can be generalized. Particles such as *ja* (*yes*), *genau* (*exactly*), and *richtig* (*right*) can be analyzed in the same way. Similarly, expressions such as *nein* (*no*) may be taken to denote falsity predicates (however, see Incurvati and Schlöder (2017)). On such a position, differences between expressions have to be motivated differently. One possibility is to say that, for instance, *okay* and *ja* have different epistemic profiles: while *okay* indicates ignorance, *ja* indicates knowledgability. A thorough discussion of this idea has to await the future and should be done minimally within a first-order account. The same goes for the mentioned yet not discussed uses of *okay*.

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Subkinds and anaphoricity: Avoid covert complexity[1]

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Abstract. This paper is about the theoretical implications of Despić's (2019) generalization regarding languages without definite articles. Applied to the number-marking Serbian and Turkish, bare plurals and uncountables can refer anaphorically to instances but not to subkinds, while bare singulars can refer anaphorically to both instances and subkinds. The first part poses a puzzle to the view that overt and covert definites are equivalent, along with the fact that overtly-definite plurals and uncountables can refer anaphorically to subkinds. I propose that the lack of equivalence is because subkind-anaphoricity is complex, and its covertness in languages without definite articles causes it to be blocked by the simpler covert operation of reference to kinds.

Keywords: kinds, subkinds, anaphoricity, countability, number, definiteness, definite articles, covertness, blocking, meaning preservation, ranking

1. Introduction

In languages without definite articles (henceforth *article-less languages*), bare nominals can be definite. However, there is debate regarding whether this reading is equivalent to the that of overt definites in languages with definite articles (Heim 2011, Dayal 2018, Šimík & Demian 2020). Recently, Despić (2019) has posed a new puzzle to the view of equivalence: Covertly-definite plurals and uncountables cannot refer anaphorically to subkinds, but overt definites can. Another part of the puzzle, presented in §2, is that covertly-definite singulars can refer anaphorically to subkinds. The latter is not surprising under Dayal (2004), where bare singulars are different from bare plurals and uncountables. However, the first part is surprising under the aspect of her framework where overt and covert definites are equivalent.

§3 presents Dayal's framework, and §4 extends it in a way which weakens the equivalence between overt and covert definites. I propose that subkind-anaphoricity is complex, and its covertness in article-less languages causes it to be blocked by the simpler covert operation of reference to kinds. §5 details the solution to Despić's puzzle, and §6 is the conclusion.

2. Despić's (2019) puzzle

This section presents Despić's (2019) puzzle to the view that overt and covert definites are equivalent. The first piece is that in certain article-less languages, bare nominals with cumulative reference can refer anaphorically to instances but not to subkinds. A bare nominal is a nominal without an article, determiner or quantifier, and *cumulative* covers plural and uncountable reference. This generalization manifests differently depending on whether the language is number-marking, as reviewed next.

[1] Thank you to Miloje Despić, Mojmír Dočekal, Yağmur Sağ, and the organizers and participants of Sinn und Bedeutung 28.

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Beginning with non-number-marking languages, and focusing on Mandarin (Despić also reports on Japanese), bare nouns in Mandarin have cumulative reference (Rullman & You 2006). The generalization manifests as follows: Bare *shuigo* 'fruit' can refer anaphorically to (1) pieces of fruit, e.g. apples,[2] but not to (2) a kind of fruit, e.g. the apple species. *Shuigo* 'fruit' in (2) can only refer to fruit in general, hence the paraphrase 'fruit is our life.'

(1) *Wo ba na dai pingguo fang dao zhuozi-shang,*
I BA that packet apple put toward table TOP
danshi shuigo yixia zi jiu diao-chulai le.
but fruit suddenly PTCP fall.out ASP
'I put the packet with apples$_i$ on the table, but [the fruit]$_i$ immediately fell out of it.'

(2) *Women shidai zhong pingguo. Shuigo jiu shi women de ming.*
we generation grow apple fruit PTCP is we GEN life
'We have been growing apples$_i$ for generations. (#That$_i$) fruit is our life.'

Continuing to number-marking languages, they have two sorts of bare nominals with cumulative reference: Plurals and uncountables. To exemplify with Serbian (Despić also reports on Turkish and Hindi), and beginning with uncountables, bare *voće* 'fruit' can refer anaphorically to pieces of fruit (Despić 2019:ex.18), but not to (3) a kind of fruit, parallel to Mandarin bare *shuigo* 'fruit' in (1) and (2).[3]

(3) *Naše mesto već generacijama proizvodi belo grožđe. Sve dugujemo voću.*
our town already generations produces white grape everything owe fruit.DAT
'Our town has been producing [white grape]$_i$ for generations.
We owe everything to (#that$_i$) fruit.'

Continuing to plurals, bare *ptice* 'birds' can refer anaphorically to (4) bird specimens, but not to (5) kinds of birds. *Ptice* 'birds' in (5) can only refer to birds in general, hence the paraphrase 'birds were exterminated.' The parentheses in (5) show that anaphoricity is unavailable regardless of whether the antecedent is one or multiple kinds of birds.

(4) *Dugo smo u našoj bašti imali beloglave orlove.*
Long were in our garden had white.headed.PL eagles.
Na žalost, ptice su juče nenadano uginule nakon kraće bolesti.
Sadly birds are yesterday unexpectedly died.PL after short illness
'We had [bald eagles]$_i$ in our garden for a long time.
Unfortunately, [the birds]$_i$ unexpectedly died yesterday after a short illness.'

(5) *Ceo život proučavam beloglavog orla (i zlatnog orla).*
whole life study-1.PRS white.headed eagle (and golden eagle).
Na žalost, pre deset godina ptice su istrebljene.
Sadly before ten years birds are exterminated

[2] Here and throughout, when I write that a nominal can be anaphoric, I do not mean that it is the best choice; it is often better to use a demonstrative determiner (Despić 2019).
[3] Despić (2019) classifies *voće* 'fruit' (Serbian) as uncountable due to generally requiring a classifier phrase or a measure phrase for counting.

'I have been studying [the bald eagle (and the golden eagle)]$_i$ my whole life.
Unfortunately, ten years ago (#the$_i$) birds were exterminated.'

The second piece of the puzzle is that *the fruit* and *the birds* in English can refer anaphorically to subkinds, (6) and (7).

(6) Where do **kiwifruit**$_i$ originate from? […] Kiwifruit seeds were introduced into New Zealand in the 20th century […]. At this time [**the fruit**]$_i$ was known as Chinese gooseberry. (COCA, Davies 2008–)

(7) Last month, with little fanfare, the U.S. Fish and Wildlife Service removed two tropical birds, [**the Mariana mallard and the Guam broadbill**]$_i$, from its list of species that are endangered. [**The birds**]$_i$ are extinct, having joined a growing list of animals that have disappeared from the face of the Earth.[4]

The preceding data pose a puzzle to the view that overt and covert definites are equivalent. Specifically, if the licensor of instance-anaphoricity in (1) by bare *shuigo* 'fruit' (Mandarin) is a covert version of *the*, then why does it not license subkind-anaphoricity in (2), which is possible with *the fruit* in (6)? Similarly, if the licensor of instance-anaphoricity in (4) by bare *ptice* 'birds' (Serbian) is a covert version of *the*, then why does it not license subkind-anaphoricity in (5), which is possible with *the birds* in (7)?

The last piece of the puzzle is that in Serbian and Turkish, bare singulars can refer anaphorically to subkinds, e.g. (8) (Serbian). There is thus a minimal contrast where bare *ptice* 'birds' in (5) cannot refer anaphorically to subkinds, but bare *ptica* 'bird' in (8) can.[5]

(8) *Ceo život proučavam beloglavog orla.*
whole life study-1.PRS white.headed eagle
Na žalost, pre deset godina ptica je istrebljena.
Sadly before ten years bird is exterminated
'I have been studying [the bald eagle]$_i$ my whole life.
Unfortunately, ten years ago [the bird]$_i$ exterminated.'

Consider the three pieces of the puzzle: (i) Bare singulars in Serbian and Turkish can refer anaphorically to subkinds, (ii) bare plurals and uncountables in the same languages cannot refer anaphorically to subkinds, and (iii) overtly-definite plurals and uncountables in English can refer anaphorically to subkinds. The next section shows that (i–ii) are not surprising under Dayal (2004), where bare singulars are different from bare plurals and uncountables. However, (ii–iii) are surprising under the aspect of Dayal's framework where overt and covert definites are equivalent. Dayal's framework is thus both challenged by Despić's puzzle, and it serves as the basis to the solution in §4–5.

[4] Retrieved 5 November 2023 from https://www.pewtrusts.org/en/about/news-room/opinion/2004/03/15/one-by-one-the-world-is-becoming-a-lonelier-place.

[5] Not all article-less languages allow bare singulars to refer anaphorically to subkinds. In Czech, bare nominals cannot be anaphoric at all (Šimík 2021), which extends to subkinds (Mojmír Dočekal p.c.).

Before proceeding, a terminological note is in order regarding *kind* and *subkind*. In terms of the sort of referent, most of the preceding nominals are kind-denoting. However, there is a difference in how the kinds relate to the nominals. In some cases, the nominal denotes the kind corresponding to the noun, e.g. bare *ptice* 'birds' in (5) denotes the bird class (Latin name *Aves*). In other cases, the nominal denotes one or multiple kinds which stand in the subkind relation with the kind corresponding to the noun (Schoenfeld 2022). For example, bare *ptica* 'bird' in (8) denotes the bald eagle species. To make this distinction, I say that the former nominals are kind-denoting, and the latter are subkind-denoting.

3. Basis for solution

This section presents the aspects of Dayal's (2004) framework which serve as the basis to the solution of Despić's puzzle. §3.1 presents Dayal's argument that number-marking languages have two sorts of kind terms, §3.2 presents Dayal's two operations for kinds, and §3.3 extends Dayal's framework in a way which accounts for the pattern in article-less languages, but with incorrect predictions for English. §3.4 then introduces Dayal's ranking between covert operations, which is extended in §4 to solve Despić's puzzle in §5.

3.1. Number in kind terms

This subsection presents Dayal's argument that in number-marking languages, singular kind terms are more restricted than plural and uncountable kind terms. For Dayal, a kind term is a nominal which can be kind-denoting, and is analyzed as kind-denoting in cases of generic and existential quantification (Carlson 1980, Chierchia 1998). For example, *snow*, *tigers* and *the tiger* are respectively an uncountable, a plural, and a singular kind term.

In English, singular kind terms are more restricted than plural and uncountable kind terms in three ways: (i) They are restricted to well-established kinds, (ii) they cannot contribute narrow existential quantification, and (iii) their non-definite reference to instances is restricted to representative objects, as reviewed next.

First, a well-established kind is a kind which is well-established in the shared knowledge of the interlocutors (Krifka 1987). Uncountable and plural kind terms are not restricted to such kinds, (9a) and (9b), but singulars are, (9c) (Krifka et al. 1995).

(9) a. Gold which is hammered flat is usually opaque.
b. Green bottles usually have narrow necks.
c. ??The green bottle usually has a narrow neck.

Continuing to narrow existential quantification, uncountable and plural kind terms can contribute such quantification, (10a) and (10b), but singulars cannot, (10c).

(10) Yesterday between four and nine,
a. each time snow entered, the police melted it.
b. each time thieves entered, the police arrested them.
c. #each time the thief entered, the police arrested him.

Finishing with representative objects, if *the tiger* in (11c) is used to express that the speakers filmed a number of tiger specimens, then they are implied to represent the tiger species (Krifka et al. 1995, Chierchia 1998). This is absent from *tigers* in (11b), which is compatible with the speakers only filming atypical tigers (e.g. ones with three legs), and it is also absent from *snow* in (11a), which is compatible with only atypical snow falling in India.

(11) a. In India, snow is falling. *compatible with only atypical snow falling*
b. In India, we filmed tigers. *compatible with only atypical tigers being filmed*
c. In India, we filmed the tiger. *implies representative tigers were filmed*

Based on English, one might suspect that the restrictions of singular kind terms are due to the definite article. However, Dayal argues that the real culprit is number. This argument is based on two sorts of languages where kind terms are uniform with respect to definite articles: (i) Languages without definite articles, e.g. Hindi, and (ii) languages where all kind terms have definite articles, e.g. Italian. This argument utilizes singular and plural kind terms because they more easily form minimal pairs compared to uncountable kind terms.

Beginning with the restriction to well-established kinds, Dayal argues via (12) (Hindi) and (13) (Italian) that between singular and plural kind terms, only the former exhibit the restriction. This is orthogonal to definite articles, because both kind terms in (12) and (13) respectively lack and have a definite article.

(12) *anu mahangii {*kitaab, kitaabeN} bectii hai.* (Dayal 1999)
Anu sells book books expensive is
'Anu sells expensive books.'

(13) a. *#La tigre a tre zampe è facile da cacciare.* (Dayal 2004)
the tiger with three legs is easy to Hunt
'The tiger with three legs is easy to hunt.'
b. *Le tigre a tre zampe sono facili da cacciare.*
the.PL tigers with three legs are easy.PL to hunt
'Tigers with three legs are easy to hunt.'

Continuing to narrow existential quantification, Dayal argues via (14) (Russian) and (15) (Italian) that between singular and plural kind terms, only the latter can contribute such quantification. This again is orthogonal to definite articles, because both kind terms in (14) and (15) respectively lack and have a definite article.

(14) *Vchera, mezhdu 3-mya i 5-yu, kazhdyi raz kogda*
yesterday between 3 and 5 each time when
'Yesterday, between 3 and 5, each time…'
a. *#vor zaxodil v dom, polizia arrestovyvala ego.*
thief enter to house police arrested him
'…the thief entered the house, the police arrested him.'
b. *vory zaxodili v dom, polizia arrestovyvala ix.*
thieves enter.PL to house police arrested them
'…thieves entered the house, the police arrested them.'

(15) *Ieri tra le 4 e le 9, ogni volta che*
yesterday between four.o'clock and nine.o'clock each time that
'Yesterday between 4 and 9, each time…'
a. *#il ladro è entrato, la polizia lo ha arrestato.*
the thief is entered the police him has arrested
'…the thief entered, the police arrested him.'
b. *i ladri sono entrati, la polizia li ha arrestati.*
the thieves are entered the police them has arrested
'…thieves entered, the police arrested them.'

Finishing with representative objects, they have received less cross-linguistic attention than the previous two phenomena. Still, Sağ (2022) argues that the restriction occurs in Turkish, which lacks definite articles, so it too is a potential cross-linguistic restriction of singular kind terms which is orthogonal to definite articles.

Following the argument that number-marking languages have two sorts of kind terms, Dayal posits two operations for kinds, presented next.

3.2. Operations for kinds

This subsection presents Dayal's (2004) two operations for kinds. The first, due to Chierchia (1998), maps a property to the function from situations to the maximal instance of the property, if the function is in the interpretation domain of kinds, (16) (abbreviated as $\cap$).

(16) $\lambda P.\begin{cases} \lambda s.\iota P_s \text{ (if } \lambda s.\iota P_s \text{ is in the interpretation domain of kinds,} \\ \text{undefined otherwise)} \end{cases}$

Crucially, the two presuppositions of $\cap$ make it undefined for singular properties. The first comes from ι, which presupposes that the input set has a maximal element. Consequently, $\cap$ presupposes that every extension of P has a maximal element. This however fails for non-singleton singular properties, e.g. TIGER; in situations with multiple tiger specimens, TIGER lacks a maximal element. As for singleton properties, $\cap$ is undefined for them due to the presupposition that P corresponds to a kind, plus Chierchia's (1998) stipulation that singleton properties do not correspond to kinds.

Unlike $\cap$ being undefined for singular properties, it is defined for all plural and uncountable properties which correspond to kinds (a counter-example is *parts of that machine*, cf. §3.4). Thus, $\cap$ is Dayal's operation for plural and uncountable kind terms.

As for singular kind terms, Dayal initially proposes that they utilize ι applied to the taxonomic reading of the noun. I assume for concreteness that this reading comes from an operation, notated as TAXON, which applies to an instance-level property. For example, TIGER is the property over tiger specimens, and TAXON(TIGER) is a property over kinds of tigers (cf. Schoenfeld 2022, where TAXON is notated as SUBK). In the countability literature, TAXON is known as the universal sorter (Bunt 1985, Chierchia 2010). Thus, Dayal's initial proposal is that *the tiger* as a kind term denotes $\iota \circ$ TAXON(TIGER)

In a later section, Dayal notes that her initial proposal incorrectly predicts that uncountable kind terms in English should be modifiable with the definite article, contra (17). This is because ι ∘ TAXON (realized as *the*) is applicable to uncountable properties like WINE.

(17) (*The) wine comes in several varieties,
(*the) red wine, (*the) white wine and (*the) rosé. (Dayal 2004)

To account for (17), Dayal posits that the operation for singular kind terms is restricted to singular properties. I define the operation in (18), which I abbreviate as ι ▫ TAXON, in anticipation of notation introduced in §4.[6]

(18) λP.ι ∘ TAXON(P) (if P is singular, undefined otherwise)

For Dayal, ι ▫ TAXON being restricted to singular properties is connected to it resolving a tension which only arises with such properties. On the one hand, kinds are conceptually associated with plurality, i.e. a kind tends to have multiple instances. On the other hand, singular properties exclusively range over atoms, unlike plural and uncountable properties.

The presuppositions of ∩ and ι ▫ TAXON mean that they are respectively restricted to properties which are (i) plural or uncountable, and (ii) singular. This is the first ingredient in Dayal's account of the contrasts in §3.1. The second is that due to the singular morphology of the noun, the output of ι ▫ TAXON is an atomic kind, which is responsible for the limitations of singular kind terms (see Dayal 2004 for details).

Lastly, to account for the contrasts in §3.1 being orthogonal to definite articles, Dayal posits that (i) ∩ and ι (▫ TAXON) are covert in article-less languages, (ii) the definite article lexicalizes ι (▫ TAXON), and (iii) the definite article may or may not also lexicalize ∩, which is Dayal's respective analysis of Italian and English. The two operations for kinds are thus mutually-exclusive regardless of whether they are covert or lexicalized as definite articles, thus accounting for the contrasts in §3.1 being orthogonal to definite articles.

In conclusion, Dayal's framework is designed to account for differences between singular vs. plural and uncountable kind terms. Thus, it serves as a good basis to account for the aspect of Despić's (2019) puzzle where in article-less languages, plural and uncountable kind terms are more restricted in subkind-anaphoricity. However, the next subsection shows that Dayal's framework is challenged by the piece of the puzzle where overtly-definite plurals and uncountables can refer anaphorically to subkinds.

[6] Dayal (2004) notates the operation for singular kind terms as $*^{\cap}(\text{SING}) \rightarrow \iota X[P_{\text{TAXONOMIC}}(X)]$. This suggests that it applies only after ∩ fails to apply to a singular property, which in turn suggests that it is in some sense blocked by ∩. This however cannot be part of Revised Meaning Preservation (RMP, see §3.4); RMP is a ranking between covert operations, but the operation for singular kind terms is restricted to singular properties regardless of whether it is overt or covert.

3.3. Incorrect extension

Despić (2019) argues that the pattern in article-less languages follows from Dayal's (2004) framework. Here I argue that the framework needs to be extended. I show here an incorrect extension, followed by a correct one in §4.

First, a trivial extension of Dayal's framework is that ι ▫ TAXON licenses subkind-anaphoricity (in addition to reference to the maximal subkind). However, to account for the pattern in article-less languages, one should also assume that ι ▫ TAXON is the only licensor of subkind-anaphoricity. Next I detail the account, followed by the incorrect prediction for English.

Beginning with bare plurals and uncountables, recall from §2 that in Serbian, bare *voće* 'fruit' and bare *ptice* 'birds' cannot refer anaphorically to subkinds. Following the extension of Dayal (2004) where ι ▫ TAXON is the only licensor of subkind-anaphoricity, it cannot license that in (3) and (5) (below) due to being restricted to singular properties. ∩ by contrast is applicable, hence these bare nominals can be kind-denoting but not subkind-anaphoric.

(3) *Naše mesto već generacijama proizvodi belo grožđe. Sve dugujemo voću.*
our town already generations produces white grape everything owe fruit.DAT
'Our town has been producing [white grape]$_i$ for generations.
We owe everything to (#that$_i$) fruit.'

(5) *Ceo život proučavam beloglavog orla (i zlatnog orla).*
whole life study.1.PRS white.headed eagle (and golden eagle).
Na žalost, pre deset godina ptice su istrebljene.
Sadly before ten years birds are exterminated
'I have been studying [the bald eagle (and the golden eagle)]$_i$ my whole life.
Unfortunately, ten years ago (#the$_i$) birds were exterminated.'

Unlike ι ▫ TAXON being inapplicable in (3) and (5), it is applicable to bare *ptica* 'bird' in (8) (below), hence subkind-anaphoricity is licensed.

(8) *Ceo život proučavam beloglavog orla.*
whole life study.1.PRS white.headed eagle
Na žalost, pre deset godina ptica je istrebljena.
Sadly before ten years bird is exterminated
'I have been studying [the bald eagle]$_i$ my whole life.
Unfortunately, ten years ago [the bird]$_i$ exterminated.'

Finishing with non-number marking languages, the precise account of (2) (below) depends on whether bare *shuigo* 'fruit' (Mandarin) is analyzed as basically denoting a kind (Chierchia 1998) or a property (Rullman & You 2006). If the former, then bare *shuigo* 'fruit' denotes the fruit kind, which yields the attested reading of (2). If the latter, then ∩ but not ι ▫ TAXON is applicable to the property, hence bare *shuigo* 'fruit' can be kind-denoting but not subkind-anaphoric. Note that this data does not distinguish between the two analyses.

(2) *Women shidai zhong pingguo. Shuigo jiu shi women de ming.*

we generation grow apple fruit PTCP is we GEN life
'We have been growing apples$_i$ for generations. (#That$_i$) fruit is our life.'

Alarmingly, the present extension of Dayal (2004) incorrectly predicts that overtly-definite plurals and uncountables in English should lack subkind-anaphoricity, contra (6) (*the fruit*) and (7) (*the birds*). In this extension, ι ▫ TAXON (lexicalized as *the*) is the only licensor of subkind-anaphoricity, but it is inapplicable to plural and uncountable properties.

In general, ι ▫ TAXON is restricted to singular properties regardless of whether it is overt or covert, so it cannot distinguish between overt and covert definites. Thus, although the pattern in article-less languages follows from a minor extension of Dayal (2004), a more major extension is needed for the distinction between overt and covert definites. The next subsection introduces the aspect of Dayal's framework which allows to make the distinction.

3.4. Ranking

This subsection introduces Ranking, which is Dayal's (2018) redubbing of (Revised) Meaning Preservation (Chierchia 1998, Dayal 2004). Ranking is a relation between covert operations where $OP_1 > OP_2$ means that OP_2 is applicable only if OP_1 is inapplicable. The remainder of this paper distinguishes between overt and covert definites by introducing a lower-ranked licensor of subkind-anaphoricity, meaning it is more limited as covert.

As background, Chierchia (1998) introduces Ranking to explain which bare plurals in English can contribute wide existential quantification. For example, (19a) *parts of that machine* can, but (19b) *machines* cannot.

(19) a. John didn't see parts of that machine. $\surd \exists > \neg$ ($\surd \neg > \exists$)
b. John didn't see machines. $\times \exists > \neg$ ($\surd \neg > \exists$)

In Chierchia's framework, obligatorily-narrow existential quantification as in (19b) is mediated by $\cap$ (via Derived Kind Predication), whereas scopally-flexible quantification as in (19a) is licensed by covert $\exists$. The task is thus to explain why between $\cap$ and $\exists$, only the former can apply to *machines*, while the latter can apply to *parts of that machine*.

Chierchia's answer is that $\cap$ is ranked above $\exists$. Thus, $\cap$ being applicable to *machines* blocks $\exists$, so *machines* cannot contribute wide existential quantification in (19b). By contrast, $\cap$ is inapplicable to *parts of that machine* due to the property not corresponding to a kind (cf. §3.1), so $\exists$ can contribute wide existential quantification in (19b). This ranking is because $\cap$ is more meaning-preserving, which amounts to it being non-quantificational, unlike $\exists$.

Building on Chierchia, Dayal (2004) expands Ranking by positing that $\cap$ is unranked with ι and ι ▫ TAXON, yielding (20). In subsequent works, Dayal advertises Ranking without ι ▫ TAXON, but next I show that it is crucial to her analysis.

(20) {$\cap$, ι, ι ▫ TAXON} > $\exists$ (Dayal 2004:ex.88)

Dayal uses (20) to account for certain ambiguities in article-less languages. First, the non-ranking between $\cap$ and ι accounts for (21) (Hindi), where the bare plural *kutte* 'dogs' denotes

the kind or contextually salient instances. These readings respectively utilize $\cap$ and ɩ, and neither blocks the other under (20), hence (21) is ambiguous.

(21) *kutte habut bhau Nkte haiN.* (Dayal 2004)
dogs lot bark are
(i) 'Dogs (in general) bark a lot.' ~ (ii) 'The (salient) dogs bark a lot.'

Next, the non-ranking in (20) between ɩ and ɩ ▫ TAXON accounts for bare singulars like *kutta* 'dog' exhibiting ambiguity parallel to (21) (Dayal 2004). The readings utilize ɩ and ɩ ▫ TAXON, and neither blocks the other under (20), hence bare singulars are ambiguous between definite (via ɩ) and kind-denoting (via ɩ ▫ TAXON).

The Ranking in (20) is derived from Chierchia's (1998) idea that quantifiers are lower-ranked. However, Dayal (2013) argues that ∃ is not in the domain of Ranking; this would leave three unranked operations, which would call into question the need for Ranking. As a counter-point, Despić's (2019) puzzle demonstrates the need for Ranking; covert definites are more limited than overt ones in subkind-anaphoricity, which would follow if a licensor of subkind-anaphoricity is lower-ranked. The next section derives Ranking in a way which introduces such an operation, thus solving Despić's puzzle in §5.

4. Deriving Ranking

This section achieves the quadruple goal of (i) deriving that $\cap$ is restricted to properties which correspond to kinds (Chierchia 1998), (ii) deriving that ɩ ▫ TAXON is restricted to singular properties (Dayal 2004), (iii) deriving Dayal's (2004) Ranking, and (iv) deriving an extension to Ranking which solves Despić's (2019) puzzle in §5.

As the first step towards (i–ii), I conceive of $\cap$ and ɩ ▫ TAXON as being shaped by Expressibility and Resourcefulness, which respectively state that (i) kind-reference should be accessible to as many sorts of nominals as possible,[7] and (ii) operations for kinds should utilize already-available operations. I formalize the latter operations as being in OP, which includes ^ (intensionalization), ɩ and TAXON, but not PL (pluralization, see below). OP is closed under function composition, and its relevant subset is in (22).

(22) $\left\{ \begin{matrix} & ^{\wedge} \circ \iota \circ \text{TAXON} & \\ ^{\wedge} \circ \iota & ^{\wedge} \circ \text{TAXON} & \iota \circ \text{TAXON} \\ & ^{\wedge} \quad \iota \quad \text{TAXON} & \end{matrix} \right\}$ (subset of OP[8])

As a brief detour, the solution to Despić's puzzle in §5 relies on PL (and its compositions) being excluded from OP. This is derivable from the operations in (22) being universal, i.e. they are available in all languages, with variation in whether they are overt or covert. Indeed, Rullman & You (2006) argue that PL is not universal; if it were, then it would be covert in Mandarin, and nouns would be ambiguous between singular and plural, contra the fact.

[7] I am using *kind-reference* as defined in §2, where a nominal denotes the kind corresponding to the noun.
[8] The input of TAXON is an (intensional) property (Schoenfeld 2022 and references therein), so TAXON ∘ ^ is identical to TAXON, and TAXON ∘ ɩ is illicit. The input of ɩ is a set, so ɩ ∘ ^ is illicit.

Unlike PL being non-universal, I do not know of parallel arguments for TAXON. This is notable, because TAXON (aka the universal sorter) is viewed as a counterpart to the universal grinder, which is argued to be non-universal (Nunberg & Zaenen 1992, Cheng et al. 2008).

A challenge to deriving (22) from universality is that the universality of ι is disputed (Šimík & Demian 2020). If it is not universal, then the upcoming analysis is maintained by ι being covert in the article-less languages in question. However, one cannot appeal to universality to explain why OP includes ι but not PL. I leave this as an unsolved problem. (The approach where ι is not universal has its own challenge, stated in §6.)

Returning to Expressibility and Resourcefulness, one could in theory achieve the former while maintaining the latter by utilizing operations in OP. The subset in (22) has two candidates, $^ \circ \iota$ and $\iota \circ$ TAXON, but next I argue that they do not achieve Expressibility. For $^ \circ \iota$, this is because its output is an individual concept which may or may not correspond to a kind; an example of the latter is the intension of *the parts of that machine* (§3.4). Because $^ \circ \iota$ is not dedicated to kind-reference, it does not achieve Expressibility.

Unlike the output of $^ \circ \iota$ not being a kind, the output of $\iota \circ$ TAXON is a kind. However, for $\iota \circ$ TAXON to achieve Expressibility, it must license reference to the maximal subkind, which is only possible if TAXON ranges over the maximal subkind. This however is not a property of TAXON. To illustrate, bold *tiger* in (23) denotes TAXON(TIGER), which can range over a non-maximal subkind (the Bengal tiger), but ranging over the maximal subkind is odd, even though it is technically the most widespread kind of tiger.

(23) The #(Bengal) tiger is the most widespread **tiger**.

Following (23) and the preceding discussion, $^ \circ \iota$ and $\iota \circ$ TAXON do not achieve Expressibility. I posit that this extends to all operations in OP, although a full definition of OP is delayed to a future venue. I posit that in such a case, when no operation in OP can fulfill a specific purpose (here Expressibility), a composed operation in OP can be duplicated as a separate operation which fulfills the purpose. I next conceive of $\cap$ and $\iota \sqsupset$ TAXON as respectively being duplicates of $^ \circ \iota$ and $\iota \circ$ TAXON. $\sqsupset$ symbolizes duplication of a composed operation in OP, so $\cap$ can also be notated as $^ \sqsupset \iota$ (I continue to use $\cap$).

As the first step to deriving $\cap$, note that $^ \circ \iota$ is the least restricted candidate in (22) for increasing Expressibility; $^$ is unrestricted, so ι is the only restrictor (the input set must have a maximal element). By contrast, $\iota \circ$ TAXON has TAXON as an additional restrictor. For example, TAXON is restricted to non-human properties (Schoenfeld 2022). To illustrate, *president* cannot be used to count kinds of presidents, (24a). This extends to $\iota \circ$ TAXON, e.g. *the president* cannot refer anaphorically to a kind of president, (24b). By contrast, $^ \circ \iota$ is applicable to human properties, e.g. *the president* can have a de-dicto reading, (24c).

(24) a. In the 20th century, the US had two #(kinds of) presidents: Democrats and Republicans.
b. The second #(kind of) president was more common. $\iota \circ$ TAXON *inapplicable*
c. The president changes periodically. $^ \circ \iota$ *applicable*

(24b–c) are part of the generalization that ^ ∘ ι is less restricted than ι ∘ TAXON. Thus, the former takes priority as serving as the basis for a duplicate which increases Expressibility. It specifically serves as the basis for ∩, whose only difference from ^ ∘ ι is being restricted to kinds (Chierchia 1998). ^ ∘ ι fails Expressibility because it is not dedicated to kinds, and the restriction of ∩ is the minimal difference needed to achieve Expressibility.

An implication of ∩ and ^ ∘ ι being distinct is that they can differ in lexicalization. Thus, there can be languages where ^ ∘ ι is lexicalized as the definite article while ∩ is covert, e.g. English (Chierchia 1998, Dayal 2004).

∩ increases Expressibility for plural and uncountable nominals, but not for singular nominals, because it is inapplicable to singular properties (§3.2). A different operation is needed, and ι ∘ TAXON is the next best candidate. However, recall from (23) that it stops short at achieving Expressibility due to not licensing reference to the maximal subkind. It therefore serves as the basis for a duplicate which licenses reference ot the maximal subkind.

If the above were the only difference between ι ∘ TAXON and its duplicate, then the latter would be applicable to non-singular properties along with ∩. This however would not increase Expressibility; ∩ is strictly less restricted than ι ∘ TAXON (and any duplicate thereof) among non-singular properties, e.g. only ∩ is applicable to human properties.

The purpose of the duplicate of ι ∘ TAXON is to achieve Expressibility for singular nominals, which I posit is reflected by the duplicate being restricted to singular properties. This derives Dayal's (2004) operation for singular kind terms, notated here as ι ▫ TAXON.

The previous paragraph derives that ι ▫ TAXON is available only in languages with singular properties, i.e. number-marking languages. Non-number-marking languages like Mandarin lack such properties (Rullman & You 2006), so ∩ suffices for Expressibility.

After deriving the presuppositions of ∩ and ι ▫ TAXON, which are in the domain of Ranking, I derive the domain itself. I first appeal to DUP, the language-specific set of duplicates of composed operations in OP. DUP includes ∩, plus ι ▫ TAXON in number-marking languages. With that, I posit that the domain of Ranking is the argumental and covert subset of OP ∪ DUP. Based on the subset of OP in (22), and setting aside irrelevant composed operations, we get the domains in (25) for article-less languages with and without number-marking; the only difference is that the former include ι ▫ TAXON.

(25) a. {∩, ι, ι ▫ TAXON, ι ∘ TAXON} *Serbian, Turkish, Hindi*
b. {∩, ι, ι ∘ TAXON} *Mandarin, Japanese*

I lastly derive Ranking by positing, using the purposefully vague term *complex*, that complex operations are lower-ranked. Thus, Ranking amounts to avoidance of complex covert operations, if simpler ones are applicable (Avoid Covert Complexity, ACC).

With ACC, one can derive Chierchia's (1998) lower-ranking of ∃ by quantification introducing complexity. If this were the only source of complexity, then the non-quantificational ∩ and ι ∘ TAXON would be equally-ranked. However, this would incorrectly predict that in article-less

languages, bare plurals and uncountables would be ambiguous between kind-denoting (via $\cap$) and subkind-anaphoric (via $\iota \circ$ TAXON). I therefore posit a different source of complexity, namely function composition ($\circ$). Based on (25), $\circ$ as a source of complexity yields the Rankings in (26). Recall that $\cap$ and $\iota \sqsupset$ TAXON are duplicates of composed operations, but they themselves are not composed, hence they are higher-ranked. A duplicate is distinct from its original in that it can be lexicalized differently (see earlier on $\cap$), plus it counts as simplex for the purposes of Ranking.

(26) a. $\{\cap, \iota, \iota \sqsupset \text{TAXON}\} > \iota \circ \text{TAXON}$ *Serbian, Turkish, Hindi*
b. $\{\cap, \iota\} > \iota \circ \text{TAXON}$ *Mandarin, Japanese*

As an alternative to $\iota \circ$ TAXON being lower-ranked in (26) due to composition, recall from (23) that $\iota \circ$ TAXON does not license reference to the maximal subkind, unlike $\iota \sqsupset$ TAXON. The maximal subkind corresponds to the meaning of a noun in a kind term, so one can say that $\iota \sqsupset$ TAXON is more meaning-preserving (Chierchia 1998) than $\iota \circ$ TAXON.

Regardless of whether (26) is derived from complexity or meaning-preservation, it derives Dayal's (2004) triple non-ranking between $\cap$, ι, and $\iota \sqsupset$ TAXON, in a way which also introduces the lower-ranked $\iota \circ$ TAXON. Both of the latter operations license subkind-anaphoricity, but only $\iota \circ$ TAXON weakens the equivalence between overt and covert definites, which is needed to solve Despić's puzzle; the overt version is exempted from Ranking, whereas the covert version is blocked by $\cap$. §5 shows how this solves Despić's puzzle.

Beforehand, after identifying $\iota \sqsupset$ TAXON and $\iota \circ$ TAXON as licensors of subkind-anaphoricity, the question remains of whether there are additional licensors, e.g. ι. Specifically, if a nominal is subkind-denoting without TAXON, e.g. a nominal built on *species*, does ι license anaphoricity? As background, consider the anaphoric plural *the species* in (27).

(27) [**A. ocellaris**]$_i$ is the second most commonly imported marine ornamental fish species worldwide. Its close cousin [**A. percula**]$_j$, however, is the clownfish more commonly imported into the United States. [...] [**The species**]$_{i+j}$ are almost identical, except for some minor color differences. (COCA)

(27) does not determine whether ι licenses subkind-anaphoricity; *the* is three ways ambiguous between ι, $\iota \sqsupset$ TAXON, and $\iota \circ$ TAXON, and it is unknown which is used in (27). Crucially, this can be settled with Serbian. Recall from §2 that bare *ptice* 'birds' can refer anaphorically to instances but not to subkinds. We assume that the first reading utilizes ι, so we predict that if ι licenses subkind-anaphoricity, it should license that for bare *vrste* 'species.PL'. This however is not borne out in (28), where *vrste* can only be anaphoric with *ove* 'these' or *obe* 'both'. This plays a role in the next section, which solves Despić's puzzle.

(28) *Beloglavi sup (Gyps fulvus) je vrsta lešinara srednje veličine koja*
white.headed vulture Gyps fulvus is species scavenger middle size which
naseljava suptropski klimatski pojas i veoma je popularna u Srbiji. Slična
inhabits subtropical climatic area and very is popular in Serbia similar
vrsta je orao krstaš (Aquila heliaca) – to je impozantna grabljivica,
species is eagle cross Aquila heliaca – that is impressive bird.of.prey

koja	*je*	*nekada*	*naseljavala*	*široke*	*predele*	*Evroazije.*
which	is	sometime	inhabited	wide	areas	Eroasia
#Vrste	*su*	*među*	*veoma*	*ugroženim,*	*pre*	*svega*
species.PL	are	among	very	endangered	before	everything
zbog	*krivolova*		*i*	*gubitka*	*staništa.*	
because	poaching		and	loss	habitat	

'[**The Eurasian griffon vulture**]$_i$ is a mid-size scavenger species, which inhabits the subtropical climate area and is very popular in Serbia. A similar species is [**the Eastern Imperial Eagle**]$_j$ – this is a big bird of prey, that used to inhabit wide areas across Eurasia. [**Species**]$_{\#i+j}$ are among the very endangered ones, primarily because of the loss of habitat and poaching.'

5. Solving Despić's puzzle

This section details how the Ranking in §4 solves Despić's (2019) puzzle. This is akin to the near-solution in §3.3, except here I account for the difference between overt and covert definites. The next subsection begins with non-number-marking languages.

5.1. No number-marking

This subsection accounts for the pattern in non-number-marking languages where bare nominals can refer anaphorically to instances but not to subkinds. As in §3.3, the precise account of (2) (below) depends on whether bare *shuigo* 'fruit' (Mandarin) is analyzed as basically denoting a kind (Chierchia 1998) or a property (Rullman & You 2006). If the former, then the denotation of *shuigo* 'fruit' yields the attested reading of (2). If the latter, then there is mismatch between *shuigo* 'fruit' being argumental and denoting a property. This is resolvable with $\cap$, which blocks the lower-ranked $\iota \circ$ TAXON, which in turn the only licensor of subkind-anaphoricity in Mandarin (recall that non-number marking languages lack $\iota \blacksquare$ TAXON). Thus, bare *shuigo* 'fruit' can be kind-denoting but not subkind-anaphoric in (2).

(2) *Women shidai zhong pingguo. Shuigo Jiu shi women de ming.*
we generation grow apple fruit PTCP is we GEN life
'We have been growing apples$_i$ for generations. (#That$_i$) fruit is our life.'

Unlike $\cap$ blocking $\iota \circ$ TAXON, it does not block the equally-ranked ι, hence bare *shuigo* 'fruit' can refer anaphorically to pieces of fruit (§2). Thus, the reason that certain bare nominals can refer anaphorically to instances but not to subkinds is that $\cap$ blocks $\iota \circ$ TAXON, but not ι. The next subsection turns to number-marking languages.

5.2. Uncountables

This subsection accounts for why covertly-definite uncountables cannot refer anaphorically to subkinds, but overt definites can. Beginning with the former, bare *voće* 'fruit' (Serbian) is covertly-definite in that it can refer anaphorically to pieces of fruit (Despić 2019:ex.18). However, it lacks subkind-anaphoricity in (3) (below). (3) has a mismatch between *voće* being

argumental and denoting a property, which is only resolvable with ∩; ι ∘ TAXON is lower ranked, and ι ▫ TAXON is inapplicable to uncountable properties. Thus, bare *voće* 'fruit' can be kind-denoting but not subkind-anaphoric in (3).

(3) *Naše mesto već generacijama proizvodi belo grožđe. Sve dugujemo voću.*
our town already generations produces white grape everything owe fruit.DAT
'Our town has been producing [white grapes]$_i$ for generations.
We owe everything to (#that$_i$) fruit.'

Unlike ∩ blocking ι ∘ TAXON, it does not block the equally-ranked ι, hence bare *voće* 'fruit' can refer anaphorically to pieces of fruit (Despić 2019:ex.18). As for overt definites, ι ∘ TAXON is lexicalized as *the* in English, meaning it is exempted from Ranking, hence *the fruit* can refer anaphorically to subkinds (§2).

As an interim summary, the analysis in §3.3 fails because ι ▫ TAXON is the only licensor of subkind-anaphoricity; it is inapplicable to uncountable properties regardless of whether it is overt or covert, so it cannot distinguish between overt and covert definites. By contrast, here the distinction is made with ι ∘ TAXON as an additional licensor of subkind-anaphoricity, whose lower-ranking means that it is more limited as covert. The next subsection turns to plurals.

5.3. Plurals

This subsection accounts for why covertly-definite plurals cannot refer anaphorically to subkinds, but overt definites can. Beginning with the former, bare *ptice* 'birds' (Serbian) is covertly-definite in that it can refer anaphorically to bird specimens (§2). However, it lacks subkind-anaphoricity in (5) (below). (5) has a mismatch between *ptice* 'birds' being argumental and denoting a property, which as before is only resolvable with ∩; ι ∘ TAXON is lower ranked, and ι ▫ TAXON is inapplicable to plural properties. Thus, bare *ptice* 'birds' can be kind-denoting but not subkind-anaphoric in (5).

(5) *Ceo život proučavam beloglavog orla (i zlatnog orla).*
whole life study.1.PRS white.headed eagle (and golden eagle).
Na žalost, pre deset godina ptice su istrebljene.
Sadly before ten years birds are exterminated
'I have been studying [the bald eagle (and the golden eagle)]$_i$ my whole life.
Unfortunately, ten years ago (#the$_i$) birds were exterminated.'

Unlike ∩ blocking ι ∘ TAXON, it does not block the equally-ranked ι, hence bare *ptice* 'birds' can refer anaphorically to specimens (§2). As for overt definites, ι ∘ TAXON is lexicalized as *the* in English, meaning it is exempted from Ranking, hence *the birds* can refer anaphorically to subkinds (§2).

The present account of (5) assumes that the mismatch occurs at the level of PL(BIRD), the property over pluralities of bird specimens. Another option is that it occurs with PL(TAXON(BIRD)), the property over pluralities of kinds of birds (Wilkinson 1991). In this case, ι could in theory resolve the mismatch by yielding anaphoricity to the plurality of

subkinds (the bald eagle and the golden eagle). In practice however, §4 shows that ι does not license subkind-anaphoricity in Serbian, so this derivation is unavailable.

The present account of (5) also relies on PL not being in OP (§4). If it were, then ι ∘ TAXON ∘ PL would be a licensor of subkind-anaphoricity, which would be overt in Servian due to PL being overt, hence it would be exempted from Ranking. One could then assume that the mismatch in (5) occurs at the level of BIRD, which would then be resolvable via ι ∘ TAXON ∘ PL. §4 excludes PL from OP on the basis that PL is not universal (Rullman & You 2006), but a different analysis is needed if ι is also not universal (Šimík & Demian 2020).

This concludes the account of bare nominals with cumulative reference lacking subkind-anaphoricity in article-less languages. The next subsection turns to bare singulars.

5.4. Singulars

This subsection accounts for why bare singulars in Serbian and Turkish can refer anaphorically to subkinds. (I leave other article-less languages to future research, fn.5.). In (8) (below), there is mismatch between bare *ptica* 'bird' (Serbian) being argumental and denoting a property. Unlike the previous subsections, ∩ cannot resolve the mismatch due to being inapplicable to singular properties (cf. §3.2). ι is also inapplicable due to yielding a bird specimen, which is mismatched with the kind-level predicate *istrebljena* 'exterminated'. Between the three non-ranked operations, only ι ▫ TAXON is applicable.

ι ▫ TAXON can in theory resolve the mismatch in (8) by referring to (i) the antecedent subkind (the bald eagle), or (ii) the maximal subkind (the bird class, Latin name *Aves*). (ii) however is less accessible, which I account for next.

(8) *Ceo* *život* *proučavam* *beloglavog* *orla.*
whole life study.1.PRS white.headed eagle
Na žalost, *pre* *deset* *godina* *ptica* *je* *istrebljena.*
Sadly before ten years bird is exterminated
'I have been studying [the bald eagle]$_i$ my whole life.
Unfortunately, ten years ago [the bird]$_i$ exterminated.'
(Less accessible: '…*Aves* was exterminated.')

To explain why '*Aves*' is less accessible in (8), I appeal to the aspect of Dayal's (2004) framework where the output of ι ▫ TAXON is an atomic kind. For Dayal, such a kind is limited in the instantiation relation, which for Chierchia (1998) is a parthood relation (an instance of a kind is part of the extension of the kind). I posit that an atomic kind is also limited in the subkind relation, which is also a parthood relation. I posit specifically that the output of ι ▫ TAXON is a kind which is contextually atomic (Rothstein 2010). Crucially, this contextualization can be made difficult by mentioning subkinds, which highlight that the kind is not atomic. For example, (8) mentions a kind of bird (the bald eagle), which makes it difficult to contextualize *Aves* as atomic, hence this reading is less accessible. By contrast, (8) does not mention kinds of bald eagles, which allows the bald eagle species to be contextualized as atomic, making this reading accessible in (8).

In conclusion, bare singulars differ from bare plurals and uncountables because only the former can utilize ι ▫ TAXON, which is limited to singular properties. This is the same account as in §3.3, except here I account for the difference between overt and covert definites. I do so by appealing to ι ∘ TAXON as an additional licensor of subkind-anaphoricity, whose lower-ranking means that it is more limited as covert.

6. Conclusion

This paper is about the theoretical implications of Despić's (2019) generalization. First, Dayal's (2004) distinction between the two sorts of kind terms is strengthened; they differ not only in (i) well-established kinds, (ii) narrow existential quantification and (iii) representative objects, but also in (iv) subkind-anaphoricity. However, whereas (i–iii) are orthogonal to definite articles, (iv) only occurs in languages without definite articles.

This leads to the second implication: The lack of equivalence between overt and covert definites is strengthened. This adds to Šimík & Demian (2020), who found that bare nominals in Russian can be indefinite in a manner which is unavailable to overt definites. Under Heim (2011), this is captured by overt definites utilizing ι, whereas so-called covert definites are in fact indefinites which do not compete with definites, and thus can be strengthened to definite meaning. This however still faces Despić's puzzle: How come non-competing indefinites can be strengthened to instance-anaphoricity, but not to subkind-anaphoricity?

This paper solves Despić's puzzle within a framework where overt and covert definites are basically equivalent in that both utilize ι, which can be overt or covert. I weaken the equivalence for subkind-anaphoricity by positing ι ∘ TAXON as a licensor of subkind-anaphoricity, which is more limited as covert due to being ranked below ∩, the operation for plural and uncountable kind terms. Consequently, bare plurals and uncountables are more limited in subkind-anaphoricity than bare singulars. Despić's puzzle demonstrates the need for Ranking between covert operations (Chierchia 1998), and here I derive and extend Dayal's (2004) Ranking in a way which solves Despić's (2019) puzzle.

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Symmetry resolution and blocking[1]

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Abstract. We propose a blocking condition that limits the possible effects of exhaustification: exhaustifying a sentence ϕ cannot output a meaning that could be expressed as the basic, non-exhaustified, meaning of a sentence that is no more complex than ϕ. We propose that this blocking condition provides a solution to the so-called symmetry problem. We compare our solution to the proposal in Katzir (2007) and Fox and Katzir (2011), which instead prevents exhaustification from excluding alternatives that are more complex than the assertion. In support of our blocking condition, we argue that Katzir and Fox's complexity filter does not actually solve the symmetry problem in full, and in fact is incompatible with exhaustification data. We also argue against a central auxiliary assumption that Katzir and Fox's account appeals to, viz. the assumption that symmetry cannot be resolved by context.

Keywords: exhaustification, symmetry problem, complexity constraint, blocking.

1. Introduction

Exhaustification is a process that can tacitly strengthen basic sentence meanings. Prominent instances of this effect are so-called scalar implicatures, such as those often associated with uses of the existential determiner *some*. For example, (1) has a basic meaning that is merely existential, that there are players who responded, which we will state as in (2). But (1) can, and typically does, carry the stronger total meaning stated in (3). That is, (1) can be understood as also implying that there were players who did not respond, the second conjunct of (3). The presence of this implication is confirmed, for instance, by its felicitous denial, as in (4).

(1) Some players responded.

(2) Basic meaning of (1):
SOME(P)(R)

(3) Available strengthened meaning of (1):
SOME(P)(R) $\wedge$ $\neg$ALL(P)(R)

(4) A: Some players responded.
B: No, all of them did!

It is this sort of strengthening that is commonly said to arise from *exhaustification*. Its nature is a matter of debate. In particular, while the mapping from basic to strengthened meaning is classically attributed to Gricean pragmatics, it has also been credited to a grammatically encoded operator (e.g., Chierchia et al., 2011). However, since the choice between these options

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does not bear on the arguments below, we will refrain here from committing to one view or another.

Reflecting this lack of commitment, we will often use the term *strengthening* to refer to the phenomenon in question, which might be more obviously theory neutral than *exhaustification*. But sometimes we will also refer to the inferences added by strengthening as *implicatures*.

In the broadest characterization, strengthening takes the form in (5). That is, the strengthened meaning of sentence ϕ, $\text{Exh}_{\text{Excl}}(\phi)$, is the conjunction of the basic meaning of ϕ, $\text{Basic}(\phi)$, with the negations of the members of a set of propositions *Excl*. We will also refer to *Excl* as the *exclusion set*, and to its members as the *excluded propositions*.

(5) Strengthened meaning:
$\text{Exh}_{\text{Excl}}(\phi) = \text{Basic}(\phi) \wedge \bigwedge\{\neg p: p \in \text{Excl}\}$

The format in (5) can be illustrated with the equality in (6). That is, the strengthened meaning of sentence (1) given in (3) can be understood as due to strengthening relative to an exclusion set that contains just the proposition ALL(P)(R), that all players responded.

(6) $\text{Exh}_{\{\text{ALL(P)(R)}\}}(1) = \text{SOME(P)(R)} \wedge \neg\text{ALL(P)(R)}$

A central task for a theory of strengthening is to explain limitations on the range of actually observed sentence meanings of the format in (5). To illustrate one important type of limitation, we can continue to focus on sentence (1). Consider a hypothetical exclusion set that only contains ¬ALL(P)(R), the proposition that *not* all players responded. As stated in (7), strengthening (1) relative to this exclusion set would yield ALL(P)(R), the proposition that all players responded. As recorded in (8), however, such a strengthened meaning for (2) is unavailable. This verdict can be confirmed with the observation that the implication that this strengthening would add cannot be felicitously denied in response to (1). That is, in contrast to (4), the attempted denial in the dialogue in (9) is unequivocally infelicitous.

(7) $\text{Exh}_{\{\neg\text{ALL(P)(R)}\}}(1) = \text{SOME(P)(R)} \wedge \neg\neg\text{ALL(P)(R)} = \text{ALL(P)(R)}$

(8) Unavailable strengthened meaning of (1):
ALL(P)(R)

(9) A: Some players responded.
B: #No, not all of them did!

Why is it that the basic meaning of (1) can be strengthened with the conjunct ¬ALL(P)(R), yielding (3), but not with ALL(P)(R), yielding (8)? More generally, for any case where the basic meaning of a sentence ϕ can be strengthened with the conjunct ¬p, as in (10a), but not with the conjunct p, as in (10b), the question is on what grounds the former is available while the latter is not. Since the two strengthenings in (10) are in a transparent sense *symmetric*, this problem is known as the *symmetry problem*. First observed as a challenge to the Gricean reasoning in Kroch (1972), the symmetry problem has been central in analyses of exhaustification.

(10) a. $\text{Basic}(\phi) \wedge \neg p$
b. $\text{Basic}(\phi) \wedge p$

In the dominant approach, the symmetry problem is solved by constraining the membership of the exclusion set Excl. On this view, sentence (1) permits the strengthening in (3), but not the one in (8), because for the interpretation of (1), the exclusion set may contain just ALL(P)(R), but cannot contain ¬ALL(P)(R). More generally, if for a given sentence ϕ, the strengthening (10a) is attested while (10b) is not, this is assumed to be due to a constraint which relative to ϕ, allows for the exclusion set to contain just p, but prevents it from containing ¬p.

In a prominent school of thought, this approach is developed by constraining the exclusion set with reference to the *linguistic form* that would be required to express its members. The idea is that for strengthening of ϕ, any proposition in the exclusion set must be the basic meaning of a sentence, a *linguistic alternative* to ϕ, that is no more complex than ϕ itself. Horn (1972), for example, postulates lexical scales, today often called 'Horn scales', Levinson (1983) invokes an 'economy' condition, and Horn (2000) a 'brevity' condition. Katzir (2007) and Fox and Katzir (2011) formalize a notion of complexity that requires formal alternatives to be no more complex than the asserted one. This formal *complexity filter on Excl* (CF) can be stated as in (11).

(11) Complexity Filter on Excl:
$\text{Excl}(\phi) \subseteq \{\text{Basic}(\psi)\text{: } \psi \text{ is no more complex than } \phi\}$

CF has the intended effect for sentence (1). The unavailable strengthened meaning (8) could potentially arise for (1) from excluding the proposition ¬ALL(P)(R). This proposition is the basic meaning of, for example, the sentence in (12). However, due to the presence of negation *not* in the structure, (12) is more complex than (1). In fact, it seems that *any* sentence whose exclusion would yield the unavailable strengthening (8) is more complex than (1). If so, then CF correctly prevents this strengthening.

(12) Not all players responded.

In this paper, we will explore an alternative solution to the symmetry problem. We will pursue the idea that rather than by constraining Excl, the problem is solved through a condition that can block potential strengthened meanings as *permissible outputs* of Exh. To introduce the approach, consider again (1), and let us juxtapose it with sentence (13). Note that the basic meaning of (13) is identical to the unavailable strengthened meaning for (1) in (8). We now propose that since (13) is moreover no more complex than (1), its existence *blocks* the use of (1) in the strengthened meaning in (8), rendering this strengthening unavailable.

(13) All players responded.

So we propose that a potential strengthened meaning for a sentence ϕ is unavailable if this potential strengthened meaning amounts to the *basic* meaning of a sentence that is no more complex than ϕ. This *blocking constraint* (BC) is a condition on the output of Exh, rather than a condition on Excl, an input to Exh. We can state this constraint as in (14).[2]

(14) Blocking constraint (BC)
$\text{Exh}_{\text{Excl}}(\phi)$ is blocked if: $\exists\psi[\text{Basic}(\psi) = \text{Exh}_{\text{Excl}}(\phi) \wedge \psi \text{ is no more complex than } \phi]$

[2]Geurts (2011: ch. 6) appeals to complexity for listener's selection of cells from a partition of the speaker's "intentional state". A detailed comparison is deferred to future work.

We can think of BC as a constraint that requires strengthening to be in the service of abbreviation. That is, strengthening must serve to *reduce complexity* of linguistic form that would otherwise be required to express a given meaning. We might accordingly think of BC as an economy constraint rooted in the Gricean Manner maxim: Even though sentence (15) has SOME(P)(R) $\wedge$ $\neg$ALL(P)(R) as its basic meaning, it is visibly more complex than (1) itself. It in fact seems that *any* sentence with this basic meaning is more complex than (1). If so, then, the available strengthening in (3) is permitted by BC.

(15) Some but not all players responded.

The notion of complexity that BC appeals to may well be the very same notion as the one invoked by CF. But crucially, CF appeals to complexity in constraining the *input* to exhaustification, while BC references complexity in constraining permissible exhaustified *outputs*. For basic data like (1), the effects of CF and BC coincide. Not only do both correctly exclude the unavailable strengthening in (8), but both also permit the available strengthening in (3).

Our argument in favor of BC in the following has two sides. In section 2, we argue that CF cannot be maintained as a constraint on Excl, and hence BC is needed to account for basic cases like (1). In section 3, we then examine cases that are compatible with CF, but where CF is insufficient. These are cases where an unavailable implicature would be derivable based on alternatives that are not more complex than the asserted sentence. These examples will also reveal shortcomings of several auxiliary assumptions made in the account based on CF in Katzir (2007) and Fox and Katzir (2011), which we explore in section 4.

2. The case against the complexity filter

The symmetry problem introduced in Section 1 arises when a sentence can convey one of two conceivable contradictory implicatures but not the other. CF aims to address this question, but is formulated as a general constraint on Excl, not just for situations in which symmetry arises. The effects of CF are therefore predicted to be observable even in cases where embedding removes the potential contradiction. To start, consider (16) the exchange adapts an example used in Fox and Katzir (2011) for a different purpose (see footnote 3 below).

(16) A: Tell me what exactly the detective has concluded up to this point
B: The detective concluded that Jed stole some of the books.

Sentence (16B) is logically compatible with the simultaneous exclusion all sorts of alternatives that can arise from altering the predicate *stole some of the books*. For example, the truth of (16B) is compatible with the exclusion of each of the alternatives listed in (17). Note that this compatibility is crucially enabled by the embedding under *conclude*. Even though the embedded clauses in (17a) and (17b) are complementary, the embedding under *conclude* ensures that (17a) and (17b) as a whole can both be false at the same time.

(17) a. The detectives concluded that Jed stole all of the books.
b. The detectives concluded that Jed did not steal all of the books.
c. The detectives concluded that Jed did not steal the jewels.
d. The detectives concluded that Jed did not steal the jewels unless they were hidden in the books

Note that the sentences (17b)–(17d) are more complex than (16B), and that it does not seem possible to avoid the added complexity while expressing the same propositions. The complexity filter CF therefore predicts that those propositions cannot be in the exclusion set. But this prediction seems incorrect. It seems possible for (16B) to be strengthened by the negation of each of these propositions. We found that each of those implicatures can be felicitously denied in a response to (16B), perhaps by a third interlocutor, as in (18).

(18) a. C: No! The detective also concluded that Jed did not steal all of the books!
b. C: No! The detectives also concluded that Jed did not steal the jewels!
c. C: No! The detectives also concluded that Jed did not steal the jewels unless they were hidden in the books

The possibility of these responses shows that, at least in a context in which the details matter, as established in our case by sentence (16A), the proposition expressed by the more complex alternatives in (17b) can be in Excl. Importantly, while this is incompatible with CF, it is compatible with BC. To illustrate, sentence (19) is more complex than (16B), and the proposition that it expresses does not seem to permit a less complex encoding. Hence, nothing blocks a strengthening of (16B) that excludes just the proposition expressed by (17b). It is clear, in fact, that a strengthened meaning that excludes all of the propositions expressed in (17) cannot be expressed as a basic meaning without an obvious increase in complexity relative to (16B), hence such a strengthening is permitted by BC.[3]

(19) The detectives concluded that Jed stole some but not all of the books.

It is important to acknowledge that, while we take (16) to show that CF cannot be maintained, the strengthening observed for sentences with embedding sometimes *is* constrained in a way that seems aligned with CF. Fox and Spector (2018: p. 15) discuss cases of embedding under a universal operator that seem to pattern differently from (16). In contrast to the reply in (18a), the one on (20B) seems infelicitous. This reply should be felicitous if (20A) could be understood as excluding potential alternatives like those in (21). But since the presence of negation renders those more complex than (20A), the infelicity of (20B) is in line with CF.

(20) a. A: You're required to buy some of the furniture.

[3]The example in Fox and Katzir (2011) that (16) adapts, given in (i), involves association with *only*. Fox and Katzir use (i) to support the claim that more complex alternatives can be excluded by *only* if they arise from substitutions of material that is *explicitly provided in the context*, here by the first sentence of (ia) and the second sentence of (ib).

(i) a. Detective A only concluded that the robbers [stole the books]$_F$. Detective B concluded that the robbers [stole the books but not the jewelry]$_F$.
b. Detective B concluded that the robbers [stole the books but not the jewelry]$_F$. Detective A only concluded that the robbers [stole the books]$_F$.
Inference: ¬ Detective A concluded that the robbers stole the books but not the jewelry.
Inference: ¬ Detective A concluded that the robbers stole the books and the jewelry.

In Fox and Katzir (2011), the implicit claim is that such contextual support is *necessary* to enable to the exclusion of the relevant alternatives. However, they do not actually consider controls where the relevant sort of contextual support is missing. In fact, aligned with our intuitions about (16), observations in Hirsch (2024) indicate that such support is not in fact needed (cf. also Hirsch and Schwarz, 2023). Even without being continued by the second sentence, the first sentence in (ia) could well be taken to entail that Detective A did *not* conclude that the robbers did not steal the jewelry. Likewise for (ib).

b. B: # No! We are not allowed to buy all of it.

(21) a. You're not allowed to buy all of the furniture.
b. You're required to not buy all of the furniture.

However, given our interpretation of (16), a different explanation must be sought. While blocking sets limits on what can be excluded, it is clearly not the only constraint on strengthening. Which implicatures that are possible in principle are actually attributed to a speaker generally depends on context. We suggest that the infelicity in this case has to do with the fact that the question of whether there is an additional requirement not to buy all furniture seems contrived without further context, and hence failing to addressing this question is not taken to be meaningful here. In support of this suggestion, (22) shows that a context that is expected to motivate B's pedantic objection indeed renders it more natural (as does adding an additive). In (23), the pendantic objection seems justified even more clearly, as the stakes are raised further, and here the relevant implicature in fact seems quite unexceptional.[4]

(22) a. B: Did you listen to the instructions? Tell me exactly what we have to do.
b. A: We're required to buy some of the furniture.
c. B: No! We are (also) not allowed to buy all of it.

(23) a. B: Did you listen to the instructions? Tell me exactly how to diffuse the bomb.
b. A: One has to press some of the buttons.
c. B: No! You (also) must not press all of them.

Moreover, while the examples incompatible with CF presented so far all invoke contextual support in a dialogue, this is not a general feature of such data. Similar inferences can arise quite naturally without much context. The example in (24) is a case in point (cf. also so-called conditional perfection, see, e.g., Horn, 2000). The felicity of objections like those in (25) suggests that strengthening can exclude alternatives of arbitrary complexity.

(24) To get a cookie, you must first eat an apple.

(25) a. Wait, I thought I would also have to eat an orange!
b. Wait, I thought I would also have to either eat an orange or take a walk!
c. Wait, I thought I would also have to not use my phone for one hour!

Taken together, these examples suggest that CF is not viable as a general constraint on the exclusion set: Strengthening based on alternatives that should be screened out by CF are often attested once contradictions are avoided by eliminating symmetry through embedding.

If CF is not viable, this means that we need a different solution to the symmetry issue posed by cases like (1). We saw in the previous section that BC potentially provides such a solution. In the following, we will further motivate BC based on cases of symmetry in which CF cannot possibly provide a solution, since the problematic formal alternatives are no more complex than what is asserted.

[4]The example in (i), from our handout distributed at the conference, may be harder to fix, but even this example seems to improve if the context asks for an exact report on what speaker A knows.

(i) A: Every week, some players responded.
B: # Wait, I thought (it's also true) that every week some of them did not respond!

3. The case for blocking

CF prevents the unwanted strengthening in (8) for (1) by exploiting a limitation of English relative to the structure of (1). In contrast to ALL, ¬ALL is not lexicalized. Expressing ¬ALL therefore requires a syntax that transparently encodes negation, but adding negation to (1) would increase complexity. It is in virtue of this increase that CF here has the intended effect. Notably, then, if the meaning ¬ALL *were* lexicalized, then CF would not help.

Exploring this line of thought, we will now present a challenge to CF as a general solution the symmetry problem. We will discuss cases where unwanted meanings are carried by acceptable sentences which lack the complexity that would be needed for CF to screen them out. We refer to the such sentences as *simplex threats*. In each case, the unwanted meaning that the simplex threat supports, while potentially output by Exh, is correctly blocked by BC. Hence these simplex threats furnish an argument for the presence of BC as a constraint on exhaustification.

3.1. Three cases of simplex threats

Before delving in, let us clarify that while we seem to be the first to interpret the simplex threats discussed below as support for a blocking condition, our discussion crucially builds on previous work. The simplex threat based on expressed negation that we will present (Section 3.1.1) is a variant of a case discussed in Romoli (2013). Like we do for our case, Romoli interpreted his example as a challenge for CF. The simplex threats with antonyms (Section 3.1.2) are related to data in Breheny et al. (2018), and directly inspired by cases in Buccola et al. (2022). Again, like we do for our variants, Breheny et al. and Buccola et al. used their data to challenge CF. Finally, the case of contextually supported simplex threats (Section 3.1.3) is centrally discussed in Katzir (2007) and Fox and Katzir (2011). We will discuss their additional assumptions aimed at diffusing this simplex threat (and potentially the others as well) in Section 4.

3.1.1. Simplex threats enabled by expressed negation

The first type of simplex threat we present arises in certain data where an overt negation interacts scopally with another operator (cf. Romoli, 2013). Here we focus on a case where negation is interpreted in scope of an existential indefinite, as in (26).[5]

(26) Some players have not responded.

The basic meaning of this sentence can be given in (27) (where D is the domain of individuals). As stated in (28), we observe an asymmetry in the intuitively available strengthenings much like the one that we described for (1). Sentence (26) can be understood as conveying that some but not all players responded, see (28a), but not as conveying that none of them did, see (28b).

(27) Basic meaning of (26):
SOME(P)(D–R)

[5]This example has an advantage over Romoli's in that it cannot be explained by the additional 'Atomicity' constraint proposed in Trinh and Haida (2015) to save the CF account (which we do not have the space to discuss here).

(28) a. Available strengthened meaning of (26):
SOME(P)(D–R) ∧ ¬ALL(P)(D–R) = ¬ALL(P)(R) ∧ SOME(P)(R)
b. Unavailable strengthened meaning of (26):
SOME(P)(D–R) ∧ ¬SOME(P)(R) = NO(P)(R)

CF fails to derive this asymmetry. Sentence (29a) below, which permits a surface scope reading with the basic meaning NO(P)(R), is no more complex than (26). Therefore, since (28a) is the strengthened meaning of (26) that can result from, say, the exclusion set {NO(P)(R)}, CF correctly permits this strengthening. However, sentence (29b), with the basic meaning SOME(P)(R), is not more complex than (26), either. Therefore, since (28b) is the strengthening for (26) that would result from, say, the exclusion set {SOME(P)(R)}, CF permits this unwanted strengthening as well.

(29) a. All players have not responded.
b. Some players have responded.

If CF does not capture the asymmetry in (28), then what does? We propose that the blocking condition BC has the intended effect. BC correctly prevents (28b) as a strengthened meaning for (26). It is blocked due to the existence of a sentence that is no more complex than (26) and that has (28b) as its basic meaning. For example, (29a) is such a sentence. We moreover suggest that, in contrast, BC permits the strengthened meaning in (28a). To be sure, there are sentences that have (28a) as their basic meaning. Example (30) is a case in point. However, (30) is more complex than (26). We submit that this is in fact true for all sentences with the basic meaning (28a). If so, then BC correctly permits (28a) as a strengthened meaning for (26).

(30) Some but not all players have responded.

The crucial feature of example (26) that distinguishes it from our original case in (1) is that it already contains negation: It is on those grounds that a symmetric pair of linguistic alternatives can be derived by removing rather than adding complexity. We now turn to a case in which simplex threats arise by simple substitutions, based on antonymic content vocabulary.

3.1.2. Simplex threats enabled by antonyms

Another type of simplex threat can arise in cases where a predicate that appears in the scope of another operator has a lexical antonym (cf. Breheny et al., 2018; Buccola et al., 2022). Here we consider the case where a predicate of this sort appears in the scope of an existential indefinite.

(31) Some players were inside.

The basic meaning of (31) is given in (32). As stated in (33), we once again observe an asymmetry in the intuitively available strengthenings. (31) can be understood as conveying that some but not all players were inside, see (33a), but not as conveying that all were inside, see (33b).

(32) Basic meaning of (31):
SOME(P)(In)

(33) a. Available strengthened meaning of (31):
SOME(P)(In) ∧ ¬ALL(P)(In)

b. Unavailable strengthened meaning of (31):
SOME(P)(In) ∧ ¬¬ALL(P)(In) = ALL(P)(In)

It may initially appear as though CF captured this asymmetry, as CF may seem to apply to (31) in the same way it applies to the basic example (1). To begin, since sentence (34a), with basic meaning ALL(P)(In), is no more complex than (31), CF permits the exclusion set to be, for example, {ALL(P)(In)}. Hence it permits exhaustification that yields the available strengthened meaning in (33a). At first sight, CF seems to also correctly prevent the undesirable inference. After all, while sentence (34b) transparently has ¬ALL(P)(In) as its basic meaning, the presence of syntactic negation renders (34b) more complex than (31).

(34) a. All players were inside.
b. Not all players were inside.

However, closer inspection reveals CF to be insufficient to prevent the exclusion set from containing ¬ALL(P)(In). The reason is that this same proposition is also expressed by a different sentence, one that crucially is no more complex than (31), viz. (35), where *inside* is replaced by its antonym *outside*:

(35) Some players were outside.

Sentence (35) transparently expresses the proposition SOME(P)(Out). Since the complementarity of the antonyms *inside* and *outside* guarantees the equality of the two sets Out and D–In, this basic meaning is equivalent to SOME(P)(D–In) and hence to ¬ALL(P)(In). Therefore, CF does not prevent an exclusion set containing this proposition after all. Allowing for, say, {¬ALL(P)(In)} as the exclusion set, CF after all fails to prevent the unavailable strengthened meaning in (33b). In other words, sentence (35) is a simplex threat.

The blocking condition BC captures the asymmetry in (33). BC correctly blocks (33b) as a strengthened meaning for (31), due to the existence of a sentence like (34a), which is no more complex than (31) and has (33b) as its basic meaning. While there are sentences with the basic meaning (33a), we submit that they all are more complex than (31). For example, both of the sentences in (36) have (33a) as their basic meaning. But given their complexity relative to (31), their existence does not stand in the way of (31) having this same meaning as a result of strengthening. We submit that this extends to all sentences with the basic meaning (33a). If so, then BC correctly allows for (31) to acquire this meaning from strengthening.

(36) a. Some but not all players were inside.
b. Some players were inside and some were outside.

The example in (31) illustrates that symmetric linguistic alternatives can evade the grasp of CF in virtue of featuring predicates that have antonyms. By introducing semantic negation without adding syntactic complexity, replacing such a predicate with its antonym can give rise to a simplex threat. We will next attend to yet another type of simplex threat, cases where a problematic alternative should be permitted in virtue of features of the linguistic context.

3.1.3. Simplex threats enabled by context

Under a construal of the notion of syntactic complexity that seems initially plausible and that we have tacitly assumed so far, a structure β counts as no more complex than a structure α only if β can be obtained from α by merely deleting constituents of α or replacing terminal nodes. However, based on an observation in Matsumoto (1995), Katzir (2007) suggests that for the purposes of the theory of exhaustification, this condition is too demanding. Consider the conjunctive sentence given by the concatenation of the clause in (37a) with (37b).

(37) a. It was warm yesterday ...
b. ... and it is a little bit more than warm today.

While the basic meaning of (37a) merely implies that it was warm yesterday, Matsumoto observed that as part of the conjunctive sentence, (37a) intuitively permits a strengthened meaning that implies in addition that yesterday it was *not* a little bit more than warm. Hence strengthening can exclude the proposition expressed by the linguistic alternative to (37a) stated in (38).

(38) It was a little bit more than warm yesterday ...

Under CF, this is surprising since (38) appears to have more structure than (37a). In fact any sentence with the same basic meaning as (38) seems to have more structure than (37a). This leads Matsumoto to conclude that a complexity constraint on the exclusion set is not viable. However, Katzir suggests that Matsumoto's observation can be reconciled with CF by properly construing the notion of complexity that CF is taken to reference. Katzir proposes that for the purposes of CF, a constituent that appears in the linguistic context of an utterance is treated like a lexical item, in the sense that CF applies *as though* this constituent lacked internal structure. Hence in the case at hand, given that the constituent *a little bit more than warm* appears in the linguistic context of (37a), substituting it for *warm* will not actually be taken to incur an increase of complexity for the purposes of CF. If so, then (38) counts as no more complex than (37a), reconciling CF with the observed strengthening.

Assuming the revised understanding of complexity motivated by Matsumoto's example, consider now the sentence given by the concatenation of (39a) with (39b), which adapts similar examples discussed in Katzir (2007) and Fox and Katzir (2011).

(39) a. Last week, some of them responded, ...
b. ... and this week (too), not all of them responded.

We take it that, with *them* referring to the players, (39) can give rise to the very same strengthening asymmetry that we initially detected for sentence (1). Even in the context of the continuation (39b), (39a) can be understood as conveying that some but not all players responded last week, as in (40a). This meaning for (39a) can be brought out clearly by including the additive particle *too* in (39b), thereby forcing the strengthened interpretation for (39a) in (40a). In contrast, as indicated in (40b), with or without the additive particle, (39a) certainly cannot be understood as conveying that last week all of the players responded.

(40) a. Available strengthened meaning of (39a):
$\textsc{some}(\textsc{p})(\textsc{r}) \wedge \neg \textsc{all}(\textsc{p})(\textsc{r})$

b. Unavailable strengthened meaning of (39a):
SOME(P)(R) ∧ ¬¬ALL(P)(R) = ALL(P)(R)

Under the amended construal of complexity, *both* of the linguistic alternatives to (39a) in (41) qualify as no more complex than (39a). In particular, this is true for (41b), on the grounds that the constituent *not all of them responded* appears in the linguistic context (39b). CF therefore permits the unwanted strengthening in (40b) alongside the attested one in (40a). Hence the alternative (41b) constitutes yet another case of a simplex threat.

(41) a. Last week, all of them responded ...
b. Last week, not all of them responded ...

On the other hand, the asymmetry in (40) is once again captured by BC. BC applies to this case in the very same way as it does to our initial example in (1). The unavailable strengthening in (40b) is blocked by sentence (41a), for example, given that (41a) has (40b) as its basic meaning. The available strengthening in (40a) correctly evades blocking. While sentence (42) has (40a) as its basic meaning, it is more complex than (39a). Assuming that this is true for all sentences with this basic meaning, BC correctly permits the strengthening in (40a).

(42) Last week, some but not all of them responded ...

To recap, we have now seen three types of simplex threats, cases where CF fails to exclude alternatives that would yield unavailable strengthenings. We also saw that in each case, the unavailable strengthening is correctly blocked under BC. In the absence of an alternative explanation for why the potential strengthenings in question are unavailable, this furnishes an argument that BC is needed as a constraint on the output of exhaustification.

How conclusive is this argument? We will next scrutinize a possible alternative approach to the simplex threats that we presented, emerging from proposals in Katzir (2007) and Fox and Katzir (2011). We will argue that the alternative account does not in fact successfully remove the challenge posed by simplex threats. Moreover, we will argue that a crucial assumption that the alternative is based on, which we will call the *Stalemate Assumption*, cannot be accurate.

4. Symmetric stalemate to the rescue?

Our argument for the blocking condition BC could perhaps be considered conclusive if it were safe to assume that CF would be the only constraint on the exclusion set. However, it is of course possible that further constraints on Excl can be motivated, and that these constraints offer another account of our simplex threat data. We will now discuss one attempt to supplement CF in this way, viz. a cluster of assumptions motivated in Katzir (2007) and Fox and Katzir (2011).

Katzir and Fox propose that in the grammar of exhaustification, CF operates alongside another central principle that regulates the membership of Excl. The principle holds that in cases where grammatical constraints on linguistic alternatives permit two alternatives that express symmetric propositions, it is not possible for just one of those two propositions to be included in Excl, even in cases in which context would motivate choosing one over the other. In the terms of Katzir and Fox, context can never *break* symmetry. In other words, the claim is that symmetry

leads to a stalemate between two mutually contradictory inferences.[6]

(43) Stalemate Assumption:
Symmetric alternatives permitted by CF cannot be selectively omitted from Excl

Naturally, when CF is supplemented with the Stalemate Assumption, the predictions for our simplex threat data change. The central feature of those data is precisely that there are two symmetric alternatives which satisfy CF. The prediction is now that in the presence of symmetric alternatives, *none* of the the potential inferences will be available. Concretely, as matters stand, in each of (28), (33), and (40), the available strengthening in (a) is now prevented as much as the unavailable strengthening in (b).

For our third simplex threat case, the case invoking the linguistic context, Fox and Katzir (2011) expressly appeal to the Stalemate Assumption to avoid the undesirable implicature. To see how this works, consider again the coordinated sentence given by (44a) and (44b), repeated from (39), as well as the two possible alternatives to (44a) in (45a) and (45b), repeated from (41).

(44) a. Last week, some of them responded, ...
b. ... and this week (too), some of them responded.

(45) a. Last week, all of them responded ...
b. Last week, not all of them responded ...

Recall that, given the baseline data discussed in Matsumoto (1995), the contextual support from (44b) should allow for (45b) to serve as an alternative to (44a), deriving the undesirable inference. The Stalemate Assumption, however, ensures that if both alternatives are available, *neither* inference can be derived. Refining the assumptions about the effect of context, Fox and Katzir (2011: fn. 16) suggest that including the meanings of contextually provided complex alternatives in the exclusion set is merely optional. This refinement has the intended effect for (44a). If we do not include (45b) in Excl, exhaustification can output the strengthened meaning in (40a); if we include both, neither implicature is derived.

But can this strategy be extended to the other two types of simplex threats that we have seen? Once we assume the Stalemate Assumption, the prediction for these cases is now that we should see no strengthening—so the problematic strengthening based on the simplex threat is correctly ruled out. But how to permit the strengthening that *is* available?

The strategy would again have to be to somehow eliminate the undesirable alternative. Fox and Katzir point to one possible route. They propose that in addition to being constrained by CF, the form of linguistic alternatives is shaped by F(ocus)-marking. The possible alternatives to a given sentence are assumed to differ in this sentence only with regard to F-marked constituents. Put differently, modulo F-marked constituents, an alternative to a given sentence is required to be an exact copy of that sentence. Certain alternatives can then be avoided by assuming a particular F-placement. To show this, we return to the relevant examples (26) and (31), repeated in (46a) and (46b), respectively.

[6]Under this formulation, symmetric alternatives must either all be included or all be excluded from the exclusion set—a stalemate cannot be broken by context. If one assumes with Fox (2007) that exclusives in fact ignore alternatives that are not 'innocently excludable,' then the stalemate assumption could instead simply say that no symmetric alternatives can be omitted from Excl.

(46) a. Some players have not responded.
b. Some players were inside.

For sentence (46a), the problematic pair of symmetric alternatives is stated again in (47a-i), repeated from (29). Likewise, the relevant symmetric alternatives to (46b) are stated in (47b), repeated from (34a) and (35).

(47) a. (i) All players have not responded.
(ii) Some players have responded.
b. (i) All players were inside.
(ii) Some players were outside.

Suppose now that the sentences in (46) carry F-marking that includes *some* in an F-marked constituent, but not the negation *not* or the antonymic predicate *inside*. For example, suppose for concreteness that both structures only feature narrow F-marking on *some*, as in (48).

(48) a. [Some]$_F$ players have not responded.
b. [Some]$_F$ players were inside.

Under Fox and Katzir's proposal, such F-marking ensures that that alternatives can differ from those sentences in the position of *some* but nowhere else. Therefore, while the sentences in (47a-i) and (47b-i) qualify as alternatives to (48a) and (48b), respectively, the simplex threats in (47a-ii) and (47b-ii) do not. With the simplex threats so eliminated by grammar, the strengthenings in (28a) and (33a) are correctly predicted to be available. That is, it is correctly predicted that (46a) can be understood as excluding (47a-i), to convey that some but not all players have responded, and (46b) as excluding (47b-i), to convey that some but not all players were inside.

However, Fox and Katzir's proposal also makes predictions about the sentences in (46) that are not in fact consistent with intuitions. The account is too permissive in some ways, and too restrictive in others. On the one hand, the proposal allows for the potential strengthenings in (28b) and (33b) to arise under conditions that support structures with appropriate F-marking, viz. structures where *not* and *inside* are included in F-marked constituents, while *some* is not. For example, (28b) and (33b) would be expected to arise from the structures in (49), with narrow focus on *not* and *inside*. Since there is in fact no reason to expect that such F-marking is categorically excluded, it is predicted that the strengthenings in (28b) and (33b) can be observed under certain conditions. However, as implied by our initial characterization of the data, intuitions are clear that these strengthenings are not in fact available under any conditions. In fact, even with a prosody favoring the F-marking in (48), the possibility of the implicature based on substituting *some* persists. Apparently, the assumption that scalar implicatures are constrained by limiting substitutions to F-marked content is incorrect.

(49) a. Some players have [not]$_F$ responded.
b. Some players were [inside]$_F$.

On the other hand, Fox and Katzir's proposal also leads one to expect that the availability of the strengthenings in (28a) and (33a) depends on F-marking. Specifically, strengthening should be obviated by F-marking that leads to a symmetric stalemate. Under conditions that force both *some* and *not* to be included in an F-marked constituent in (46a), both (47a-i) and (47a-ii) would qualify as alternatives to (46a). Likewise, both (47b-i) and (47b-ii) would qualify as

alternatives to (46b) under conditions that force both *some* and *inside* to be included in an F-marked constituent in (46b). Under such conditions, a stalemate should ensue, and hence we should not see either of the strengthenings in (28) and (33), respectively. It is predicted, for example, that neither strengthening is observed under conditions that force narrow focus on *some* and *not* or *inside*, as in (50), or that force broad focus on the entire sentence, as in (51).

(50) a. [Some]$_F$ players have [not]$_F$ responded.
b. [Some]$_F$ players were [inside]$_F$.

(51) a. [Some players have not responded]$_F$.
b. [Some players were inside]$_F$.

This prediction too seems incompatible with intuitions. As hard as one may try to force the sort of F-marking shown in (50) and (51), it seems that the strengthening asymmetries described in (28) and (33) persist, with (28a) and (33a) continuing to be available. In particular, these asymmetries are still intuited when the sentences in (46) are produced with prosodic focus on *some* and *not* or *inside*, in an attempt to force the double narrow F-markings in (50). And, paralleling an observation in Romoli (2013), they also persist in responses to a wh-question like *What happened?*, which should favor the broad F-markings in (51).

In sum, the strategy of appealing to the Stalemate Assumption and F-marking to avoid the simplex threat fails on two counts: First, we showed direct counter-evidence to the proposal that the exclusion set is constrained by F: focus placement that should make undesirable alternatives available and desirable ones unavailable do not change which implicature is available in cases of symmetry. Second, we saw that focus marking that should make *both* alternatives available fails to lead to a stalemate. An alternative explanation is needed, and we propose that the blocking condition BC can fill this gap.

Our observations warrant a further conclusion. Much of the recent literature on the symmetry problem assumes the Stalemate Assumption and takes the goal of any successful solution to the symmetry problem to offer a way of evading a stalemate that would otherwise be expected. It is particularly notable therefore that in the absence of a formal way to exclude the simplex threats via assumptions about grammar, our data appear to be incompatible with Stalemate Assumption itself. What if the assumption is actually incorrect? What if what the symmetry problem actually calls for is a solution that avoids the otherwise expected symmetric availability of two opposite implicatures? Under this perspective, symmetry does not need to be 'broken' to allow an inference, rather, the task is simply to exclude unattested strengthenings.

There is in fact more direct empirical evidence against the Stalemate Assumption. Consider the following dialogue, based on a similar example in Breheny et al. (2018):

(52) What do you do to protect your teeth?
Kid 1: I brush my teeth. (And) I don't eat candy.
Kid 2: I brush my teeth (too).

Here Kid 2 can be taken to imply that they eat candy—presumably through the denial of the alternative *I don't eat candy*. As noted in Breheny et al. (2018), this is problematic for CF, since the alternative *I eat candy* constitutes what we labeled a simplex threat. But we think that cases like (52) raise a more general problem for accounts that try to restrict the exclusion set:

If we are still harboring hopes that a new, more sophisticated formal criterion will disqualify the problematic alternative in (52), the following dialogue should convince us otherwise:[7]

(53) What do you do to protect your teeth?
Kid 1: I brush my teeth. (But) I don't floss.
Kid 2: I brush my teeth (too).

It seems to us that here Kid 2 can be taken to imply that they do not floss either. In fact, this by itself seems unremarkable and as it should be, since it can be derived simply by denying the alternative *I floss*. But in combination with (52), it shows that a formal explanation is not just seem unlikely here, it is uncalled for. What tips the balance toward an implicature based on the negated or non-negated alternative is context: The question in (52) and (53) makes reporting *not eating candy* and *flossing* directly relevant and therefore omitting them meaningful—but the same is not true of their negations. And this is clearly not because of formal aspects of these alternatives, but because of what we know about how flossing and eating candy affect our teeth. Taken together, the two dialogues suggest that the Stalemate Assumption is incorrect.

Nothing about the solution in terms BC rides on the Stalemate Assumption, and BC has the further virtue of remaining silent on cases like (52) and (53): There is no simpler expression to convey the strengthened meaning, whether we base the implicature on the negated or non-negated alternative. Which one, if any, a speaker is more likely to have in mind is resolved by pragmatic reasoning. Note that if we abandon the Stalemate Assumption, we no longer need to worry about the possibility that both alternatives are in the exclusion set, since a pragmatic account, maybe based on the Gricean Maxim of Quality, will preempt contradictory utterances.[8]

But aren't there clear cases of 'de facto' stalemates between symmetric inferences? How can we explain those, if we abandon the Stalemate Assumption? Consider the following example:

(54) a. A: I have a yellow bicycle.
b. B: # That's not true! You have a cheap bicycle.

Here B's objection seems contrived, but why? The sentence should have the following two alternatives, and—unless we make the Stalemate Assumption—shouldn't we now expect that an implicatures based on either of them is viable?

(55) a. Alternative 1: I have an expensive bicycle
b. Alternative 2: I have a cheap bicycle

Note first that B's response would be fine in a context in which (for some contrived reason) everyone knows that for a bike, being yellow implies being expensive. The existence of the formal lexical alternatives of equal complexity (here: *cheap* and *expensive*) does not automatically create a stalemate. This is incompatible with Stalemate Assumption, which predicts that (54) should be infelicitous in *any* context.

For sure, without a rich context (54) is quite odd. But appealing to a formal stalemate condition

[7]See Trinh (2018), e.g., for a proposal that disallows dropping a negation in an alternative, which would remove the simplex threat in (52), but is in compatible with (53), which precisely requires dropping negation in a an alternative.

[8]So we take the observation that alternatives in the exclusion set need to be innocently excludable not as a constraint on Exh, but as a pragmatic effect.

to explain this seems unnecessary. There is a plausible pragmatic reason for why A cannot be taken to court by B for having implied that their bicycle is not cheap. If A arbitrarily adds the alternative *expensive* to the exclusion set (and we see no reason why they should not be able to do so in principle), this is not reliably recoverable by B, and hence B is not entitled to object to the implications of this choice on the grounds of what A asserted. Of course A would not even try this, knowing that their message would not be recoverable, and resort to a different way to convey this meaning instead. Contexts that remove the arbitrariness from the choice of alternatives by justifying one inference over another remove the infelicity.

These examples illustrate that BC is not the only constraint on strengthening. Pragmatic reasoning constrains what is included in the exclusion set in a given context. This should not be surprising, given that conversational implicatures more generally are obviously context dependent. They also provide evidence against the Stalemate Assumption. If it is indeed incorrect, this further supports our argument that BC is needed to solve the symmetry problem. As we saw, this closes potential alternative avenues to explain simplex threats.

5. Conclusion

We have argued that the Blocking Constraint (BC), itself maybe derivable from the Gricean Manner maxim, provides a potential solution to the symmetry problem. We presented evidence that an alternative account in terms of a syntactic Complexity Filter (CF) on alternatives is questionable, since implicatures based on complex alternatives that CF should rule out are in fact often available. BC was furthermore motivated by cases where an account in terms of CF is impossible, since the problematic alternative are simplex. Finally, we have argued that the Stalemate Assumption, which plays a crucial role in supporting the CF account and could support alternative strategies to deal with simplex threats, is incorrect, as well as the assumption that the exclusion set is a subset of the alternatives relevant for focus.

Formal constraints such as CF assume that sets of alternatives, or at least those excluded by Exh, are sets of linguistic expressions. BC too is sensitive to the linguistic resources of a language, but it is an output condition on strengthening, rather than a constraint on the alternatives that strengthening is based on, and does not require an exclusion set with formal alternatives. We have only looked at a limited number of cases in this paper, but based on these it seems to us that the members of the exclusion set might in fact be completely free and not subject to formal or semantic constraints, although they must be recoverable in context and may be subject to other pragmatic effects.

We saw that BC correctly predicts that in cases of symmetry in which *neither* strengthened reading is expressible without added complexity, *both* implicatures can in principle be available. BC makes a further prediction: If in a case of symmetry *both* strengthened readings are expressible without added complexity, then *neither* implicature should be available, because each one should be blocked by its competitor. Swanson (2010) presents examples which he argues provide exactly this scenario: Two stronger but mutually exclusive strengthened meanings of an expression have lexicalised counterparts. Let's consider one of these examples:

(56) Going to confession is permitted.

(57) a. Going to confession is optional.
b. Going to confession is required.

Sentence (56) can implicate (57a), but not (57b). It can convey that confession is not required, hence optional, but not that confession is not optional, hence required. Swanson uses this and related examples to show that CF cannot be the only constraint on Excl. In our terminology, *Going to confession is optional* poses a simplex threat. We add here the observation that the example is also a counterexample to the Stalemate Assumption, since the inference in (57b) is possible although it has a symmetric counterpart.

If Swanson is correct and the lexical meaning of *optional* lexically encodes *permitted and not required*, then (56) also falsifies BC: BC correctly predicts that the assertion with *require* blocks the unavailable strengthening of *permit* to convey 'required;' but the assertion with *optional* should block the available strengthening that confession is *not* required. We contend, however, that *optional* does not actually have this meaning. If it did, both of the following statements should be equally infelicitous, but only the second is outright contradictory:[9]

(58) a. ?Doing drugs is optional, and in fact it is not permitted
b. #Doing drugs is optional, and in fact it is required

This suggests that the lexical meaning of *optional* is close in meaning to *not required*, and only conveys *permitted* in certain (possibly most) contexts as an implicature. One informant called (58a) 'cheeky,' indicating that it is hard not to draw the implicature. But there is a clear contrast to (58b). That an implicature is at play is also supported by the observation that the inference tends to vanish under negation, leading to the implausible reading that taking drugs is required:

(59) a. Taking drugs is not optional.
b. Taking drugs is non-optional

The relation between *optional* and *permitted* is then parallel to the relation between *some* on the one hand and *not all* (and *some not*) on the other: The strengthened versions of these are truth-conditionally equivalent, but neither basic meaning is equivalent to the strengthened reading of the other, and hence BC correctly predicts that each of them can be strengthened.

This diffuses the challenge for BC, but not for CF and the Stalemate Assumption: Even if the basic meaning of *optional* does not entail *permitted*, the alternative poses a simplex threat for CF. The case of *optional* shows that, contrary to what is sometimes assumed (starting with Horn 1972), expressions that play an equivalent role to *not all*/*some not* vis-á-vis their alternatives can be lexicalized. It does not, as we had worried, constitute a failure of blocking.

Blocking effects are generally quite stubborn. We saw that *some* cannot convey *all* even if we use focus to make alternatives salient that should in principle support this implicature. And yet Bonnefon et al. (2009) point out cases that do look like true failures of blocking:

(60) a. A: What impression did I make during dinner?
b. B: Some thought you drank too much.

[9]The following example found online supports this point:

(i) Breaking the law is optional and the consequential punishment is known so what's the problem?

(61) a. Some but not all thought that you drank too much.
b. Everyone thought you drank too much.

We may well infer here that B believes that everyone thought that A drank too much. This could be derived by exclusion of the alternative in (61a). This is of course the very strengthening both Blocking and CF set out to prevent. The example seems to falsify both. We think think there is a way, however, to make sense of this under the Blocking account: Bonnefon et al. (2009) plausibly argue the choice of *some* is a 'politeness strategy,' used to avoid hurting the feelings of the addressee. Under the blocking account we can make sense of this if politeness and other social constraints can take certain utterances out of the picture, preempting otherwise expected blocking effects. This could open the door for *some* to convey *everyone* in (60).[10]

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Standard and non-standard theories of attitudes and NPIs[1]

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Abstract. Some clause-taking verbs (e.g., *believe*) can also take DPs, some (e.g., *surmise*) cannot, and some (e.g., *groan*) can appear without a complement. The standard theory of complementation is forced to appeal to lexical ambiguity to explain this. An alternative theory says that "complements" of clause-taking predicates are not arguments, thereby offering a way to explain this variation without appealing to lexical ambiguity. This paper argues that the alternative theory is not more explanatory than the standard theory.

Keywords: complements, modifiers, attitudes, NPIs, Strawson entailment.

1. Introduction

As illustrated in (1), *Mia greeted Ted* may appear with or without a clause-level modifier, and *Mia groaned* may appear with or without a complement.

(1) a. Mia greeted Ted (passionately).
b. Mia groaned (that she was unhappy).

Event Semantics offers the following explanation for the fact that there is "room" for *passionately* in (1a). *Mia greeted Ted* denotes a property of eventualities rather than a truth value; the modifier *passionately* also denotes a property of eventualities.[2] When the two co-occur, they may combine by the same modification rule that combines *boy* and *who likes me* in *Ted is a boy who likes me*. Some versions of Event Semantics offer a similar explanation for the optionality of the complement in (1b) by rejecting the traditional distinction between complements and modifiers, and assuming that *groaned*, *Mia groaned* and *that she was unhappy* all denote properties of eventualities. This avoids treating *groaned* as lexically ambiguous. Based on examples with NPIs (negative polarity items), we argue that versions of Event Semantics that treat all clause-taking verbs as properties of eventualities do not have an advantage over theories that stipulate that some clause-taking verbs are lexically ambiguous.

2. Two variants of Event Semantics

We assume that the definition of the interpretation function ⟦ ⟧ subsumes presupposition-sensitive versions of Functional Application (FA) and Predicate Modification (PM) (see, for example, Heim & Kratzer, 1998; von Fintel & Heim, 2011), as in (2)-(3), where w is a possible

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[2] We use the term *eventuality* to refer to any event-like entity; this includes events, states, situations, etc.

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world and g is a variable assignment. FA combines a predicate with its arguments; PM combines a predicate with another predicate of the same type.

(2) FA. If α is a branching node and {β, γ} is the set of α's daughters, then α is in Dom([[ ]]^{w,g}) if: (i) [[β]]^{w,g} is a function, and (ii) [[γ]]^{w,g} is in Dom([[β]]^{w,g}) or [[γ]]$^{g}_{\not e}$ is in Dom([[β]]^{w,g}), where [[γ]]$^{g}_{\not e}$ = [λw: [[γ]]^{w,g} is defined. [[γ]]^{w,g}].[3]
In this case, [[α]]^{w,g} = [[β]]^{w,g}([[γ]]^{w,g}) or [[α]]^{w,g} = [[β]]^{w,g}([[γ]]$^{g}_{\not e}$), whichever is applicable.

(3) PM. If α is a branching node, {β, γ} is the set of α's daughters, and [[β]]^{w,g} and [[γ]]^{w,g} are functions from eventualities to truth values or from "normal" individuals to truth values, then [[α]]^{w,g} = [λo: [[β]]^{w,g}(o) and [[γ]]^{w,g}(o) are defined. [[β]]^{w,g}(o) = [[γ]]^{w,g}(o) = 1].[4]

What we refer to below as Variant I of Event Semantics says, with Davidson, 1967, that verbs take eventuality arguments, often in addition to non-eventuality arguments. Thus, for example, the surface verb pronounced *greeted* in *Mia greeted Ted* is – underlyingly – the verb *greet*^{e} in (4a), rather than the verb *greet*$^{non\text{-}e}$ in (4b) (from now on, the assignment function parameter – g – is often omitted when idle). We use the convention that e is an eventuality variable, and x and y are "normal" individual variables.

(4) a. [[*greet*^{e}]]^{w} = [λx. λy. λe: GRT_w(e, y, x) is defined. GRT_w(e, y, x)]
b. [[*greet*$^{non\text{-}e}$]]^{w} = [λx. λy: Grt_w(y, x) is defined. Grt_w(y, x)]

FA combines *greet*^{e} with its non-eventuality arguments, yielding a function from eventualities to truth values. A clause-level modifier such as *passionately* denotes a function from eventualities to truth values; *passionately* combines with *Mia greet*^{e} *Ted* by PM.

(5) a. [[*Mia greet*^{e} *Ted*]]^{w} = [λe: GRT_w(e, Mia, Ted) is defined. GRT_w(e, Mia, Ted)]
b. [[*passionately*]]^{w} = [λe. e is a passionate eventuality in w]
c. [[[*Mia greet*^{e} *Ted*] *passionately*]]^{w} = [λe: GRT_w(e, Mia, Ted) is defined. GRT_w(e, Mia, Ted) = [[*passionately*]]^{w}(e) = 1]

What we refer to below as Variant II of Event Semantics is itself a variant of Parsons, 1990, and Altshuler, Parsons & Schwarzschild, 2019. It says that verbs – like clause-level modifiers – take only eventuality-arguments. Thus, the verb pronounced *greeted* underlyingly decomposes into the verb *greet*$^{\theta}$ in (6) and the thematic predicates *Ag* and *Th* in (7), which introduce thematic role bearers. By assumption, the uniqueness principle in (8) is in effect.

(6) [[*greet*$^{\theta}$]]^{w} = [λe: e has an agent and a theme in w. e is a greeting eventuality in w]

[3] Read '[λo: μ. ε]' as per Heim & Kratzer, 1998 (i.e., as: the smallest function that maps every o such that μ to either (i) or (ii), whichever is applicable: (i) ε, (ii) 1 if ε and 0 otherwise). The shortform '[λo. ε]' is used whenever the domain of the function is constrained only by the type of o, and the latter is recoverable from notational conventions.

[4] Since presupposition filtering is characteristic of conjunction (as in *Ted is married and his spouse is nice*; see Karttunen, 1973, 1974), and modification is a form of conjunction, modification exhibits filtering too. Our simplified formulation of PM does not do justice to filtering. This has no bearing on the issues discussed here.

(7) a. $[\![Ag]\!]^w$ = [λx. λe. e has an agent in w & x is the agent of e in w]
b. $[\![Th]\!]^w$ = [λx. λe. e has a theme in w & x is the theme of e in w]

(8) For every possible world w, eventuality e and thematic role θ (agent, theme, etc.), at most one x is a θ-bearer of e in w.

Thematic predicates combine with their non-eventuality arguments via FA, but PM is the rule by which *greet*$^{\theta}$ combines with its non-eventuality "arguments". [*Ag Mia*] *greet*$^{\theta}$ [*Th Ted*] may further combine by PM with *passionately*.

(9) $[\![$ [*Ag Mia*] *greet*$^{\theta}$ [*Th Ted*] $]\!]^w$ = [λe: e has an agent and a theme in w. e is a greeting eventuality in w & Mia is the agent of e in w & Ted is the theme of e in w]

In both Variant I and Variant II, the "closer" ∃ in (10a), or one of its counterparts – e.g., *not* in (10b) – appears at the top of the LF, as illustrated in (10c), where α could be, for example, [*Ag Mia*] *greet*$^{\theta}$ [*Th Ted*].

(10) a. $[\![\exists]\!]^w$ = [λP: {o| P(o) ∈ {1, 0}} ≠ ∅. {o| P(o) = 1} ≠ ∅]
b. $[\![not]\!]^w$ = [λP: {o| P(o) ∈ {1, 0}} ≠ ∅. {o| P(o) = 1} = ∅] (cf. Schein 2020)
c. When {e| $[\![\alpha]\!]^{w,g}$(e) ∈ {1, 0}} ≠ ∅, $[\![\exists\ \alpha]\!]^{w,g}$ = 1 iff {e| $[\![\alpha]\!]^{w,g}$(e) = 1} ≠ ∅.

Variant I and Variant II do not explain the non-optionality of what are traditionally considered to be arguments in the same way. For example, in Variant I, the ill-formedness of *Mia greeted* (as a main clause) follows from the definition of $[\![greet^{e}]\!]^w$, according to which it takes three arguments. Indeed, the LF [∃ *Mia greet*^{e}] is uninterpretable. In Variant II, on the other hand, the LF [∃ [*Ag Mia*] *greet*$^{\theta}$] is interpretable, as $[\![greet^{\theta}]\!]^w$ takes only an eventuality argument. Given this, the ill-formedness of *Mia greeted* must follow from θ-Realization in (11), which requires presupposed thematic information to be syntactically realized (or from some other principle along those lines). Indeed, $[\![greet^{\theta}]\!]^w$(e) is defined only if e has a theme, yet the LF [∃ [*Ag Mia*] *greet*$^{\theta}$] lacks a node of the form [*Th* …].

(11) <u>θ-Realization</u>
For any verb V, let: (i) A_V = {ζ| ζ is a thematic predicate and for any (w, g, e), $[\![V]\!]^{w,g}$(e) is defined only if {Z| $[\![\zeta]\!]^{w,g}$(Z)(e) = 1} ≠ ∅}, and (ii) n_V = the cardinality of A_V.
For any verb V such that $n_V \geq 1$, the largest LF that contains V is well-formed only if there is a sequence ($\zeta_1, \zeta_2, \ldots, \zeta_{n_V}$) and a sequence ($\beta_1, \beta_2, \ldots, \beta_{n_V}$) such that:
(a) $\zeta_1 \in A_V$ and [ζ_1 β_1] is the sister of V, and
(b) for all m such that $1 < m \leq n_V$,
$\zeta_m \in A_V$ and [ζ_m β_m] is the sister of the mother node of [ζ_{m-1} β_{m-1}].[5]

It is difficult to determine, solely on the basis of surface verbs such as *greeted*, whether one variant of Event Semantics has an advantage over the other, because there is no obvious reason

[5] For simplicity, the current formulation of θ-Realization is not automatically violated when a verb combines with its "external argument" before combining with its "internal arguments".

to claim that Variant I and Variant II do not deliver the same meaning for, say, *Mia greeted Ted*. In other words, there is no obvious reason to say that the statement in (12) is not valid.

(12) [λw. λe: GRT_w(e, Mia, Ted) is defined. GRT_w(e, Mia, Ted)] =
[λw. λe: e has an agent and a theme in w. e is a greeting eventuality in w & Mia is the agent of e in w & Ted is the theme of e in w]

There are, however, reasons to claim that Variant I and Variant II do not deliver the same meaning for sentences whose main verb is a clause-taking verb. This provides a basis for evaluating the strengths and weaknesses of these two variants. The meanings we propose below for clause-taking verbs, like the meanings we proposed here for *greeted*, are simplified meanings not intended to provide accurate representations of the intuitive meanings of the corresponding sentences, but rather to highlight the challenges Variants I-II face vis-à-vis the optionality problem introduced in Section 1. To keep things simple, we will also ignore the semantic contribution of temporal morphemes (e.g., tense and aspect), as we have done so far.

3. Attitude reports: Variants I vs Variant II

On its 'de dicto' reading, *Ted believes that the red unicorn is happy* has the presupposition and assertion specified in (13) (see Karttunen, 1974). Presumably, *The red unicorn is happy* presupposes that there is exactly one red unicorn, and asserts that the red unicorn is happy.

(13) Ted believes that the red unicorn is happy.
Presupposition: Ted believes the presupposition of *The red unicorn is happy*.
Assertion: Ted believes the assertion of *The red unicorn is happy*.

The standard theory of attitudes (Hintikka, 1962, 1969; Karttunen, 1974; Heim, 1992), according to which *The red unicorn is happy* is an argument of *believes*, predicts these facts. Variant I affords various eventuality-based executions of the standard theory. Let us work with the version in (14), according to which the verb pronounced *believes* is underlyingly *believe*^{p}, whose first non-eventuality argument is a proposition (p – a function from worlds to truth values), and its second non-eventuality argument is a "normal" individual. DOX(x)(e)(w) = {w′| w′ is compatible with what x believes in (w, e)}.[6]

(14) $[\![\textit{believe}^p]\!]^w$ = [λp. λx. λe: DOX(x)(e)(w) ≠ ∅ & DOX(x)(e)(w) ⊆ {w′| p(w′) ∈ {1, 0}}. DOX(x)(e)(w) ⊆ {w′| p(w′) = 1}]

FA is the rule by which *believe*^{p} combines with its non-eventuality arguments.

(15) LF of *Ted believes that the red unicorn is happy* within Variant I:
∃ *Ted* [*believe*^{p} [∃ *the red unicorn is*^{e} *happy*]]

[6] We ignore, for simplicity, the fact that *believe* is a Neg-raising verb. Some non-Neg-raisers (e.g., *surmise* and *conjecture*) have meanings that are quite close to the "weak" meaning of *believe*.

Alternatives to the standard theory of attitudes are made available by, for example, Moltmann, 1989; Higginbotham, 1999; Kratzer, 2006, 2013, 2022; Moulton, 2009; Elliot, 2017/2020; Bondarenko, 2017; Phillips & Kratzer, 2023; Bondarenko & Elliott, 2023. Let us temporarily work with the specific alternative illustrated in (16)-(17), which is faithful to Variant II. Accordingly, the verb pronounced *believes* underlyingly decomposes into *believe*^{Comp} and the thematic predicates *Comp* and *Bel*. *believe*^{Comp} denotes a function from eventualities with a believer and propositional content to truth values. The propositional content is introduced by *Comp*, and the believer by *Bel*.

(16) $[\![\textit{believe}^{Comp}]\!]^w = [\lambda e$: $\{y|\ [\![Bel]\!]^{w,g}(y)(e) = 1\} \neq \varnothing$ & $\{p|\ [\![Comp]\!]^{w,g}(p)(e) = 1\} \neq \varnothing$ & $[\![att]\!]^w(e) = 1$ & (e is a believing eventuality in w iff DOX(the believer of e in w)(e)(w) $\subseteq$ $\{w'|\ CON(e)(w)(w') = 1\}$). e is a believing eventuality in w]
(where $[\![att]\!]^w = [\lambda e'$. DOX(the believer of e′ in w)(e′)(w) $\neq \varnothing$ & DOX(the believer of e′ in w)(e′)(w) $\subseteq$ $\{w'|\ CON(e')(w)(w') \in \{1, 0\}\}$]).

(17) a. $[\![Comp]\!]^w = [\lambda p.\ \lambda e.$ CON(e)(w) is defined & CON(e)(w) = p]
(where CON(e)(w) is the unique p such that p is the content of e in w, if there is one; undefined otherwise).
b. $[\![Bel]\!]^w = [\lambda y.\ \lambda e.$ e has a believer in w & y is the believer of e in w]

Both *Bel* and *Comp* combine with their non-eventuality arguments by FA. PM is the rule by which *believe*^{Comp} combines with its non-eventuality "arguments", namely, [*Bel* …] and [*Comp* ...] (*Exp* is the thematic role that introduces an experiencer).

(18) LF of *Ted believes that the red unicorn is happy* within Variant II:
∃ [*Bel Ted*] *believe*^{Comp} [*Comp* ∃ [*Exp the red unicorn*] *is*$^{\theta}$ *happy*]

Clearly, Variants I and II do not deliver the same meaning for *Ted believes that the red unicorn is happy*, even if they deliver the same meaning for *The red unicorn is happy*; cf. (12).

(19) [λw. λe: DOX(Ted)(e)(w) $\neq \varnothing$ & DOX(Ted)(e)(w) $\subseteq$ {w′| there is exactly one red unicorn in w′ & $\{e'|\ HPY_{w'}(e'$, the red unicorn in w′) $\in \{1, 0\}\} \neq \varnothing\}$.
DOX(Ted)(e)(w) $\subseteq$ $\{w'|\ \{e'|\ HPY_{w'}(e'$, the red unicorn in w′) = 1$\} \neq \varnothing$]
≠
[λw. λe: e has a believer in w & CON(e)(w) is defined & DOX(the believer of e in w)(e)(w) $\neq \varnothing$ & DOX(the believer of e in w)(e)(w) $\subseteq$ $\{w'|\ CON(e)(w)(w') \in \{1, 0\}\}$ & (e is a believing eventuality in w iff DOX(the believer of e in w)(e)(w) $\subseteq$ $\{w'|$ CON(e)(w)(w′) = 1}).
Ted is the believer of e in w & e is a believing eventuality in w & CON(e)(w) = [λw″: there is exactly one red unicorn in w″ & $\{e''|\ HPY_{w''}(e''$, the red unicorn in w″) $\in \{1, 0\}\} \neq \varnothing\}$. $\{e''|\ HPY_{w''}(e''$, the red unicorn in w″) = 1$\} \neq \varnothing$]]

A compelling argument in favor of Variant II comes from the fact that verbs of the class that includes *groan*, *sigh* and *growl* have optional complement clauses (see Levin, 1993; Kratzer, 2013; Bogal-Allbritten, 2016). These verbs contrast with verbs such as *believe*.

(20) a. (With sadness,) Mia groaned (that Ted was miserable).
b. (With sadness,) Mia believes *(that Ted was miserable).

Variant I has to rely on two verbs pronounced *groaned* to account for (20a,b). Variant II can account for (20a,b) by appealing to θ-Realization in (11). Indeed, $[\![believe^{Comp}]\!]^w(e)$ is defined only if $\{p|\ [\![Comp]\!]^{w,g}(p)(e) = 1\} \neq \varnothing$ and so, *Mia believes* is ill-formed. According to (21), $[\![groan^{(Comp)}]\!]^w(e)$ can be defined when $\{p|\ [\![Comp]\!]^{w,g}(p)(e) = 1\} = \varnothing$, and so, *groan* does not require a "complement" any more than it requires a clause-level modifier such as *with sadness*.

(21) $[\![groan^{(Comp)}]\!]^w = [\lambda e: \{y|\ [\![Ag]\!]^{w,g}(y)(e) = 1\} \neq \varnothing.$ e is a groaning eventuality in w]

An argument in favor of Variant I comes from the fact that $believe^p$ accounts for the fact that intuitively, *Ted believes that Mia is a happy cat* and *Ted doesn't believe that Mia is a cat* cannot be simultaneously true; $believe^{Comp}$+*Bel*+*Comp*, on the other hand, does not account for this fact. This is shown by the contrast between (22) and (23); '=>' (entailment) is defined in (24).

(22) For all (ϕ, φ, w) such that $[\![\phi]\!]_{\langle}$ => $[\![\varphi]\!]_{\langle}$:
if $\{e|$ DOX(Ted)(e)(w) $\subseteq \{w'|\ [\![\phi]\!]^{w'} = 1\}\} \neq \varnothing$,
then $\{e|$ DOX(Ted)(e)(w) $\subseteq \{w'|\ [\![\varphi]\!]^{w'} = 1\}\} \neq \varnothing$,
and if $\{e|$ DOX(Ted)(e)(w) $\subseteq \{w'|\ [\![\varphi]\!]^{w'} = 1\}\} = \varnothing$,
then, $\{e|$ DOX(Ted)(e)(w) $\subseteq \{w'|\ [\![\phi]\!]^{w'} = 1\}\} = \varnothing$;
therefore, if $[\![\exists$ *Ted believe*^{p} $\phi]\!]^w = 1$, $[\![$*not Ted believe*^{p} $\varphi]\!]^w \neq 1$, and
if $[\![$*not Ted believe*^{p} $\varphi]\!]^w = 1$, $[\![\exists$ *Ted believe*^{p} $\phi]\!]^w \neq 1$.

(23) There is at least one (ϕ, φ, w) such that $[\![\phi]\!]_{\langle}$ => $[\![\varphi]\!]_{\langle}$ and:
(a) $\{e|$ DOX(Ted)(e)(w) $\neq \varnothing$ & DOX(Ted)(e)(w) $\subseteq \{w'|\ [\![\phi]\!]^{w'} = 1\}$ & $[\![att]\!]^w(e) = 1$ & Ted is the believer of e in w & CON(e)(w) = $[\![\phi]\!]_{\langle}\} \neq \varnothing$, and
(b) for all e′ such that $[\![att]\!]^w(e') = 1$, Ted is not the believer of e′ in w or CON(e′)(w) ≠ $[\![\varphi]\!]_{\langle}$,
therefore,
$[\![\exists$ [*Bel Ted*] $believe^{Comp}$ [*Comp* ϕ] $]\!]^w = [\![$*not* [*Bel Ted*] $believe^{Comp}$ [*Comp* φ] $]\!]^w = 1$.

(24) If f and h are of type t: f => h iff f = 0 or h = 1
If f and h are of type (σ,ρ): f => h iff for any z such that f(z) is defined: h(z) is defined and f(z) => h(z).

Let us address this shortcoming of Variant II by revising *Comp* and *Bel* as in (26)-(27), based on (25). The revised *Comp* and *Bel* avoid the unwelcome outcome in (23).[7]

(25) e′ $\sim_w$ e iff e′ is just like e in w with the possible exception that:
one of {CON(e)(w), CON(e′)(w)} is defined and the other is not, or CON(e)(w) and CON(e′)(w) are defined but CON(e)(w) ≠ CON(e′)(w).

[7] This revision of *Bel* and *Comp* is reminiscent of some accounts of the homogeneity of plural definite descriptions, which is illustrated by the fact that *The students complained* implies that all the students complained, and *The students didn't complain* implies that no student complained (see Fodor, 1970; Löbner, 2000).

(26) $[\![Comp]\!]^w$ = [λp. λe:
(CON(e)(w) = p & for all q such that p => q, {e′| e′ ∼$_w$ e & CON(e′)(w) = q} ≠ ∅) or
(for all q => p, {e′| e′ ∼$_w$ e & CON(e′)(w) is defined & CON(e′)(w) = q} = ∅).
CON(e)(w) is defined & CON(e)(w) = p]

(27) $[\![Bel]\!]^w$ = [λx. λe: if CON(e)(w) is defined, then:
(for all q such that CON(e)(w) => q, {e′| e′ ∼$_w$ e & CON(e′)(w) = q & e′ has a believer in w & x is the believer of e′ in w} ≠ ∅) or
(for all q such that q => CON(e)(w), {e′| e′ ∼$_w$ e & CON(e′)(w) = q & e′ has a believer in w & x is the believer of e′ in w} = ∅).
e has a believer in w & x is the believer of e in w]

(28) By Variant II modified according to (26)-(27), for all (ϕ, φ, w) such that $[\![\phi]\!]^c$ => $[\![\varphi]\!]^c$:
if {e| $[\![Bel]\!]^w$(Ted)(e) = $[\![Comp]\!]^w$($[\![\phi]\!]^c$)(e) = $[\![believe^{Comp}]\!]^w$(e) = 1} ≠ ∅,
then {e| $[\![Bel]\!]^w$(Ted)(e) = $[\![Comp]\!]^w$($[\![\varphi]\!]^c$)(e) = $[\![believe^{Comp}]\!]^w$(e) = 1} ≠ ∅,
and if {e| $[\![Bel]\!]^w$(Ted)(e) = $[\![Comp]\!]^w$($[\![\varphi]\!]^c$)(e) = $[\![believe^{Comp}]\!]^w$(e) = 1} = ∅,
then {e| $[\![Bel]\!]^w$(Ted)(e) = $[\![Comp]\!]^w$($[\![\phi]\!]^c$)(e) = $[\![believe^{Comp}]\!]^w$(e) = 1} = ∅;
therefore, if $[\![$∃ [*Bel Ted*] $believe^{Comp}$ [*Comp* ϕ] $]\!]^w$ = 1, $[\![$*not* [*Bel Ted*] $believe^{Comp}$ [*Comp* φ] $]\!]^w$ ≠ 1, and
if $[\![$*not* [*Bel Ted*] $believe^{Comp}$ [*Comp* φ] $]\!]^w$ = 1, $[\![$∃ [*Bel Ted*] $believe^{Comp}$ [*Comp* ϕ] $]\!]^w$ ≠ 1.

To account for "negative" verbs, we may assume additional decomposition. For example, *doubt* decomposes into *not*+$believe^{Comp}$ (and *not* scopes over the subject, yielding the LF [*not* [*Bel* …] $believe^{Comp}$ [*Comp* …]]).

This solution to the problem illustrated in (23) is at odds with any account of the variability among verbs regarding complement-taking that relies on θ-Realization. We elaborate on this in the remainder of the paper.

4. DP-complements with propositional content

4.1. More variability regarding complement-taking

As we saw, *groaned* – as opposed to *believes* – need not take a complement. There is additional variability among predicates regarding complement-taking. As (29a) illustrates, some nouns are optionally clause-taking (see Higgins, 1972; Stowell, 1981; Grimshaw, 1990; Elliott, 2017/2020). As (29b) shows, such nouns do not, themselves, take DP complements. As (30) shows, some DP-taking verbs are clause-taking, some clause-taking verbs are not DP-taking, and some DP-taking verbs are not clause-taking.

(29) a. Ted believes/denies/rejects/questions the claim (that Mia has been happy).
b. Ted believes/denies/rejects/questions the claim (*the rumor) that Mia has been happy.

(30) a. Ted believes/denies (the claim) that Mia has been happy.
b. *Ted surmises/conjectures the claim.

c. Ted surmises/conjectures (*the claim) that Mia has been happy.
d. Ted rejects/questions *(the claim) that Mia has been happy.

Suppose that in Variants I-II, when the determiner *the* precedes a singular predicate (as in, for example, *the dog*), it has the meaning in (31). By convention, u is a variable over eventualities or "normal" individuals.

(31) $[\![\textit{the}]\!]^w = [\lambda P$: there is exactly one u such that P(u) = 1. the unique u such that P(u) = 1]

According to Variant I, the ambiguity of *claim* is lexical (see (32)): $[\![\textit{claim}^{p-}]\!]^w$ takes only an eventuality argument; $[\![\textit{claim}^{p}]\!]^w$ takes a proposition in addition to an eventuality, the proposition supplies the content of the eventuality. By convention, s is a variable over eventualities that are claims, rumors, beliefs and the like. The ambiguity of *believes* is also lexical (see (33)): $[\![\textit{believe}^{p}]\!]^w$ takes a proposition as its first argument; $[\![\textit{believe}^{s}]\!]^w$ takes an eventuality as its first argument (e.g., $[\![\textit{the claim}^{p-}]\!]^w$ or $[\![\textit{the}\ [\textit{claim}^{p}\ \phi]\ ]\!]^{w,g}$, where ϕ is a clause such as [$\exists$ *Mia was*^{e} *happy*]).

(32) a. $[\![\textit{claim}^{p-}]\!]^w = [\lambda s.$ s is a claim in w]
b. $[\![\textit{claim}^{p}]\!]^w = [\lambda p.\ \lambda s$: CON(s)(w) = p. $[\![\textit{claim}^{p-}]\!]^w(s) = 1]$

(33) a. $[\![\textit{believe}^{p}]\!]^w$ is as in (14)
b. $[\![\textit{believe}^{s}]\!]^w =$
$[\lambda s.\ \lambda x.\ \lambda e$: $[\![\textit{believe}^{p}]\!]^w$(CON(s)(w))(x)(e) is defined. $[\![\textit{believe}^{p}]\!]^w$(CON(s)(w))(x)(e)]

Unlike *believes*, verbs such as *surmises* and *rejects* are not lexically ambiguous (the former takes only propositions; the latter only eventualities). Some lexical meanings (e.g., those of *believe*^{s} and *claim*^{p}) make explicit reference to CON (borrowed from Variant II) but crucially, FA is still the rule by which verbs and nouns combine with their complements.

According to Variant II, all verbs and nouns combine with their "complements" via PM. Thus, the ambiguity of *believes*, like that of *claim*, is not lexical; it follows from the definedness conditions of *believe* and *claim*, in conjunction with θ-Realization and pragmatic principles. We illustrate how this works with (34)-(38) and relevant assumptions from Section 3.

(34) $[\![\textit{believe}^{Comp}]\!]^w$ is as in (16)

(35) $[\![\textit{surmise}^{Comp,Th-}]\!]^w = [\lambda e$: {y| $[\![\textit{Bel}]\!]^{w,g}$(y)(e) = 1} ≠ ∅ & {p| $[\![\textit{Comp}]\!]^{w,g}$(p)(e) = 1} ≠ ∅ & {y| $[\![\textit{Th}]\!]^{w,g}$(y)(e) = 1} = ∅ & $[\![\textit{att}]\!]^w$(e) = 1 & (e is a surmising eventuality in w iff DOX(the believer of e in w)(e)(w) ⊆ {w′| CON(e)(w)(w′) = 1}}).
e is a surmising eventuality in w]

(36) $[\![\textit{reject}^{Th,Comp-}]\!]^w = [\lambda e$: {y| $[\![\textit{Rej}]\!]^{w,g}$(y)(e) = 1} ≠ ∅ & {p| $[\![\textit{Comp}]\!]^{w,g}$(p)(e) = 1} = ∅ & {y| $[\![\textit{Th}]\!]^{w,g}$(y)(e) = 1} ≠ ∅ & CON(the theme of e in w)(w) is defined & $[\![\textit{att}']\!]^w$(e) = 1 & (e is a rejecting eventuality in w iff DOX(the rejecter of e in w)(e)(w) ⊆ {w′| CON(the theme of e in w)(w)(w′) = 0}).
e is a rejecting eventuality in w],

where $[\![att']\!]^w$ = [λe′. DOX(the rejecter of e′ in w)(e′)(w) ≠ ∅ & DOX(the rejecter of e′ in w)(e′)(w) ⊆ {w′| CON(the theme of e′ in w)(w)(w′) is defined}]

(37) $[\![claim^{Th-}]\!]^w$ = [λs: {y| $[\![Th]\!]^{w,g}$(y)(e) = 1} = ∅. s is a claim in w]

(38) a. *Rej* is a thematic predicate that introduces a rejecter.
b. $[\![Th]\!]^w$ = [λu. λe: if CON(e)(w) is defined, then CON(e)(w) = CON(u)(w). e has a theme in w & u is the theme of e in w]

By θ-Realization, a verb that presupposes that {p| $[\![Comp]\!]^{w,g}$(p)(e) = 1} ≠ ∅ (e.g., $surmise^{Comp,Th-}$) has [*Comp* β] as a sister (cf. Section 3). In addition, by θ-Realization, a verb that presupposes that {y| $[\![Th]\!]^{w,g}$(y)(e) = 1} ≠ ∅ (e.g., $reject^{Th,Comp-}$) has [*Th* β] as a sister, and a verb like $believe^{Comp}$ can – but need not – have [*Th* β] as a sister. In order to derive that $believe^{Comp}$ can have [*Th* β] instead of [*Comp* β] as a sister, we assume that a theme can be a proxy of CON for θ-Realization purposes (though not the other way around); economy principles ban the co-occurrence of [*Th* β] and [*Comp* β]. Importantly, for any thematic predicate ζ and verb V, if V presupposes that {Z| $[\![\zeta]\!]^{w,g}$(Z)(e) = 1} = ∅ (e.g., $surmise^{Comp,Th-}$, $reject^{Th,Comp-}$), V cannot have [ζ β] as a sister, as for any e, $[\![V\ [\zeta\ \beta]\ ]\!]^{w,g}$(e) ≠ 1 (resulting in presupposition failure, trivial truth, or trivial falsity). By extending θ-Realization to nouns, we derive that $claim^{Th-}$ can, but need not, have [*Comp* β] as a sister (though it cannot have [*Th* β] as a sister; cf. $surmise^{Comp,Th-}$). Accordingly, $[\![Th]\!]^w$ can take as its argument $[\![the\ claim^{Th-}$ [*Comp* ϕ] $]\!]^{w,g}$, $[\![the\ claim^{Th-}]\!]^w$, etc.

It is far from obvious that Variant II offers a more explanatory theory of complementation compared to Variant I, despite being lexically more economical, as it is far from clear that the thematic presuppositions are predictable in all cases. For example, it is not clear why a regretting eventuality must have a theme with propositional content but cannot, itself, have propositional content; see (36). Still, for the sake of the discussion, let us concede that the lexical economy of Variant II gives it a significant advantage relative to Variant I.

Crucially, there are intuitive inferences that Variant II cannot explain in a manner that is consistent with θ-Realization. Consider (39)-(40). Clearly, (39a) does not intuitively entail (39b), because existence of a unique claim that Mia is a cat does not follow from the existence of a unique claim that Mia is a happy cat. Similarly, (40a) does not entail (40b).

(39) a. Ted believes the claim that Mia is a happy cat.
b. Ted believes the claim that Mia is a cat.

(40) a. Ted doesn't believe the claim that Mia is a cat.
b. Ted doesn't believe the claim that Mia is a happy cat.

However, (39a) intuitively Strawson entails (39b), and (40a) intuitively Strawson entails (40b) (*p* Strawson entails *q* iff *q* follows from [*p* and what *q* presupposes]; see von Fintel, 1999). We base this claim on grammaticality judgments regarding counterparts of (39)/(40) that contain

NPIs (e.g., *ever*, *any*).[8] As we show, assuming the standard theory of NPI-licensing, only Variant I can predict those grammaticality judgments and, at the same time, account for the attested variability regarding complement-taking.

4.2. DP-complements and NPI-licensing

Relying on insights from Fauconnier, 1975; Ladusaw, 1979; Lahiri, 1998; von Fintel, 1999; Guerzoni & Sharvit, 2007; Gajewski & Hsieh, 2014, we assume that NPIs are licensed only in environments that support inferences that are SDE (Strawson downward entailing) and not SUE (Strawson upward entailing). In other words, we assume (41) (where $\delta_{[\gamma/\gamma']}$ is just like δ except that any occurrence of γ is replaced with γ'). '$=>_{ST}$' – Strawson entailment – is defined in (42): '=>' in (24) is stronger than '$=>_{ST}$'.

(41) a. An NPI α is acceptable only if α is dominated by an LF node β such that β is SDE, but not SUE, with respect to α.[9]

b. (i) δ is SDE with respect to γ iff for any g and γ' such that $[\![\gamma']\!]^g_{¢} => [\![\gamma]\!]^g_{¢}$: $[\![\delta]\!]^g_{¢} =>_{ST} [\![\delta_{[\gamma/\gamma']}]\!]^g_{¢}$.

(ii) δ is SUE with respect to γ iff for any g and γ' such that $[\![\gamma']\!]^g_{¢} => [\![\gamma]\!]^g_{¢}$: $[\![\delta_{[\gamma/\gamma']}]\!]^g_{¢} =>_{ST} [\![\delta]\!]^g_{¢}$.

(42) If f and h are of type t: $f =>_{ST} h$ iff $f => h$

If f and h are of type (σ,ρ): $f =>_{ST} h$ iff for any z such that f(z) and h(z) are defined: $f(z) =>_{ST} h(z)$.

Both Variant I and Variant II account for the NPI pattern in (43), based on the assumption that the NPI *ever* is an indefinite expression, as implied by (44) (cf. Ladusaw, 1979, regarding *any*).

(43) a. Ted doubts/doesn't believe that Mia has (ever) been happy.
b. Ted believes that Mia has (*ever) been happy.
c. Only Ted believes that Mia has (ever) been happy.
d. Ted believes/doesn't believe the claim that Mia (*ever) made.

(44) Where $[\![\gamma]\!]^{w,g}$ is a function from eventualities to truth values, $[\![ever\ \gamma]\!]^{w,g} = [\![\gamma]\!]^{w,g}$.

Suppose γ is a (possibly silent) modifier such as *in Mia's youth*. It follows that: (i) the Variants I-II LFs of (43a) – i.e., (45a,b) – are SDE, but not SUE, with respect to *ever* γ; and (ii) the Variants I-II LFs of (43b) – i.e., (46a,b) – are SUE with respect to *ever* γ.

[8] Grammaticality judgments are more reliable, in this case, than inference judgments. Consultants do not always understand the question *Does 'Ted believes the claim that Mia is a happy cat' Strawson entail 'Ted believes the claim that Mia is a cat'?* (even if it is accompanied by an explanation of what is meant by *Strawson entailment*). Asking, instead, *Does 'Ted believes the claim that Mia is a cat' follow from 'Ted believes the claim that Mia is a happy cat and there is a unique claim that Mia is a cat and …'?* does not make the task easier.

[9] This version of the condition on NPIs is based on Gajewski, 2011; Homer, 2008; and Crnič, 2019. An alternative version requires NPIs to be in the scope of an operator that is itself, semantically, SDE and not SUE.

(45) a. *not Ted believe*^{p} [∃ *Mia was*^{e} *happy ever* γ]
b. *not* [*Bel Ted*] *believe*^{Comp} [*Comp* ∃ [*Exp Mia*] *was*$^{\theta}$ *happy ever* γ]

(46) a. ∃ *Ted believe*^{p} [∃ *Mia was*^{e} *happy ever* γ]
b. ∃ [*Bel Ted*] *believe*^{Comp} [*Comp* ∃ [*Exp Mia*] *was*$^{\theta}$ *happy ever* γ]

In addition, the Variants I-II LFs of (43c) in (47) are exclusively SDE with respect to *ever* γ, assuming (48) (cf. von Fintel, 1999; Horn, 1969) and Predicate Abstraction (PA) in (49).

(47) a. *only Ted* [*believe*^{p} [∃ *Mia was*^{e} *happy ever* γ]]
b. *only Ted* [6 [[*Bel* t_6] *believe*^{Comp} [*Comp* ∃ [*Exp Mia*] *was*$^{\theta}$ *happy ever* γ]]]

(48) $[\![\textit{only Ted}]\!]^{w} = [\lambda f\text{: } \{e|\ f(\text{Ted})(e) = 1\} \neq \varnothing.\ \{y|\ \{e|\ f(y)(e) = 1\} \neq \varnothing\} = \{\text{Ted}\}]$

(49) PA
a. If α is a branching node, k is a numerical index and {k, β} is the set of α's daughters, then $[\![\alpha]\!]^{w,g} = [\lambda o\text{: } [\![\beta]\!]^{w,g[k\rightarrow o]}$ is defined. $[\![\beta]\!]^{w,g[k\rightarrow o]}]$.
b. If k a numerical index, $[\![t_k]\!]^{w,g}$ is defined only if g(k) is. If defined, $[\![t_k]\!]^{w,g} = g(k)$.

As for (43d), the relative clause *that Mia made* has the LF [6 ∃ *Mia made*^{e} t_6 *ever* ...] in Variant I and the LF [6 ∃ [*Ag Mia*] *made*$^{\theta}$ [*Th* t_6] *ever* ...] in Variant II; those LFs are interpreted by PA, and combine – respectively – with *claim*$^{p-}$ and *claim*$^{Th-}$ by PM. By the meaning of *the* in (31), the claim that Mia made at some point in her youth and the claim that Mia made at some point in her life are one and the same claim. In other words, the LFs of (43d) are both SUE and SDE with respect to *ever* within Variants I-II, as illustrated in (50) ($[\![\textit{ever in Mia's youth}]\!]_{¢}$ => $[\![\textit{ever in Mia's life}]\!]_{¢}$, and $[\![\textit{ever in Mia's life}]\!]_{¢} \neq>_{ST} [\![\textit{ever in Mia's youth}]\!]_{¢}$).

(50) (i) $[\![$*Ted believe*^{s} *the* [*claim*$^{p-}$ [6 ∃ *Mia made*^{e} t_6 *ever in Mia's youth*]] $]\!]_{¢}$
$_{ST}<=>_{ST}$
$[\![$*Ted believe*^{s} *the* [*claim*$^{p-}$ [6 ∃ *Mia made*^{e} t_6 *ever in Mia's life*]] $]\!]_{¢}$
(ii) $[\![$[*Bel Ted*] *believe*^{Comp} [*Th the claim*$^{Th-}$ [6 ∃ [*Ag Mia*] *made*$^{\theta}$ [*Th* t_6] *ever in Mia's youth*]] $]\!]_{¢}$
$_{ST}<=>_{ST}$
$[\![$[*Bel Ted*] *believe*^{Comp} [*Th the claim*$^{Th-}$ [6 ∃ [*Ag Mia*] *made*$^{\theta}$ [*Th* t_6] *ever in Mia's life*]] $]\!]_{¢}$

Crucially, only Variant I predicts – correctly and straightforwardly – the existence of dialects of English that allow NPIs in complements of nouns N such that [$_{DP}$ *the* N [$_{Complement}$ …]] serves as the complement of *doesn't believe* or of inherently negative verbs such as *doubt*, as shown in (51a,b).[10] The acceptable (51a,b) contrast with (43d), with *Ted doubts the claim that Mia (*ever) made*, and with (52).

[10] Two naturally occurring examples found online are a.-b. below (Gary Thoms, pc).

a. Pettygrove, however, having built the first building on the levee, denied the claim that they ever intended public ownership.
b. Some of us with E5 licenses might dispute the claim that they ever really cleaned up their act in the objective sense …

(51) a. Ted doesn't believe the claim that Mia has (ever) been happy.
b. Ted doubts the claim that Mia has (ever) been happy.

(52) Ted believes the claim that Mia has (*ever) been happy.

The definedness and truth conditions of *Ted believes/doesn't believe the claim that Mia is …* are derived from (53) within Variant I: the embedded noun combines with its clausal complement by FA; the embedding verb combines with its DP complement in the same way.

(53) a. When defined, $[\![the\ [claim^{p}\ \phi]\ ]\!]^{w,g}$ is the unique s such that s is a claim in w and CON(s)(w) = $[\![\phi]\!]^{g}_{¢}$.
b. $[\![Ted\ believe^{s}\ the\ [claim^{p}\ \phi]\ ]\!]^{w,g}$ = [λe: DOX(Ted)(e)(w) ≠ ∅ & $[\![the\ [claim^{p}\ \phi]\ ]\!]^{w,g}$ is defined & DOX(Ted)(e)(w) ⊆ {w′| $[\![\phi]\!]^{w',g}$ is defined}. DOX(Ted)(e)(w) ⊆ {w′| $[\![\phi]\!]^{w',g}$ = 1}]

According to (53a), the claim that Mia was happy at some point in her youth and the claim that Mia was happy at some point in her life are distinct claims. Moreover, as shown in (54), the Variant I LF of (51a) is SDE with respect to *ever*.

(54) For all w:
if $[\![not\ Ted\ believe^{s}\ the\ [claim^{p}\ [\exists\ Mia\ was^{e}\ happy\ ever\ in\ Mia's\ life]]\ ]\!]^{w}$ = 1, and $[\![not\ Ted\ believe^{s}\ the\ [claim^{p}\ [\exists\ Mia\ was^{e}\ happy\ ever\ in\ Mia's\ youth]]\ ]\!]^{w}$ is defined, then:
$[\![the\ [claim^{p}\ [\exists\ Mia\ was^{e}\ happy\ ever\ in\ Mia's\ life]]\ ]\!]^{w}$ and $[\![the\ [claim^{p}\ [\exists\ Mia\ was^{e}\ happy\ ever\ in\ Mia's\ youth]]\ ]\!]^{w}$ are defined, and
{e| DOX(Ted)(e)(w) ⊆ {w′| $[\![\exists\ Mia\ was^{e}\ happy\ in\ Mia's\ life]\!]^{w'}$ is defined}} ≠ ∅, and
{e| DOX(Ted)(e)(w) ⊆ {w′| $[\![\exists\ Mia\ was^{e}\ happy\ in\ Mia's\ youth]\!]^{w'}$ is defined}} ≠ ∅, and
{e| DOX(Ted)(e)(w) ⊆ {w′| $[\![\exists\ Mia\ was^{e}\ happy\ in\ Mia's\ life]\!]^{w'}$ = 1}} = ∅, therefore,
{e| DOX(Ted)(e)(w) ⊆ {w′| $[\![\exists\ Mia\ was^{e}\ happy\ in\ Mia's\ youth]\!]^{w'}$ = 1}} = ∅.
Therefore, $[\![not\ Ted\ believe^{s}\ the\ [claim^{p}\ [\exists\ Mia\ was^{e}\ happy\ ever\ in\ Mia's\ life]]\ ]\!]_{¢}$ =>$_{ST}$ $[\![not\ Ted\ believe^{s}\ the\ [claim^{p}\ [\exists\ Mia\ was^{e}\ happy\ ever\ in\ Mia's\ youth]]\ ]\!]_{¢}$.

Variant II cannot straightforwardly reproduce this result. The definedness and truth conditions of *Ted believes/doesn't believe the claim that Mia is …* are derived from (55): the embedded noun combines with its clausal "complement" by PM; the embedding verb combines with its DP "complement" in the same way.

(55) a. When defined, $[\![the\ claim^{Th-}\ [Comp\ \phi]\ ]\!]^{w,g}$ is the unique s such that s is a claim in w and CON(s)(w) = $[\![\phi]\!]^{g}_{¢}$.
b. $[\![\ [Bel\ Ted]\ believe^{Comp}\ [Th\ the\ claim^{Th-}\ [Comp\ \phi]]\ ]\!]^{w,g}$ = [λe: $[\![Bel\ Ted]\!]^{w,g}$(e) and $[\![Th]\!]^{w,g}([\![the\ claim^{Th-}\ [Comp\ \phi]\ ]\!]^{w,g})$(e) and $[\![believe^{Comp}]\!]^{w,g}$(e) are defined. $[\![Bel]\!]^{w,g}$(Ted)(e) = $[\![believe^{Comp}]\!]^{w,g}$(e) = $[\![Th]\!]^{w,g}([\![the\ claim^{Th-}\ [Comp\ \phi]\ ]\!]^{w,g})$(e) = 1]

According to (55a), the claim that Mia was happy at some point in her youth and the claim that Mia was happy at some point in her life are distinct claims. Nevertheless, the Variant II LF of (51a) is not SDE with respect to *ever*. As shown in (56), when *q* entails *p* and *the claim*$^{Th-}$

Comp p is not the theme of any *p*-believing eventuality of which Ted is the believer, it is possible that *the claim*$^{Th-}$ *Comp q* is the theme of some *q*-believing eventuality of which Ted is the believer.

(56) There is at least one w such that:
(a) $[\![$*the claim*$^{Th-}$ [*Comp* ∃ [*Exp Mia*] *was*$^{\theta}$ *happy ever in Mia's life*] $]\!]^{w}$ is defined,
(b) there is an e such that $[\![$*Bel Ted*$]\!]^{w}$(e) = $[\![$*believe*$^{Comp}]\!]^{w}$(e) = $[\![$*Th the claim*$^{Th-}$ [*Comp* ∃ [*Exp Mia*] *was*$^{\theta}$ *happy ever in Mia's youth*] $]\!]^{w}$(e) = 1
(therefore, $[\![$*not* [*Bel Ted*] *believe*^{Comp} [*Th the claim*$^{Th-}$ [*Comp* ∃ [*Exp Mia*] *was*$^{\theta}$ *happy ever in Mia's youth*]] $]\!]^{w}$ = 0), and
(c) for all e′ such that $[\![$*Bel Ted*$]\!]^{w}$(e′) = $[\![$*believe*$^{Comp}]\!]^{w}$(e′) = 1, $[\![$*Th the claim*$^{Th-}$ [*Comp* ∃ [*Exp Mia*] *was*$^{\theta}$ *happy ever in Mia's youth*] $]\!]^{w}$(e′) is defined and e′ has a theme in w and $[\![$*the claim*$^{Th-}$ [*Comp* ∃ [*Exp Mia*] *was*$^{\theta}$ *happy ever in Mia's life*] $]\!]^{w}$ is not the theme of e′ in w)
(therefore, $[\![$*not* [*Bel Ted*] *believe*^{Comp} [*Th the claim*$^{Th-}$ [*Comp* ∃ [*Exp Mia*] *was*$^{\theta}$ *happy ever in Mia's life*]] $]\!]^{w}$ = 1).
Therefore, $[\![$*not* [*Bel Ted*] *believe*^{Comp} [*Th the claim*$^{Th-}$ [*Comp* ∃ [*Exp Mia*] *was*$^{\theta}$ *happy ever in Mia's life*]] $]\!]_{c} \neq>_{ST}$ $[\![$*not* [*Bel Ted*] *believe*^{Comp} [*Th the claim*$^{Th-}$ [*Comp* ∃ [*Exp Mia*] *was*$^{\theta}$ *happy ever in Mia's youth*]] $]\!]_{c}$.

Notice that neither (57a) nor (57b) is SDE with respect to *ever*. Thus, both Variant I and Variant II account for (52) (= *Ted believes the claim that Mia has (*ever) been happy*). However, (57a) is SUE with respect to *ever* but (57b) is not.

(57) a. ∃ *Ted believe*^{s} *the* [*claim*^{p} [∃ *Mia was*^{e} *happy ever in* …]]
b. ∃ [*Bel Ted*] *believe*^{Comp} [*Th the claim*$^{Th-}$ [*Comp* ∃ [*Exp Mia*] *was*$^{\theta}$ *happy ever in* …]]

Given this, only Variant I predicts that (39a) (= *Ted believes the claim that Mia is a happy cat*) intuitively Strawson entails (39b) (= *Ted believes the claim that Mia is a cat*). This, too, favors Variant I, despite the difficulty in obtaining direct support for that prediction.[11]

We now explore, and discard, three attempts to salvage Variant II. One of them involves treating *the* as ambiguous; the other two involve revising the meaning of *Th*.

4.3. Some potential solutions

The first attempt to salvage Variant II that we explore is based on the idea that the surface definite determiner *the* can sometimes be interpreted the same way as the surface indefinite determiners *a* and *any*. That idea has been used to account, for example, for the ambiguity –

[11] See Footnote 8. It should also be noted that in those dialects of English where (51a,b) are well-formed, they contrast with their possessive counterparts in (i) below (Gary Thoms, pc; Tim Stowell, pc). This contrast is not currently explained by either Variant I or Variant II. However, (i) is consistent with (41) within Variant I, as (41) is merely a necessary condition on NPIs.

(i) a. Ted doubts/doesn't believe Jim's claim that Mia has (*ever) been happy.
b. Ted doubts/doesn't believe Jim's claim that Mia has (*ever) been happy.

illustrated in (58) – of superlative DPs such as *the highest mountain*. This is shown in (59)-(60), modified from Heim, 1999 (d is a degree variable, t_5 is a degree-denoting trace, and t_3 and t_4 are "normal"-individual-denoting traces).

(58) a. Absolute reading of *Ted climbed the highest mountain*:
The highest z in {x| x is a mountain} was climbed by Ted.
b. Relative reading of *Ted climbed the highest mountain*:
There is some z in {x| x is a mountain and Ted climbed x} such that for all y in {x′| x′ is a mountain and someone who is not Ted climbed x′}, z is higher than y.

(59) a. $[\![\textit{the}\ \beta]\!]^{w,g}$ is the unique u such that $[\![\beta]\!]^{w,g}(u) = 1$ (if there is one, otherwise undefined).
b. $[\![\sout{\textit{the}}\ \beta]\!]^{w,g} = [\![\textit{a}\ \beta]\!]^{w,g} = [\![\textit{any}\ \beta]\!]^{w,g} = [\![\beta]\!]^{w,g}$
c. $[\![\textit{-est}]\!]^{w} = [\lambda R.\ \lambda x: \{d|\, R(d)(x) = 1\} \neq \varnothing.\ \{d|\ \{y|\, R(d)(y) = 1\} = \{x\}\} \neq \varnothing]$
d. $[\![\textit{mountain}]\!]^{w} = [\lambda x.$ x is a mountain in w$]$
e. $[\![\textit{high}]\!]^{w} = [\lambda d.\ \lambda x.$ x is at least d-high in w$]$

(60) a. Absolute LF of *Ted climbed the highest mountain*:
∃ [*Ag Ted*] *climbed*$^{\theta}$ [*Th the* [*-est* [5 [t_5*-high mountain*]]]]
b. Relative LF of *Ted climbed the highest mountain*:
Ted [*-est* [5 4 ∃ [[~~*the*~~ [t_5*-high mountain*]] [3 ∃ [*Ag* t_4] *climbed*$^{\theta}$ [*Th* t_3]]]]]

Suppose the two options in (59a,b) are available, not only in degree constructions, but also in *the claim that*-constructions. It is thus correctly predicted *Ted doesn't believe the claim that Mia has ever been happy* has a reading that is equivalent to *Ted doesn't believe any claim that Mia has ever been happy*. This is a welcome prediction. However, both sentences are incorrectly predicted to be unacceptable. The determiner *any* is – like *ever* – an NPI, but both LFs in (61) are not SDE with respect to *any* and/or *ever*, as implied by (56) and by the fact that when *q* entails *p* and no *claim*$^{Th-}$ *Comp p* is the theme of a *p*-believing eventuality of which Ted is the believer, there can be a *claim*$^{Th-}$ *Comp q* that is the theme of some *q*-believing eventuality of which Ted is the believer.

(61) a. *not* [*Bel Ted*] *believe*^{Comp} [*Th the* [*claim*$^{Th-}$ [*Comp* ∃ … *was*$^{\theta}$ … *ever* …]]]
b. *not any/*~~*the*~~ [*claim*$^{Th-}$ [*Comp* ∃ … *was*$^{\theta}$ … *ever* …]] [3 ∃ [*Bel Ted*] *believe*^{Comp} [*Th* t_3]]

The availability of (59b) also makes an unwelcome prediction regarding *Ted doesn't believe the claim that Mia (*ever) made*. We expect it to be acceptable, with or without *ever*, just like *Ted doesn't believe any claim that Mia (ever) made*, because the LF in (62) is SDE (and not SUE) with respect to *any* and *ever*: when there is no eventuality of Ted believing some *claim*$^{Th-}$ made by Mia in Mia's life, it follows that there is no eventuality of Ted believing some *claim*$^{Th-}$ made by Mia in Mia's youth (but not the other way around).

(62) *not any/*~~*the*~~ *claim*$^{Th-}$ [3 ∃ [*Ag Mia*] *made*$^{\theta}$ [*Th* t_3] *ever* …] [3 ∃ [*Bel Ted*] *believe*^{Comp} [*Th* t_3]]

Two other attempts to salvage Version II are given in (63)-(64). (63) illustrates how all the thematic predicates can be re-analyzed as denoting constant functions whose domains are constrained by the relevant thematic information, and whose value is always the truth value 1. (64) re-analyzes *Th* on a par with *Bel* and *Comp* in (26)-(27).

(63) a. $[\![Comp]\!]^w = [\lambda p.\ \lambda e\text{: CON}(e)(w) = p.\ 1]$
b. $[\![Bel]\!]^w = [\lambda x.\ \lambda e\text{: x is the believer of e in w. 1}]$
c. $[\![Th]\!]^w = [\lambda u.\ \lambda e\text{: u is the theme of e in w \& (if CON}(e)(w) \text{ is defined, then CON}(e)(w) = \text{CON}(u)(w)).\ 1]$
d. $[\![Ag]\!]^w = [\lambda x.\ \lambda e\text{: x is the agent of e in w. 1}]$

(64) *Bel* and *Comp* are defined as in (26)-(27). In addition:
$[\![Th]\!]^w = [\lambda u.\ \lambda e$: if CON$(e)(w)$ is defined, then CON$(u)(w)$ = CON$(e)(w)$ and
(for all q such that CON$(e)(w)$ => q, $\{(e', u')|\ e' \sim_w e$ & $u' \sim_w u$ & CON$(e')(w)$ = CON$(u')(w)$ = q & e' has a theme in w & u' is the theme of e' in w$\} \neq \varnothing$) or
(for all q such that q => CON$(e)(w)$, $\{(e', u')|\ e' \sim_w e$ & $u' \sim_w u$ & CON$(e')(w)$ = CON$(u')(w)$ = q & e' has a theme in w & u' is the theme of e' in w$\} = \varnothing$).
e has a theme in w & u is the theme of e in w]

Indeed, both (63) and (64) predict that the Variant II LF of (51a) is SDE with respect to *ever*, and that the Variant II LF of (52) is SUE with respect to *ever*.

(65) By Variant II revised according to (64)/(63), for all w such that $E^{yth}_w \neq \varnothing$ and $E^{lf}_w \neq \varnothing$ (where E^{yth}_w = {e| $[\![believe^{Comp}]\!]^w$(e) and $[\![Bel]\!]^w$(Ted)(e) and $[\![Th]\!]^w$($[\![the\ claim^{Th-}$ [*Comp* ∃ [*Exp Mia*] *was*$^\theta$ *happy ever in Mia's youth*] $]\!]^w$)(e) are defined}, and E^{lf}_w = {e| $[\![believe^{Comp}]\!]^w$(e) and $[\![Bel]\!]^w$(Ted)(e) and $[\![Th]\!]^w$($[\![the\ claim^{Th-}$ [*Comp* ∃ [*Exp Mia*] *was*$^\theta$ *happy ever in Mia's life*] $]\!]^w$)(e) are defined}):
if {e| e ∈ E^{yth}_w & $[\![believe^{Comp}]\!]^w$(e) = $[\![Bel]\!]^w$(Ted)(e) = $[\![Th]\!]^w$($[\![the\ claim^{Th-}$ [*Comp* ∃ [*Exp Mia*] *was*$^\theta$ *happy ever in Mia's youth*] $]\!]^w$)(e) = 1$\} \neq \varnothing$,
then {e| e ∈ E^{lf}_w & $[\![believe^{Comp}]\!]^w$(e) = $[\![Bel]\!]^w$(Ted)(e) = $[\![Th]\!]^w$($[\![the\ claim^{Th-}$ [*Comp* ∃ [*Exp Mia*] *was*$^\theta$ *happy ever in Mia's life*] $]\!]^w$)(e) = 1$\} \neq \varnothing$,
and if {e| e ∈ E^{lf}_w & $[\![believe^{Comp}]\!]^w$(e) = $[\![Bel]\!]^w$(Ted)(e) = $[\![Th]\!]^w$($[\![the\ claim^{Th-}$ [*Comp* ∃ [*Exp Mia*] *was*$^\theta$ *happy ever in Mia's life*] $]\!]^w$)(e) = 1$\} = \varnothing$,
then {e| e ∈ E^{yth}_w & $[\![believe^{Comp}]\!]^w$(e) = $[\![Bel]\!]^w$(Ted)(e) = $[\![Th]\!]^w$($[\![the\ claim^{Th-}$ [*Comp* ∃ [*Exp Mia*] *was*$^\theta$ *happy ever in Mia's youth*] $]\!]^w$)(e) = 1$\} = \varnothing$.

Nevertheless, neither (63) nor (64) has a significant advantage over Variant I. Contra what (63) implies, when it is known that Ted did nothing to Mia, *Ted didn't greet Mia* is uninformative, not a presupposition failure (cf. *Ted didn't greet his friends*, which is a presupposition failure when it is known that Ted has no friends). Some conjunction facts corroborate this. (66) illustrates the well-known fact that *p CONJUNCTION q* is infelicitous if *p* is incompatible with the presuppositions of *q*. (67) shows that: (i) *p furthermore/and q* is felicitous only if $p \not\Rightarrow q$, and (ii) *p in particular q* is felicitous only if $p \Rightarrow q$. The fact that (68) patterns like (67), rather than (66), suggests that if *greet* indeed decomposes into thematic and non-thematic predicates, the information contributed by the thematic predicates is, like the non-thematic information, asserted rather than presupposed.

(66) a. #Ted has no friends at all; in particular/and, he didn't greet his friends.
b. #Ted has no friends at all; furthermore/and he didn't (even) greet his friends.

(67) a. Ted has no friends at all; in particular/#furthermore/#and, he doesn't have (any) close friends.
b. Ted has no close friends; furthermore/and//#in particular, he doesn't (even) have (any) distant friends.

(68) a. Ted didn't do anything to Mia; in particular/#furthermore/#and, he didn't greet her.
b. Ted didn't hug Mia; furthermore/and/#in particular, he didn't (even) greet her.

As for (64), it cannot be compatible – simultaneously – with the θ-Realization account of the variability regarding complement-taking, and with the condition on NPI-licensing in (41), because the presupposition of *Th* in (64) is sometimes too easily satisfied. Take, for example, the verb pronounced *rejects*, which licenses NPIs (as shown by the acceptability of *Ted rejects the claim that Mia has ever been happy*), and takes DP-complements but not clausal complements (see (29)-(30)). The presupposition of its theme argument is too easily satisfied, regardless of whether or not *reject*$^{Th,Comp-}$ decomposes into *not+posrej*$^{Th,Comp-}$, where *posrej*$^{Th,Comp-}$ is the "positive" counterpart of *reject*$^{Th,Comp-}$ (cf. Section 3 on *doubt*). According to (36), the domain of $[\![$*reject*$^{Th,Comp-}]\!]^{w}$/$[\![$*posrej*$^{Th,Comp-}]\!]^{w}$ includes only eventualities e such that {p| $[\![$*Comp*$]\!]^{w}$(p)(e) = 1} = ∅. As a result, the domain of $[\![$*reject*$^{Th,Comp-}$ [*Th the claim*$^{Th-}$ [*Comp* ϕ]] $]\!]^{w,g}$/$[\![$*posrej*$^{Th,Comp-}$ [*Th the claim*$^{Th-}$ [*Comp* ϕ]] $]\!]^{w,g}$ may include eventualities e such that $[\![$*Th the claim*$^{Th-}$ [*Comp* ϕ] $]\!]^{w,g}$(e) is trivially defined. This reproduces for *rejects* the problem illustrated in (56) regarding *believes*. All alternatives to (64) that are compatible with the θ-Realization account of the attested variability regarding complement-taking face a similar problem. This, in turn, makes it extremely difficult – if not impossible – to derive the attested variability regarding complement-taking from the same principles that govern the optionality of non-arguments (such as *passionately*), effectively depriving Variant II of its advantage relative to Variant I.[12]

It is also worth noting that while (63)/(64) account for the licensing of NPIs by *doesn't believe* (illustrated in (43a)), they do not account for the fact that intuitively, *Ted believes that Mia is a happy cat* entails – rather than merely Strawson entails – *Ted believes that Mia is a cat*. By (64)/(63), it is the case that $[\![$*not* [*Bel Ted*] *believe*^{Comp} [*Comp* ∃ [*Exp Mia*] *is*$^{\theta}$ *a cat*] $]\!]_{¢}$ =>$_{ST}$ $[\![$*not* [*Bel Ted*] *believe*^{Comp} [*Comp* ∃ [*Exp Mia*] *is*$^{\theta}$ *a happy cat*] $]\!]_{¢}$, but it is also the case that $[\![$∃ [*Bel Ted*] *believe*^{Comp} [*Comp* ∃ [*Exp Mia*] *is*$^{\theta}$ *a happy cat*] $]\!]_{¢}$ ≠> $[\![$∃ [*Bel Ted*] *believe*^{Comp} [*Comp* ∃ [*Exp Mia*] *is*$^{\theta}$ *a cat*] $]\!]_{¢}$ (though $[\![$∃ [*Bel Ted*] *believe*^{Comp} [*Comp* ∃ [*Exp Mia*] *is*$^{\theta}$ *a happy cat*] $]\!]_{¢}$ =>$_{ST}$ $[\![$∃ [*Bel Ted*] *believe*^{Comp} [*Comp* ∃ [*Exp Mia*] *is*$^{\theta}$ *a cat*] $]\!]_{¢}$). Within Variant I, $[\![$∃ *Ted believe*^{p} [∃ *Mia is*^{e} *a happy cat*] $]\!]_{¢}$ => $[\![$∃ *Ted believe*^{p} [∃ *Mia is*^{e} *a cat*] $]\!]_{¢}$.

The picture that emerges is that adopting Variant II requires either attributing to the thematic predicates and/or the definite determiner grammatical presuppositions that do not reflect the intuitive presuppositions of the sentences that (supposedly) contain them, or giving up the idea that the variability regarding complement-taking follows from the same principles that account for the optionality of modifiers such as *passionately*.

[12] It seems fair to say that if Bondarenko & Elliott (2023), which offers an account of the NPI facts, offered an account of the variability regarding complement-taking as well, a similar concern would arise there.

5. Conclusion

We evaluated two variants of Event Semantics against variation regarding complement-taking and intuitive inferences supported by clause-taking and DP-taking predicates. Variant I, which preserves the traditional distinction between complements and modifiers, accounts for these facts, but only at the expense of positing lexical ambiguity. Variant II, which defies that traditional distinction, fails to offer a more explanatory account of the facts. It is worth noting that a hybrid theory along the lines of Wang, to appear, might offer an account that avoids the shortcomings of both variants.

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Reconstructing coordinations[1]

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Abstract. The debate about the proper analysis of coordination is usually organized around two competing approaches. On the first approach, sentences with apparent DP coordination consist of a coordination of full clauses. On the second approach, such sentences involve a coordination of DPs, in which the coordinator combines two quantificational elements. We introduce them, and subsequently evaluate them, on the basis of apparent subject DP coordinations in raising constructions. The data presents a challenge primarily for the first approach.

Keywords: coordination, disjunction, conjunction, raising, reconstruction.

1. Introduction

One central issue in the work on the syntax-semantics interface is the proper analysis of coordination sentences, namely, what is their interpretation and underlying structure (e.g., Ross, 1967; Montague, 1973). By 'coordination' we mean connectives as *and* and *or*. Traditionally, in logic, connectives are defined as sentential, truth-functional operators. Their applicability to entire sentences as single units is readily found in natural language in cases such as (1):

(1) a. [Roses are red] and [violets are blue]
b. [Roses are red] or [violets are blue]

However, natural language coordination appears to have a much wider distribution – we can conjoin and disjoin noun phrases, verb phrases, verbs, and adjectives, for example:

(2) a. [[Tom] and [Jerry]] are running away
b. Jerry [[ate cheese] or [baked a cake]]
c. Tom [[cursed] or [caught]] Jerry
d. Tom is [[fast] and [furious]]

In light of these apparently disparate uses of coordination, the following question presents itself: Is the (merely) truth-functional characterization of coordination adequate as a characterization of natural language coordination, despite its apparent surface variation? Or does this surface variation reflect greater versatility in coordination operators of natural language?

There are two families of approaches to this question. We present them in a simplified fashion, abstracting away from many details and technicalities. One general approach assumes that natural language coordination does mirror our standard logical representations, and we do in fact only conjoin full clauses or any other t-type elements, as described schematically in (3).

(3) $[_{XP} \ldots]$ {and/or$_{CR}$} $[_{XP} \ldots]$,
where XPs are of type *t*

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This approach must then account for the surface variation, and it usually achieves this via syntactic movement and ellipsis. In other words, what we see is the surface structure in (4a), which has the LF in (4b), where we again abstract away from many of the subtleties of the mechanisms involved (cf., e.g., Ross, 1967; Schein, 2017; Hirsch, 2017). The surface scope of the coordinator, under these assumptions, reveals the minimal possible scope of the coordination.

(4) a. Spike bit Tom {or/and$_{\text{CR}}$} Jerry.
b. [[Spike bit Tom] [{or/and$_{\text{CR}}$} [~~Spike bit~~ Jerry]]]

This approach offers multiple benefits: it adopts a single lexical entry for each coordinator, which is the logical coordinator, and avoids the assumption that grammar must incorporate special mechanisms to generate systematic ambiguity in the case of coordination (i.e., type shifting). We will henceforth refer to this approach as conjunction reduction, or coordination reduction ('CR'), to highlight its applicability to disjunction as well as conjunction.

The other family of approaches assumes, instead, that the semantics of coordination constructions aligns with what we get at surface form: what seems like DP coordination, for example, is in fact DP coordination (cf. Partee and Rooth, 1983). A general scheme is represented in (5): hence, sentences like (4a) can have the simple structure in (6) under this approach. We will refer to this type of approach as the flexibility approach, since it takes coordinators to be flexible in being able to coordinate elements of different semantic types.

(5) [$_{\text{XP}}$ . . .] {and/or$_{\text{FL}}$} [$_{\text{XP}}$ . . .]
where XPs are of a *conjoinable* type[2]

(6) Spike bit [[$_{\text{DP}}$ Tom] or/and [$_{\text{DP}}$ Jerry]]

This paper presents evidence that challenges the CR approach. We begin by presenting the data and the problem it poses for CR. We then show how the flexibility approach straightforwardly accounts for it. In the last section, we rehearse different strategies of how to solve the problem while remaining loyal to CR, all of which run into some problem or other.

2. Reconstructing coordination

Our data consists of subject DP coordinations in raising constructions. We focus on conjunction and disjunction in two different environments. Importantly, we show that the flexibility approach can easily account for the data, while the CR approach falls short.

2.1. Reconstructing conjunction

We begin with apparent subject DP conjunction. Consider (7a), which has two possible readings, described in (7b) and (7c).[3] The strong (and preferred) reading is represented in (7b),

[2]Traditionally (Partee and Rooth, 1983), the coordinated XPs are assumed to be of a conjoinable type, where t is a conjoinable type and if τ is a conjoinable type, then for all types σ, $\langle\sigma,\tau\rangle$ is a conjoinable type. For alternatives, see Link (1983), Krifka (1990), and Schmitt (2013), among others.

[3]We assume that *un-* modifies Adj heads (e.g., Collins, 2023), and use the simplified notation of $\neg\ell$ for referring to the meaning of *unlikely*.

which is that Gali is unlikely to go to the party, and Tali is unlikely to go to the party. Another, weaker reading is represented in (7c), which is that it is unlikely that both go. For this weaker reading to be more readily accessible, rising pitch accent, or 'topic accent', may be required on the conjunction, and falling pitch accent, or 'focus accent', on *unlikely* (cf. Büring, 1997, 2003). This focus marking should also helps one to avoid getting a homogeneity inference that would collapse the readings (see, e.g., Szabolcsi and Haddican, 2004).

(7) a. Gali and Tali are unlikely to go to the party.
b. $\neg\ell$ (Gali goes to the party) $\wedge$ $\neg\ell$ (Tali goes to the party) **(strong reading)**
c. $\neg\ell$ (Gali goes to the party $\wedge$ Tali goes to the party) **(weak reading)**

To show that, indeed, both readings of the sentence are available, consider the felicitous continuation in (8). Clearly, it contradicts the stronger reading in (7b), but it is perfectly compatible with the weaker reading in (7c).

(8) Gali and Tali are unlikely to go to the party, though one will go for sure.

The weak reading in (7c) crucially depends on the embedding predicate outscoping the conjunction, as represented. This is captured by the condition in (9): When raising constructions have apparently coordinated DPs in subject position, an LF must be available on which the coordination is interpreted in the scope of the raising predicate.

(9) Scope Condition:
A raising construction in which a coordinator scopes above a raising predicate at surface form can have an LF where the reverse scope holds.

2.2. Reconstructing disjunction

Before introducing our next data point, we introduce the phenomenon of free choice (Kamp 1973, i.a.). Consider the disjunctive sentence in (10), which conveys a conjunctive meaning, also called the free choice ('FC') inference, provided in (11).

(10) Gali is allowed to watch The Thing or Eraserhead.

(11) ($\Diamond$ Gali watches The Thing) $\wedge$ ($\Diamond$ Gali watches Eraserhead)

While there are different theories of how this reading can be derived (cf. Aloni, 2007; Fox, 2007; Franke, 2009; Goldstein, 2019; Bar-Lev and Fox, 2020), what they all have in common is, roughly, the general schema in (12): a mechanism (pragmatic or semantic) applies to an LF in which disjunction takes *narrow scope* relative to the modal. While the specifics of the different derivations are inconsequential to our goal, it is crucial that this scope relation between the modal and disjunction obtains to get the FC interpretation in (11).

(12) ($\mathbf{OP}_{\text{FC}}$) [allowed [... or ...]] $\Rightarrow$ ($\Diamond$ ...) $\wedge$ ($\Diamond$ ...)

We can now return to subject DP disjunction. Consider the sentence in (13a). It has two possible readings: an ignorance reading, as in (13b), on which it is not known which of Gali or Tali is allowed to go to the party; and the FC reading, described in (13c). On this reading, Gali is allowed to go to the party, and Tali is allowed to go to the party (but perhaps it is forbidden that both go).

(13) a. Gali or Tali are allowed to go to the party.
b. (◇ Gali goes to the party) ∨ (◇ Tali goes to the party) **(ignorance reading)**
c. (◇ Gali goes to the party) ∧ (◇ Tali goes to the party) **(free choice reading)**

To accentuate the availability of the FC reading, consider the conversation in (14). B's answer is a perfectly reasonable response under the FC reading since it expresses that one of the conjuncts in (13c) may be wrong. However, it is not an adequate response on the ignorance reading — on that reading, A does not convey that Tali is allowed to go to the party, and B's reply does not contradict anything (incl. any ignorance inference).

(14) A: Gali or Tali are allowed to go to the party.
B: You may be wrong, Tali might not be allowed to go.

As previously noted, the FC interpretation requires that the disjunction is interpreted at LF in the scope of the modal predicate, as presented in (15). Only in this case can the LF be strengthened to yield the intended interpretation. Thus, the Scope Condition in (9) is instanced once more.

(15) [allowed [[Gali goes to the party] or [Tali goes to the party]]]

Having illustrated the Scope Condition for both disjunction and conjunction, we move forward to test which approach to coordination, namely CR or flexibility, furnishes suitable LFs.

2.3. Mapping problem for naive CR

The readings of the sentences described above are not obviously expected on the CR approach. This holds because the scope of coordination at LF should be at least as great as the surface scope of the coordinator, all else equal. Starting with the conjunction data set, a straightforward attempt to get at an LF for (7a) (repeated below in 16) under CR assumptions yields (17a). This LF encodes the strong reading, described in (17b): *unlikely* is outscoped by the conjunction, in breach of the Scope Condition.

(16) Gali and Tali are unlikely to go to the party.

(17) a. LF for (6a) under (naive) CR
[Gali ~~be unlikely to go to the party~~] [and$_{CR}$ [Tali are unlikely to go to the party]]
b. ⇒ ¬ℓ (Gali goes to the party) ∧ ¬ℓ (Tali goes to the party) **(strong reading)**

While the strong reading entails the target weak reading, it is too strong, as demonstrated in section 2.1. A similar issue is found in free choice examples. Simple CR assigns the sentence in (13a) (repeated below in 18) the LF in (19a), which consists of clausal coordination. This LF does not adhere to the scope condition in (9): the modal predicate is interpreted in the scope of the disjunction, yielding only the ignorance reading (19b) and not the FC reading (19c), whether we apply the free choice generating mechanisms or not.

(18) Gali or Tali are allowed to go to the party.

(19) a. LF for (13a) under (naive) CR
[[Gali ~~be allowed to go to the party~~] or$_{CR}$ [Tali are allowed to go to the party]]

b. $\Rightarrow$ ($\Diamond$ Gali goes to the party) $\vee$ ($\Diamond$ Tali goes to the party) **(ignorance reading)**
c. $\not\Rightarrow$ ($\Diamond$ Gali goes to the party) $\wedge$ ($\Diamond$ Tali goes to the party) **(free choice reading)**

There is a possible narrow-scope coordination LF for both cases, where each coordinated constituent is truth-value denoting, presented in (20). Crucially, none of the standard assumptions about ellipsis seem to allow us to get (20) from the surface structure in (7a)/(13a), where the coordination scopes over the raising predicate. We are faced with a *scope mapping problem*: the surface scope structures cannot be mapped to the inverse scope LFs on the CR analysis, which assumes the coordination of two truth-denoting constituents.

(20) [$\langle$unlikely/allowed$\rangle$ [[Gali goes to the party] [$\langle$or/and$_{\text{CR}}\rangle$ [Tali goes to the party]]]]

In Section 3, we explore various mechanisms aimed at resolving this issue, all of which ultimately fall short. It is important to note that this mapping problem is inherent only to the CR approach. In contrast, the flexibility approach doesn't encounter any such issue, as we will illustrate in the following section.

2.4. Straightforward account: Flexibility

Our data present a challenge specifically to the CR approach to coordination, while alternative approaches readily account for it. One such alternative is the flexibility approach we mentioned earlier, positing that coordination can compose with various constituents, and is not strictly limited to truth-value denoting ones.

One formulation of this approach assumes that the grammar possesses the capacity to shift the meanings of coordinators and other components, allowing them to properly combine (cf. Partee and Rooth, 1983).[4] Flexibility easily captures the target LFs we seek for our data, thus yielding the required interpretations. For the conjunction example in (7a) flexibility can assign it the LF in (21).[5] This LF is attained by reconstructing the coordination phrase from its subject position at the surface level (21b).

(21) a. Surface: [[[Gali] and$_{\text{FL}}$ [Tali]]$_1$ unlikely [t$_1$ to go to the party]]
b. LF: [unlikely [[[Gali] and$_{\text{FL}}$ [Tali]] to go to the party]]

On this LF, *unlikely* outscopes the conjunction, in alignment with the scope condition in (9). The same reconstruction process can be applied to the disjunction example in (13a), as illustrated in (22). As mentioned earlier, strengthening (or other means) can provide the desired FC interpretation on the basis of the LF in (22a).

(22) a. Surface: [allowed [[[Gali] or$_{\text{FL}}$ [Tali]] go to the party]]
b. LF: [[[Gali] or$_{\text{FL}}$ [Tali]]$_1$ allowed [t$_1$ go to the party]]

Additionally, under this account, the parses on which the subject does not reconstruct yield the other readings available for these data (the strong reading for conjunction, 7b, and the ignorance reading for disjunction, 13b).

[4]Alternative theories of semantic flexibility can be found in Link (1983), Krifka (1990), Winter (2001), Schmitt (2013), Champollion (2016), and others. We suppress their discussion here for brevity.

[5]While we aim to abstract from the specifics, or_{FL} can be formally analyzed as the propositional logic disjunction type-shifted to combine with quantifiers $[\![\text{or}_Q]\!] = \lambda Q_{\langle\langle et\rangle t\rangle}.\lambda Q'_{\langle\langle et\rangle t\rangle}.\lambda P_{\langle et\rangle}.Q(P) \vee Q'(P)$, and the proper names Montague Lifted (Partee, 1986), i.e., $[\![\text{Gali}\hat{}]\!] = \lambda P_{et}.P(\text{Gali})$.

3. Towards a CR derivation

As was mentioned before, there is a possible LF for the narrow-scope of coordination, where each coordinated constituent is truth-value denoting, repeated here (schematically) in (23). However, the standard mechanisms assumed to be available to CR do not obviously allow (23) to be an LF of (7a)/(13a). Let us elaborate more on that matter.

(23) [*Raising predicate* [[. . .] [{or/and$_{CR}$} [. . .]]]]

3.1. Right node raising?

Usually, in discussing conjunction reduction, the focus is on coordinated DPs in object position. However, all of our examples have coordination in the subject position. It is independently hard to deal with subject coordination in a way compatible with the theories of ellipsis. To illustrate this, consider again the CR derivations of (7a) and (13a), repeated here as (24) and (25), respectively.

(24) [Gali ~~be unlikely to go to the party~~] [and$_{CR}$ [Tali are unlikely to go to the party]]

(25) [[Gali ~~be allowed to go to the party~~] or$_{CR}$ [Tali are allowed to go to the party]]

These structures not only have the unintended meanings, as we mentioned above, they are also ill-formed for an independent syntactic reason. In all these cases, the Backward Anaphora Constraint (BAC) is violated, which intends to block ellipsis from applying to an element that precedes its antecedent in a coordinate structure (Langacker, 1969: 171).

For cases where there seems to be an operation of backward deletion (particularly in verb-final languages like Japanese), it was suggested that a different operation than standard ellipsis takes place: Right Node Raising (Hankamer, 1979: 103-123). Hirsch (2017) utilizes this operation to derive *subject* DP coordination, as the one in (26a). He assumes that the underlying structure of such coordinations would be TP coordination, as in (26b). In order to get the surface structure, he then suggests that RNR takes place, by which the rightmost shared material may be pronounced once at the end of the sentence, as seen in (26c).

(26) Derivation of subject DP coordination in CR:
  a. Every student and every professor came.
  b. [$_{\&P}$ [$_{TP}$ every student [$_{VP}$ came]] [and$_{CR}$ [$_{TP}$ every professor [$_{VP}$ came]]]]
  c. [[$_{\&P}$ [$_{TP}$ every student t_1] [and$_{CR}$ [$_{TP}$ every professor t_1]]] [$_{VP}$ came]$_1$]

As Hirsch points out, there is no consensus regarding what the syntax of RNR involves, so we will remain vague about the details as well - whatever mechanism is available for (26) should also be able to apply in our examples. Unfortunately, simply transferring RNR to the derivation of (7a)/(13a) would not yield the required readings. Consider again the conjunction example in (7a). Although we can derive the correct surface form through RNR movement, as in (27b), because at LF, represented here in (27a), *unlikely* does not scope over the conjunction, there is a violation of the scope condition we need for deriving the intended reading.

(27) a. Possible CR underlying structure of (15a):
[$_{\&P}$ [$_{TP}$ Gali [allowed to go to the party]] [or$_{CR}$ [$_{TP}$ Tali [allowed to go to the party]]]]
b. RNR to get surface form:
[[$_{\&P}$ [$_{TP}$ Gali t_1] [or$_{CR}$ [$_{TP}$ Tali t_1]]] [allowed to go to the party]$_1$]

But let's assume that the raising predicate, *unlikely*, originates above the conjunction and not below it, as in (28a) – this LF is the one required to get the intended meaning. Now, in order to get the surface form, the verb phrase RNRs out of each conjunct, as in (28b-i), and finally, the remaining clause that now contains overtly only *Gali and Tali* raises to the subject position (28b-ii).

(28) a. Required CR underlying structure of (15a):
[unlikely [[[Gali to go to the party] [and$_{CR}$ [Tali to go to the party]]]]]
b. Movement to surface form:
(i) RNR:
[unlikely [[[Gali t_1] [and$_{CR}$ [Tali t_1]]][to go to the party]$_1$]]
(ii) Remnant movement:
[[[Gali t_1] [and$_{CR}$ [Tali t_1]]]$_2$ [are unlikely [t_2 [to go to the party]$_1$]]]

This derivation is problematic for several reasons. For example, this account makes at least one false prediction: the subject of the structure is a clause, and, hence, we should find singular agreement on the verb. However, the original sentence crucially requires plural agreement. Something else is needed.[6]

3.2. Predicate movement?

Another logical possibility is that the raising predicate originates inside each clause and moves across-the-board at LF (cf. Simons, 2005; Meyer and Sauerland, 2017). Take the disjunction example from (13a). Its CR base structure is provided in (29a). Now, we assume that *allowed* can move out of both disjuncts, as represented in the LF in (29b). This LF can yield the free choice reading as all that is needed is strengthening.

(29) a. Base structure:
[[Gali [allowed to go to the party]] [or$_{CR}$ [Tali [allowed to go to the party]]]]
b. Covert movement of the modal:
[allowed$_1$ [[Gali [t_1 go to the party]] [or$_{CR}$ [Tali [t_1 go to the party]]]]]

However, we face again a number of problems. In particular, Meyer and Sauerland (2017) note that overt full clausal coordination with predicates like *allowed*, i.e., the overt counterpart of (29a), lacks the FC reading we derive here (see, e.g., Zimmermann, 2000; Geurts, 2005, for a different type of wide-scope disjunction examples). One puzzling question that arises from this observation is why should the described covert across-the-board movement require CR ellipsis.

[6]The failure of RNR can be presented for the disjunction case in (13a), too. However, as McCawley (1998: p. 301) already observed, among others, *or* can trigger singular agreement as well as plural agreement. Thus, we chose to highlight the issue in the conjunction case alone.

Moreover, if we can move the predicate so that it outscopes the disjunction, we are likely to overgenerate. To see this, consider (30a), where we added the modifier exactly twice to the original sentence. Allowing for the predicate to move should make it possible for the sentence to convey (30b), which is not the case; we only get the meaning paraphrased in (30c) (cf. Gotzner et al., 2020 for the derivation of FC interpretations in non-monotone environments).

(30) a. Gali or Tali have been exactly twice allowed to go to a party.
b. (It's allowed that Gali goes to a party exactly twice) and (it's allowed that Tali goes to a party exactly twice)
c. Exactly twice was it the case that (Gali was allowed to go to a party) and (Tali was allowed to go to a party)

Once again, something else is needed.

3.3. Clausal nominals?

Finally, the CR approach may allow for coordination of proper names if these are underlyingly clausal nominal (cf. e.g., Stowell, 1981; Heim and Kratzer, 1998, for such an analysis of nominals outside the context of coordination). Consider the structures in (31)/(32) for the sentences in (7a)/(13a), respectively, where the subject of the clauses, variable x, is a PRO that is abstracted over. These structures yield the desired readings.[7]

(31) [unlikely [[$\exists$ [λx [$x \geq$ Gali and$_{\text{CR}}$ $x \geq$ Tali]]] go to the party]]

(32) [allow [[$\exists$ [λx [$x \geq$ Gali or$_{\text{CR}}$ $x \geq$ Tali]]] go to the party]]

While this route is *prima facie* promising, free choice readings and reconstructed conjunction readings are also possible with coordinations of full quantificational DPs. Two examples are in (33)/(34), which have the reconstructed conjunction and free choice readings, respectively.

(33) Most professors and all lecturers are unlikely to go to the party.
$\Rightarrow \neg\ell$ (most professors go to the party $\wedge$ all lecturers go to the party)

(34) Most professors or all lecturers are allowed to go to the party.
$\Rightarrow$ ($\Diamond$ most professors go to the party) $\wedge$ ($\Diamond$ all lecturers go to the party)

These examples resist even the extended CR analysis that we sketched in (31)/(31), since an analogous clausal analysis of quantifiers would require yet further mechanisms, which we will not explore here.

4. Conclusion

We have presented a new family of observations that are, on the face of it, not compatible with a coordination reduction approach. The observations and the arguments capitalize on the

[7] We take $\geq$ to be a primitive parthood relation. For more details see, e.g., Champollion and Krifka (2016).

ability of DP coordination to reconstruct in raising constructions.[8] Crucially, the observations we described cannot be captured if each junct of a coordination reconstructs separately — rather, the coordinator itself (hence, the full coordination phrase) must reconstruct. This can, of course, be easily accounted for on a flexibility approach to coordination. It goes without saying that a wealth of other data must be explained on an adequate theory of coordination, none of which we could attend to here (see, e.g., Schmitt, 2013; Hirsch, 2017; Schein, 2017; Champollion, 2016, for some recent advances).

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[8]We focused only on two combinations of coordinators and embedding predicates: conjunction + a downward-entailing predicate (*unlikely*), and disjunction + an upward-entailing predicate (*allowed*). Our reasoning extends to various other combinations that we set aside for brevity. We also skipped the discussion of how adverbial modification in coordinated phrases, which is often taken to argue for coordination reduction (e.g. Schein, 2017; Hirsch, 2017), affects the availability of the reconstructed readings – on the face of it, it seems not to affect it.

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Individuation criteria and copredication: modification in context[1]

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Abstract. When instances of copredication (e.g., *damaged, insightful book*) are combined with quantification such as that provided by numerals (e.g., *three damaged, insightful books*), it has been argued that the result is a *double-distinctness* interpretation. For instance, 'three damaged insightful books, each of which are physically distinct and informationally distinct from the others' (see, e.g, Gotham, 2017; Chatzikyriakidis and Luo, 2018). However, doubt has been cast on this view by Liebesman and Magidor (2017, 2019), who provide examples where the double distinctness reading does not arise. The challenge that is taken up in this paper is to explain, in a systematic way, why quantified copredication constructions seem to have double-distinctness interpretations in simple and/or minimal contexts, and also why and on what basis these can be overridden in more elaborate contexts.

Keywords: countability, copredication, mereology, polysemy, Type Theory with Records.

1. Introduction

Polysemous nouns such as *book* and *lunch* have multiple interrelated senses across domains typically assumed to be distinct. For instance, *lunch* can denote an EVevtuality as in (1a), or a PHYSical entity as in (1b), and *book* can denote a PHYSical entity as in (2a), or an INFormational entity as in (2b), and the domains for physical things, eventualities, and informational entities (e.g., propositions), are typically considered to be distinct, as encoded, for instance, in assumptions about entities in these domains being of distinct semantic types, viz., e, v, and $\langle s,t\rangle$. In addition, such nouns can license copredication as in (1c), based on Asher and Pustejovsky, 2006, and (2c).

(1) a. Lunch lasted two hours. (EV)
b. Lunch was delicious. (PHYS)
c. Lunch lasted two hours and was delicious. (EV, PHYS)

(2) a. That book is too big for the shelf. (PHYS)
b. That book is insightful. (INF)
c. That book is insightful, but too big for the shelf. (INF, PHYS)

When quantification and plurality are combined with copredication, it has been argued that this necessitates so-called *double distinctness* readings (Gotham, 2014, 2017, 2021). For instance, sentences such as (3) are assumed to require that the three books are not only physically distinct, but also informationally distinct (no duplicate copies), which, if true, demands a compositional analysis such as those provided by Gotham (2017) and Chatzikyriakidis and Luo (2018).[2]

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[2]Some reports in the literature are that constructions such as *two insightful books* can be used to refer to, say,

(3) Alex bought three insightful, thick books.

However, in recent work stemming from the philosophical metaphysics literature, it has been denied that double-distinctness readings are semantically derived (Liebesman and Magidor, 2017, 2019), given that in some cases, quantified copredication does not seem to require double distinctness. For instance that, in the right context, *Three informative books are heavy* can mean that, of some contextually salient pile of informative books, three of them are heavy (even if this includes duplicate copies). Gotham (2021) responds by arguing that such constructions have a strict reading that requires double distinctness, and a looser (pragmatic halo) reading in which such readings can be pragmatically cancelled. In essence, the debate can be summarised as whether we need a semantics to derive double distinctness readings, and a theory of pragmatic weakening to account for counter-instances, or whether all double-distinctness readings are pragmatically derived. In either case, however, we have a theoretical challenge, which can be formulated as the main question that concerns this paper:

Main Question: What mechanisms, semantic or pragmatic, underpin when double-distinctness readings arise, and when they do not?

My proposal is to balance a combination of semantic factors (what is lexically encoded), with more general pragmatic factors (reasoning about plausible readings in context). Semantically, I make use of Gotham's insights into the way that modifiers such as *thick* and *informative* as well as verbal predicates such as *memorise* can affect the way common nouns are individuated. However, rather than hard-coding this in the semantics of modifiers, I instead propose that they constrain the contexts via which the domains and individuation criteria of common nouns can be restricted. In a nutshell, I propose that polysemous common nouns lexically introduce a question under discussion (QUD, see e.g., Ginzburg, 2012; Roberts, 2012). For instance, *book* introduces a QUD that can be paraphrased as *How are we individuating books, as informational entities, physical entities, or both?*. The possible answers to this QUD can be characterised in terms of properties that restrict the individuation conditions of the polysemous noun. These properties compete, as updates to the contextual domain restriction of the common noun, with properties that are (partial) answers to any contextually specified QUDs such as *Which contextually salient pile of books is being referred to?*. Given that one QUD can be higher on the 'stack' than the other, meaning that it has priority when it comes to being answered, the contribution of modifiers can depend on which QUD is being addressed (first). Modifiers and verbal predicates constrain, in a systematic way, the available answers to these questions. The account makes the following predictions, all of which, I argue, are borne out:

Prediction 1: Double distinctness readings arise for quantified copredication utterances in neutral contexts.

Prediction 2: Double distinctness readings do not arise when there is a more prominent QUD where the use of at least one modifier in the utterance provides a (partial) answer to this QUD.

Prediction 3: Adding extra modifiers can restrict readings further, such that double distinctness readings can reemerge, depending on the restrictions introduced by the additional modifiers.

two informationally distinct books in a multi-work volume (Asher, 2011; Gotham, 2014). I tend to side with Chatzikyriakidis and Luo (2018) in finding this reading at the very least highly contextually restricted.

This paper is structured as follows. In section 2, I introduce the main data and and my hypotheses. In section 3, I give a high-level summary of the analysis in informal terms. Section 4 constitutes the majority of this paper. I briefly introduce a version of a richly typed semantic theory, Type Theory with Records (TTR, Cooper, 2012, 2023), and define a family of types of properties that will be needed to articulate my account: properties of physical entities, informational entities and eventualities. Then, building on Cooper (2023), I provide a simplified notion of Kaplanian contexts such that common nouns denote characters, functions from contexts to properties. I define an extra parameter for these contexts that governs nominal contextual domain restriction in the spirit of the indexical account of Stanley and Gendler Szabó (2000) and Stanley (2002), and also include in lexical entries for common nouns a counting base (cb) field that, in this paper, governs the individuation criteria of the noun relative to a context (for related notions, see, Rothstein, 2010; Landman, 2011, 2016; Sutton and Filip, 2019, 2020; Gotham, 2017; Chatzikyriakidis and Luo, 2018). My analysis of modifiers follows in which modifiers can constrain choices of answers to QUDs, either in referential terms (*Which of the salient sets of books matters for this utterance?*) or in terms of individuation, prompted by the fact that polysemous common nouns underspecify their individuation criteria (*How are we individuating books?*). Finally, I show that this approach derives the above predictions. I conclude in section 5.

2. Data and hypotheses

2.1. Main data

The main question addressed in this paper are the admissible interpretations of sentences like (4). Gotham (2014, 2017, 2021) judges that the only reading, at least strictly speaking, for such constructions is the *double distinctness* reading, which, in this case is that there are (at least) three physically distinct books that are each damaged and the contents of each is insightful such that there are no duplicate copies (each have a different contents).

(4) Three insightful books are damaged.

However, Liebesman and Magidor (2017, 2019) argue that the double distinctness reading is only one reading, and, in context, weaker readings are available. For instance, the context in (5):[3]

(5) Librarians Alex and Billie are looking for insightful books to put in a prominent display to recommend to readers. Billie sorts the books into piles potentially for the display and

[3]The examples I use are adjusted from the one in the literature, which uses *heavy*, and *informative*. Given that *heavy* can also refer to the contents of a book (as in *heavy going*, and *informative* can be slightly awkward as a modifier of *book*, I opt for alternative modifiers. Indeed, in searching for examples to test for double distinctness readings, it is important to control for whether modifiers can themselves be polysemous. A clear example is with the abstract noun *statement*, that can be used to denote stating eventualities and the informational contents stated. (It also has a reading in which it denotes physical artefacts such as written statements, which I set aside here.) Prima facie, one might think that *defamatory* at least suggests an informational entity reading, however (i) also has a reading in which Ronald says the same thing on different occasions, but defames someone twice.

(i) Ronald made two short defamatory statements during the trial.

those that would not be suitable. Alex examines the books in the display pile and says (4) to Billie.

In such contexts, the intuition is that (4) could be true even if there are duplicate books (e.g., three copies of the same insightful book). Liebesman and Magidor (2017) rightly, in my view, suggest that the reading here relates to contextual domain restriction. In this case, *insightful* can serve as a modifier that restricts the domain of quantification to those books that Billie pulled down from other shelves in the library, and seemingly does not require that they are informationally distinct from one another.

The example and context presented closely follow the exchange between Liebesman and Magidor and Gotham. However, on closer inspection, the data are more slippery and complex in at least two ways that have not, to my knowledge, been discussed in the literature. First, word order and structure matter. In the context given in (5), (6) does not so easily get the domain restriction reading (if it does at all).

(6) Three damaged books are insightful.

Furthermore, similar examples can be given with both of the modifiers in attributive position. Were Alex to instead say (7), this would seem to behave the same as (4) with respect to use on its own and also in the context given in (5).

(7) There are three damaged, insightful books.

However, reversing the order as in (8) or introducing a coordinated conjunction as in (9), again, seems to make the reading where *insightful* restricts *book* to some set of insightful books in the context less available.

(8) There are three insightful, damaged books.

(9) There are three damaged and insightful books.

At the very least this suggests the need for a dynamic approach that is sensitive to compositional structure such that contextual domain restriction, for instance, can be resolved or at least updated sub-sententially.

Second, additional modifiers can reinstate the double distinctness reading relative to the context in (5). For instance, (10) only has the double distinctness reading, since, if the two books are duplicates, Alex would not have memorised the first page of two books. That is to say that even if *insightful* can serve, not to individuate books by their distinct contents, but as a contributor to fixing a restricted domain for quantification, then additional modifier that concerns the informational contents of books such as *memorised* can re-introduce an informational distinctness requirement.

(10) I memorised the first page of three damaged, insightful books.

Notably, it matters that the extra modifier (*memorised*) concerns the informational contents of the books, for if we minimally adjust the example as in (11), where we now have additional physically relevant information, then the double distinctness reading is no longer the only one.

(11) I tore out the first page of three damaged, insightful books.

2.2. Hypotheses

I propose the following three hypotheses that can explain these effects. I assume that there can be multiple QUDs in a discourse context that are ordered such that the most pressing question to be addressed is 'on top of the stack' (see, e.g., Roberts, 2012; Ginzburg, 2012: and references therein).

> **Common nouns underspecify their contextual domains:** Stanley and Gendler Szabó (2000) and Stanley (2002) analyse contextual nominal domain restriction in terms of indexicality. This means that when someone uses a common noun, N, one must determine whether there is some salient contextual parameter that restricts the extension of N. The choice of contextual domain restriction can be constrained by the QUD at the top of the stack.
>
> **Priority for QUDs first in the stack:** By default, the information in an utterance will be used to select a contextual nominal restriction for the relevant noun that (at least partially) addresses the QUD at the top of the stack. Only information in the utterance not relevant to this QUD may then be used to select a contextual restriction on the noun that (at least partially) addresses QUDs lower in the stack.
>
> **Polysemous common nouns lexically introduce an additional QUD:** When someone uses a polysemous noun, N, I propose that this introduces a QUD into the conversation along the lines of *How are we individuating Ns?* For instance, a use of *book* introduces a question: *Are we individuating books in terms of physical entities, contents, or both?*

More generally, I also assume the following condition on grammatical counting: Counting in natural languages requires identifying a quantized set of entities relative to the context (e.g., Sutton and Filip, 2020, see also Krifka, 1989). For instance, if Alex has read one volume containing *The Trial* and *The Metamorphosis* and Billie has read a single volume copy of *The Trial* and a single volume copy of *The Metamorphosis*, then relative to the informational reading of *book* they have read two books, and relative to he physical copy reading, they have read three books.

3. Analysis: informal summary

An informal analysis of the above examples with *books* runs as follows.

Deriving prediction 1: First suppose that someone utters (4), or, for that matter, (7), in a neutral context where there are no salient groups of books sorted by being insightful/not-insightful or damaged/not-damaged in the context, and neither *insightful* nor *damaged* address any overarching QUD. In this case, both *insightful* and *damaged* constrain the answer to the lexically introduced QUD (*How are we individuating books?*). The result is the double distinctness interpretation.

Deriving prediction 2: While Alex and Billie are engaged in their book search, presumably the most pressing (and top of the stack) QUD in this context is *Which books shall we put on the dis-*

play? Subquestions involved in making this decision include: *Which books are insightful?* and *Which books would look good on the display?* When Alex utters (4) while examining the piles of books Billies has made, the *Common nouns underspecify their contextual domains* assumption attaches to Alex's use of *book(s)*. In this context, both the pile of books considered insightful and the pile of books not considered insightful are salient. Since the lexically introduced QUD is lower in the stack, *insightful* does not partially answer the lexically introduced QUD (*How are we individuating books?*). Instead, Alex's use of the modifier *insightful* contributes to restricting the domain of quantification to those books in the insightful pile and, in so-doing, addresses one subquestion of the main QUD. The use of *damaged* does not straightforwardly select a salient group of books in the wider context and so alternative nominal restriction property can be employed. One such is that introduced as an answer to the QUD lexically introduced by *book*: books that are being individuated in terms of physical distinctness, or in terms of both physical and informational distinctness. In other words, *informative* constrains which salient pile of books is being referred to, and *damaged* constrains how books are being individuated. The plausible reading of (4) is therefore: *Of the books we are considering informative, three physically distinct copies of them are damaged.* This allows for informational duplicates, in line with the reported intuitions about such cases.

Deriving prediction 3: If Alex utters (10) instead of (4) in context (5), two informationally relevant modifiers are used: *memorise* and *insightful*. Of these only the latter is relevant to the QUD set up by the context, and so *three damaged insightful books* gets the same reading as (4) does in the context: that three of the books in the insightful pile are damaged. I.e., *book* is individuated in terms of physical distinctness or both physical and informational distinctness. The use of *memorise* then further restricts this to the latter reading. Since *memorised the first page of* is not relevant to the main QUD (*Which books would look good on the display?*), this instead addresses the lexically introduced QUD (*How are we individuating books?*) and thereby restricts the individuation conditions of *three damaged insightful books* to ones that are also informationally distinct. I.e., we get the double distinctness interpretation.

If Alex utters (11) instead of (4) in context (5), again *three damaged insightful books* gets the same interpretation as in the original case. I.e., *book* is individuated in terms of physical distinctness or both physical and informational distinctness. Now, however, instead of *memorise*, Alex has used *tear out (a page from)*. Although providing extra information about what Alex does to these books, *tear out* does not further restrict the individuation criteria of *book* and so the double distinctness interpretation is not enforced.

4. Formal Analysis

4.1. Formal background: From simple type theory to a rich theory of types

Data such as (1) and (2) are taken to indicate that polysemous nouns denote not just one sense or the other in any given context, but can also denote both (see, e.g., Collins, 2017). Given this distinctness of domains and types, polysemy and copredication are a challenge for semantic theories built upon the simply typed λ-calculus. For instance, in (12), assuming that types e and v have disjoint domains, there is no type τ (the type for variable x) definable in the

simply typed λ-calculus that can apply to entities of type *e* and/or of type *v*, since the only type constructor in the simply typed λ-calculus forms functional types. (See, e.g., Chomsky, 2000 for informal remarks to this effect and, e.g., Pustejovsky, 1994; Asher and Pustejovsky, 2006; Asher, 2011, amongst many others for a discussion of the technical challenges involved.)

(12) $[\![\text{lunch}]\!] = \lambda w.\lambda x_{\tau}\texttt{lunch}(w)(x)$ $\leftarrow$ No type τ that subsumes *e* and/or *v*!

In short, polysemy and copredication provide a challenge for any formal semantics based upon the simply typed λ-calculus in which the referents of polysemous common nouns are entities in discrete domains. For instance, eventualities and physical entities for *lunch* and *informational entities* and physical entities for *book*.[4]

The analysis I put forward follows in the tradition of responding to this challenge with the adoption of a semantics built upon a theory of types that is richer than the simply typed λ-calculus, namely Rich Type Theories (RTTs), examples of which include Ranta's seminal work (Ranta, 1994), Modern Type Theories (MTT, Chatzikyriakidis and Luo, 2020), and Type Theory with Records (TTR, Cooper, 2012, 2023). (See Sutton, 2024 for an overview.) RTTs deviate from simple type theories (STTs) in two key respects:

(13) a. Types are part of the object language, not just metalanguage annotations on object language expressions.
b. Propositions are types.

The assumption of (13a) has a major impact on compositional semantics. In model theoretic semantics built upon STTs, natural language expressions are mapped to typed (basic or complex) expressions in the λ-calculus, and complex expressions are constructed compositionally, where these expressions have a set theoretic interpretation relative to a model. In RTTs, one assumes that natural language expressions are interpreted as types (basic or complex), and formal semantics relates to constructing types. Via composition, types can be arbitrarily complex, and the interpretations of declarative sentences are also thereby types. In compositionally deriving the interpretation of e.g., (utterances of) two distinct declarative sentences, we may end up with two types that share some super type (e.g., a type of situations or events), but are distinguishable not only in terms of what situations/events are of this type, but also in terms of their structure (and the way they were constructed). For instance, if *lunch_was_delicious* and *lunch_lasted_two_hours* are types, they will differ not only with respect to what situations are of this type, but also with respect to the types that they are. We thus have, not only a justification for (13b), but also a fine-grained conception of intensionality.

4.2. Type Theory with Records (TTR)

The richly typed semantics I use is Type Theory with Records (TTR, e.g., Cooper, 2012, 2023). TTR distinguishes between *records* (that model situations), and *record types*, where, for some record type T, and record r, it is either the case or not that $r : T$. For example, the record in (14) represents a situation that contains an individual a and some piece of the world/potential truth-

[4] I will use the broad term *informational entity* to include e.g., the denotations of CPs, the contents of books etc. I use the term *physical entity* to refer both to objects or animate individuals such as balls and cats and stuff such as air and oil.

maker s_{37}. Such entities are *values* in record. These values are labelled x and c_{cat} respectively. Labels are used in TTR similarly to discourse referent labels in DRT (e.g., Kamp and Reyle, 1993). Labels can be used to access/pick out values.

(14) $$\begin{bmatrix} \text{x} & = & a \\ \text{c}_{\text{cat}} & = & s_{37} \end{bmatrix}$$

The frame in (15) is a *Record Type*. Record types are used in TTR as the interpretations of e.g., declarative sentences (propositions as types). The proposition in (15) is that the value of the label x is of type *Phys* (for physical entity), and that the bit of the world labelled c_{cat} is of the type $\text{cat}(x)$. $\text{cat}(x)$ is an abbreviated form of $\langle \lambda v : Phys(\text{cat}(v)), \langle \text{x} \rangle \rangle$, a type constructor that takes the value of label x, and, if that value is of type *Phys*, returns the type of situation in which the value of x is a cat. In other words, the proposition that there is some cat.

(15) $$\begin{bmatrix} \text{x} & : & Phys \\ \text{c}_{\text{cat}} & : & \text{cat}(\text{x}) \end{bmatrix}$$

The record in (14) is of the type in (15) iff $a : Phys$ and s_{37} is of type $\text{cat}(a)$.

Setting contexts aside for a moment, common nouns in TTR can interpreted as functions from records to record types, i.e. as *properties*.[5] (As shall be outlined below, following Cooper (2023), here common nouns will be analysed as functions from contexts to properties.) As a simplified example:

(16) $$\lambda r : [\text{x} : Phys]. \left[\text{c}_{\text{cat}} \ : \ \text{cat}(r.\text{x}) \right]$$

This function applies to any record that witnesses (i.e. contains) a physical entity, and returns the proposition that that entity is a cat. $r.\text{x}$ specifies a path that retrieves the value of the label x in r. The type $\text{cat}(r.\text{x})$ is therefore a dependent type: the type it is depends on the value of x in r. Were we to apply the record in (15) to the function in (16), this would yield the following proposition, that a is a cat:

(17) $$\left[\text{c}_{\text{cat}} \ : \ \text{cat}(a) \right]$$

4.3. Properties for polysemous nouns in TTR

Modelling polysemous nouns in TTR will require describing situations that contain not just physical entities, but also eventualities and informational entities. This requires a bit of housekeeping in defining types. I will use the labels x, i and e for *Phys*, *Inf*, and *Ev*, respectively. In order to define types of properties of entities of entities of types *Phys*, *Inf*, and *Ev*, I define the types *PhysType*, *InfType* and *EvType* ($\sqsubseteq$ is the subtype relation):

(18) $T : PhysType$ iff $T \sqsubseteq [\text{x} : Phys]$

(19) $T : EvType$ iff $T \sqsubseteq [\text{e} : Ev]$

(20) $T : InfType$ iff $T \sqsubseteq [\text{i} : Inf]$

[5] Properties in simply typed semantics are usually of type $\langle s, \langle e, t \rangle \rangle$. Since record types in TTR are anyway intensional, properties are treated as functions from records to record types.

For example, the type in (15) is of type *PhysType*, because it is a subtype of type [x : *Phys*]. Since I am assuming that Ns and NPs can, minimally, be used to refer to entities of types *Phys*, *Inf*, and *Ev*, it will be convenient to define a type that is a subtype of either [x : *Phys*], [e : *Ev*], or [i : *Inf*].

(21) $T : \mathit{OntType}$ iff $T : \mathit{PhysType} \vee \mathit{EvType} \vee \mathit{InfType}$

These types of properties are given in (22a), (23a), and (24a), instances of properties of these types are given in (22b), (23b), and (24b), and the abbreviated notation is given in (22c), (23c), and (24c) such that (22-b,c): *PhysPpty*, (23-b,c): *EvPpty*, and (24-b,c): *InfPpty*. Similarly to (Cooper, 2023), I will use a notational convention for properties using $\ulcorner \ldots \urcorner$. For example, (22c) is a notational abbreviation of (22b). Notice that we are now representing properties as records with labels 'background' (bg) and 'foreground' (fg). The background allows us to access the type of the argument of the property and the foreground is the property as defined above.

(22) a. $\mathit{PhysPpty} := \begin{bmatrix} \mathrm{bg} & : & \mathit{PhysType} \\ \mathrm{fg} & : & (\mathrm{bg} \rightarrow \mathit{RecType}) \end{bmatrix}$

b. $\begin{bmatrix} \mathrm{bg} & = & [\mathrm{x} : \mathit{Phys}] \\ \mathrm{fg} & = & \lambda r : [\mathrm{x} : \mathit{Phys}].[\mathrm{c}_{\mathrm{cat}} : \mathrm{cat}(r.\mathrm{x})] \end{bmatrix}$

c. $\ulcorner \lambda r : [\mathrm{x} : \mathit{Phys}].[\mathrm{c}_{\mathrm{cat}} : \mathrm{cat}(r.\mathrm{x})] \urcorner$

(23) a. $\mathit{EvPpty} := \begin{bmatrix} \mathrm{bg} & : & \mathit{EvType} \\ \mathrm{fg} & : & (\mathrm{bg} \rightarrow \mathit{RecType}) \end{bmatrix}$

b. $\begin{bmatrix} \mathrm{bg} & = & [\mathrm{e} : \mathit{Ev}] \\ \mathrm{fg} & = & \lambda r : [\mathrm{e} : \mathit{Ev}].[\mathrm{c}_{\mathrm{eat}} : \mathrm{eat}(r.\mathrm{e})] \end{bmatrix}$

c. $\ulcorner \lambda r : [\mathrm{e} : \mathit{Ev}].[\mathrm{c}_{\mathrm{eat}} : \mathrm{eat}(r.\mathrm{e})] \urcorner$

(24) a. $\mathit{InfPpty} := \begin{bmatrix} \mathrm{bg} & : & \mathit{InfType} \\ \mathrm{fg} & : & (\mathrm{bg} \rightarrow \mathit{RecType}) \end{bmatrix}$

b. $\begin{bmatrix} \mathrm{bg} & = & [\mathrm{i} : \mathit{Inf}] \\ \mathrm{fg} & = & \lambda r : [\mathrm{i} : \mathit{Inf}].[\mathrm{c}_{\mathrm{inf}} : \mathrm{information}(r.\mathrm{i})] \end{bmatrix}$

c. $\ulcorner \lambda r : [\mathrm{i} : \mathit{Inf}].[\mathrm{c}_{\mathrm{inf}} : \mathrm{information}(r.\mathrm{i})] \urcorner$

The advantage of this approach is that, via the label bg, one can access and thereby modify the restriction on the argument for any property.

Following (Sutton, 2022), we can now give a first-pass lexical entry for the polysemous noun *book*:

(25) $[\![\mathrm{book}_{\text{first pass}}]\!] = \ulcorner \lambda r : \begin{bmatrix} \mathrm{x} & : & \mathit{Phys} \\ \mathrm{i} & : & \mathit{Inf} \end{bmatrix} . \begin{bmatrix} \mathrm{c}_{\mathrm{pbook}} & : & \mathrm{phys\_book}(r.\mathrm{x}) \\ \mathrm{c}_{\mathrm{ibook}} & : & \mathrm{inf\_book}(r.\mathrm{i}) \\ \mathrm{c}_{\mathrm{theme}} & : & \mathrm{contains}(r.\mathrm{x}, r.\mathrm{i}) \end{bmatrix} \urcorner$

On this analysis, *book* denotes a property of situations that contain both a physical and an informational entity. Applied to such a situation, it returns the proposition that the physical

entity is a physical book, the informational entity is an informational book, and the latter is the contents of the former.[6,7]

4.4. Contextual domain restriction for common nouns

Following, e.g., Stanley and Gendler Szabó (2000) and Stanley (2002), I will treat contextual domain restriction for common nouns as a feature of the lexical entries of common nouns. Namely, that nouns denote functions from contexts to properties. As an example, *every cat*, in context, may be used to mean *every cat in my garden*. Following Cooper (2023), contexts are treated as records (i.e., situations) of some type. For the purposes of this paper, I use a somewhat simpler notion of context than Cooper (2023). For instance, a context, c_{654} that only specifies the speaker as a and the addressee as b would be:

(26) a. $c_{654} = \begin{bmatrix} \text{sp} & = & a \\ \text{ad} & = & b \end{bmatrix}$

b. $c_{654} : \begin{bmatrix} \text{sp} & : & \mathit{Phys} \\ \text{ad} & : & \mathit{Phys} \end{bmatrix}$

I will treat contexts as containing these fields, plus one extra field labelled *domr*. This field will contain a property, namely an salient property that can intersect with the denotation of a noun yielding a contextual domain restriction. The type in (27b) is of type *CntxtType*.

(27) a. $c_{247} = \begin{bmatrix} \text{sp} & = & a \\ \text{ad} & = & b \\ \text{domr} & = & \ulcorner \lambda r : [\text{x} : \mathit{Phys}].[\text{c}_{\text{ingar}} : \text{in\_garden\_of}(\text{sp}, r.\text{x})] \urcorner \end{bmatrix}$

b. $c_{247} : \begin{bmatrix} \text{sp} & : & \mathit{Phys} \\ \text{ad} & : & \mathit{Phys} \\ \text{domr} & : & \mathit{PhysPpty} \end{bmatrix}$

We can use this contextually available property to model the above assumption that *Common nouns underspecify their contextual domains*. That is to say that we can define characters in the sense of Kaplan (1989). Character types have an additional field for the context type compared to property types and the foreground (fg) is a function from contexts of some type to a property. For example, for characters of physical entities (mapping to properties of physical things):

(28) a. $\mathit{PhysChar} := \begin{bmatrix} \text{cx} & : & \mathit{CntxtType} \\ \text{bg} & : & \mathit{PhysType} \\ \text{fg} & : & (\text{cx} \rightarrow (\text{bg} \rightarrow \mathit{RecType})) \end{bmatrix}$

[6] I am somewhat sceptical about claims in the literature that something can be a book without a contents or that something can be a book without *any* physical manifestation. Of course, we can quantify over, say, informational books, and leave underspecified how, exactly, they are physically manifested.

[7] In (Sutton, 2022), I also claim that neo-Davidsonian-like relations such as *contents*, *theme* etc. license copredication. For instance, this is used to explain why *five-minute, two-page statement* is marked out of context, since the semantics of *statement* does not specify a relation between physical statements and stating eventualities, but only between stating eventualities and informational contents and between physical statements and informational contents.

b. $$\left[\begin{array}{lcl} \text{cx} & = & \left[\begin{array}{lcl}\text{domr} & : & \textit{PhysPpty}\end{array}\right] \\ \text{bg} & = & [\text{x} : \textit{Phys}] \\ \text{fg} & = & \lambda c : [\text{domr} : \textit{PhysPpty}].\lambda r : [\text{x} : \textit{Phys}].[\text{c}_{\text{cat}} : \text{cat}(r.\text{x})] \wedge c.\text{domr}(r)\end{array}\right]$$

c. $$\ulcorner \lambda c : [\text{domr} : \textit{PhysPpty}].\lambda r : [\text{x} : \textit{Phys}].[\text{c}_{\text{cat}} : \text{cat}(r.\text{x})] \dot{\wedge} c.\text{domr}(r) \urcorner$$

In (28c), we have a function from contexts to a property of situations containing a physical entity, where this physical entity is a cat. However, if the some other property is salient in the context (e.g., that of being in the garden of the speaker), then the use of *cat* in this context can be contextually restricted to only pick out any cat that is in the speaker's garden.

4.5. Counting bases for common nouns

Finally, following, e.g., Rothstein (2010), Landman (2011, 2016), Sutton and Filip (2019, 2020), Gotham (2017), and Chatzikyriakidis and Luo (2018), we also assume that common nouns record their individuation conditions. The field specifying these conditions is labelled 'cb' for *counting base*.[8]

For a polysemous noun such as *book*, I assume that the counting base property is underspecified with respect to being a physical property, and informational property, or both. This underspecification models the assumption above that *polysemous common nouns lexically introduce an additional QUD*.

We can now give a final lexical entry for *book*: it is a function from contexts to a property of situations containing physical and informational entities. This property can be contextually restricted and it underspecifies the basis for counting (i.e. whether we are counting informational books, physical books, or pairs of informational and physical books).

(29) $$[\![\text{book}_{\text{final}}]\!] = \ulcorner \lambda c : [\text{domr} : \textit{PhysPpty} \vee \textit{InfPpty}]. \lambda r : \left[\begin{array}{lcl}\text{x} & : & \textit{Phys} \\ \text{i} & : & \textit{Inf}\end{array}\right]. \left[\begin{array}{lcl}\text{c}_{\text{pbook}} & : & \text{phys\_book}(r.\text{x}) \\ \text{c}_{\text{ibook}} & : & \text{inf\_book}(r.\text{i}) \\ \text{c}_{\text{theme}} & : & \text{contains}(r.\text{x}, r.\text{i}) \\ \text{cb} & : & \textit{PhysPpty} \vee \textit{InfPpty}\end{array}\right] \dot{\wedge} c.\text{domr}(r) \urcorner$$

Although I will not formally encode my mereological assumptions here (however see, e.g., Sutton and Filip, 2017, 2019, 2020), I also assume that the counting base property is restricted to be a property of situations that contain only a quantized set of the relevant individuals (i.e. no individuals that stand in proper part relations to one another):

(30) a. If the counting base property is of type *PhysPpty*, then records of this type may only specify a quantized set of physical entities.

[8]Unlike the literature on the mass/count distinction, I will not, here, address context sensitivity of the kind displayed by nouns like *fence* and *sequence*. For instance, the fencing around a square field can count as one fence or as four fences depending on one's perspective (see, e.g., Krifka, 1989: fn. 5 in relation to Partee p.c., as well as Zucchi and White, 1996; Rothstein, 2010).

b. If the counting base property is of type $InfPpty$, then records of this type may only specify a quantized set of informational entities.
c. If the counting base property is of type $PhysPpty \wedge InfPpty$, then records of this type may only specify a quantized set of informational entities and a quantized set of physical entities.

This encodes the above assumption regarding the *condition on grammatical counting*.

4.6. Adjectival modification

For adjective such as *insightful*, I propose that their function, semantically, is twofold.

(31) Semantic role of intersective adjectives:
a. Restrict the truth-conditions (by modifying the record type in the range of the function of the NP)
b. Restrict the possibilities for contextual domain restriction (by modifying the type of the *domr* field).

Regarding (31a), for *insightful book*, this simply means that *insightful* adds a condition that the content of the book is insightful (as with any regular account of intersective modification). Regarding (31b), given that *insightful* concerns informational content, when used to modify an noun, the interpretation of the NP is still a function from contexts to properties, but any contextual domain restriction must be of type *InfPpty*. This means, for example, that, given that *book* can be contextually restricted by properties of type *InfPpty* or *PhysPpty*, *insightful book* can be evaluated relative to a property that restricts its domain, but this property must either be solely information-related, or both informationally and physically related.

This is formalised in (32). This is a function from a property to a function from a context, to a property. I have not restricted the input property semantically, but this could be done if needed. A restriction on the context is added such that any property used for nominal domain restriction is required to be an informational property (domr : *InfPpty*), since $(PhysPpty \vee InfPpty) \wedge InfPpty$ is equivalent to $InfPpty$. The resulting property is that of a book that has an insightful contents (that can be restricted, contextually, by a property of informational things or a property of physical and informational things).

(32) $[\![\text{insightful}]\!] =$
$$\ulcorner \lambda \mathfrak{P}.\lambda c : \mathfrak{P}.cx \wedge_{\cdot} \left[\text{domr} : \mathit{InfPpty}\right].\ \lambda r : \mathfrak{P}.\text{bg}.\ \mathfrak{P}(c)(r) \wedge [\text{s}_{\text{inf}} : \text{insightful}(r.\text{p})] \urcorner$$

This straightforwardly composes with the lexical entry for *book*. The result is a context-indexed property of insightful books, where the contextual domain restriction must in some way be informationally related. Notice that the cb field is still underspecified. This makes the proposal here substantially different from, for instance (Gotham, 2017) and (Chatzikyriakidis and Luo, 2018). In those analyses, adjectives such as *informative* constrain, directly, how we count entities that the relevant noun denotes. My proposal places a different and substantially weaker condition that the property *insightful book* denotes requires that any contextual domain restriction is, minimally informationally based. (This is consistent with one that is, e.g., informationally and physically based.)

(33) $[\![\text{insightful book}]\!] = [\![\text{insightful}]\!]([\![\text{book}]\!]) =$

$$\ulcorner \lambda c : \left[\text{domr} : \mathit{InfPpty}\right].\lambda r : \begin{bmatrix} \text{x} : \mathit{Phys} \\ \text{p} : \mathit{Inf} \end{bmatrix}. \begin{bmatrix} \text{s}_{\text{pb}} : \text{phys\_book}(r.\text{x}) \\ \text{s}_{\text{ib}} : \text{inf\_book}(r.\text{p}) \\ \text{s}_{\text{co}} : \text{contents}(r.\text{x}, r.\text{p}) \\ \text{cb} : \mathit{PhysPpty} \vee \mathit{InfPpty} \\ \text{s}_{\text{inf}} : \text{insightful}(r.\text{p}) \end{bmatrix} \wedge\!\!\!\cdot\; c.\text{restr}(r) \urcorner$$

Physically relevant adjectives such as *damaged* are similar to their informationally relevant cousins save for two differences: the restriction they place on the context is that any contextual domain restriction is, minimally, a physical property (where this is consistent with it being, e.g., a physical and informational property); and the restriction on the resulting property is that the physical entities that the noun denotes are damaged.

(34) $[\![\text{damaged}]\!] =$

$$\ulcorner \lambda \mathfrak{P}.\lambda c : \mathfrak{P}.cx \wedge\!\!\!\cdot\; \left[\text{domr} : \mathit{PhysPpty}\right].\ \lambda r : \mathfrak{P}.\text{bg}.\ \mathfrak{P}(c)(r) \wedge [\text{s}_{\text{dam}} : \text{damaged}(r.\text{x})] \urcorner$$

Now, we compose *damaged* with *insightful book*, the resulting property is one of books that are informationally insightful and physically damaged. Importantly, however, any property in the context that acts as a contextual domain restriction must now be one that relates to situations that witness both informational and physical entities.

(35) $[\![\text{damaged insightful book}]\!] = [\![\text{damaged}]\!]([\![\text{insightful book}]\!]) =$

$$\ulcorner \lambda c : \left[\text{domr} : \mathit{InfPpty} \wedge \mathit{PhysPpty}\right].\lambda r : \begin{bmatrix} \text{x} : \mathit{Phys} \\ \text{p} : \mathit{Inf} \end{bmatrix}. \begin{bmatrix} \text{s}_{\text{pb}} : \text{phys\_book}(r.\text{x}) \\ \text{s}_{\text{ib}} : \text{inf\_book}(r.\text{p}) \\ \text{s}_{\text{co}} : \text{contents}(r.\text{x}, r.\text{p}) \\ \text{cb} : \mathit{PhysPpty} \vee \mathit{InfPpty} \\ \text{s}_{\text{inf}} : \text{insightful}(r.\text{p}) \\ \text{s}_{\text{dam}} : \text{damaged}(r.\text{x}) \end{bmatrix} \wedge\!\!\!\cdot\; c.\text{restr}(r) \urcorner$$

4.7. Polysemous nouns lexically introduce QUDs

One of the main claims in this paper is that polysemous nouns lexically introduce QUDs of the form *how are we individuating N?*. For a noun such as *book*, for instance, there are three possible answers to this question: informationally, physically, and both informationally and physically. We can represent the lexically introduced QUD for *book* as a set of possible answers, namely the set containing (36a), (36b), and (36c). These properties are each restrictions on the cb field (the counting base field), and encode that we count informationally, physically, and both informationally and physically respectively.

(36) a. $\lambda r : \left[\ \text{p} : \mathit{Inf}\ \right].\left[\ \text{cb} : \mathit{InfPpty}\ \right]$

b. $\lambda r : \left[\ \text{x} : \mathit{Phys}\ \right].\left[\ \text{cb} : \mathit{PhysPpty}\ \right]$

c. $\lambda r : \begin{bmatrix} \text{x} : \mathit{Phys} \\ \text{p} : \mathit{Inf} \end{bmatrix}.\left[\ \text{cb} : \mathit{InfPpty} \wedge \mathit{PhysPpty}\ \right]$

4.8. Double distinctness readings arise in neutral contexts

Given the semantic analysis above, this makes predications about the available readings of *book*, *insightful book* and *damaged insightful book* where no other QUD is higher on the stack than the lexically introduced one, as in, e.g., out of the blue utterances of *damaged insightful book*, namely, that the only answers to the QUD given (36a)-(36c) that are available are those that are consistent with the constraints put on the 'domr' field in the context.

For *book*, that has a counting base that is underspecified with respect to informational and physical entities, any of (36a)-(36c) are available as contextual domain restrictions, and so a use of *book*, absent any other modification or contextual restriction is underspecified with respect to whether we are counting informational books, physical books, or both.

For *insightful book*, there is a stricter constraint on the context, any domain restriction must minimally relate to informational entities (see (33) above). This rules out (36b) as a possible domain restriction, and so the prediction is that, absent any overriding QUD, *insightful book* is underspecified with respect to whether entities it denotes are to be individuated on a solely informational basis, or on one that is both physical and informational, the correct restriction.

For *damaged insightful book*, there is a a yet stricter constraint on the context, any domain restriction must relate to a property of situations that witness informational and physical entities (see (35) above). This rules out (36a) and (36b) as a possible domain restriction, and so the prediction is that, absent any overriding QUD, *damaged insightful book* is not underspecified with respect to individuation: it should be individuated in terms of both informational and physical books: the double distinctness reading. With (36c) as the domain restriction property for *damaged insightful book*, we get the following where the counting base (cb) field is a meet type that ensures a double distinctness reading:

$$(37) \qquad \lambda r : \begin{bmatrix} \mathrm{x} : \mathit{Phys} \\ \mathrm{p} : \mathit{Inf} \end{bmatrix} . \begin{bmatrix} \mathrm{s_{pb}} : \mathrm{phys\_book}(r.\mathrm{x}) \\ \mathrm{s_{ib}} : \mathrm{inf\_book}(r.\mathrm{p}) \\ \mathrm{s_{co}} : \mathrm{contents}(r.\mathrm{x}, r.\mathrm{p}) \\ \mathrm{cb} : \mathit{PhysPpty} \wedge \mathit{InfPpty} \\ \mathrm{s_{inf}} : \mathrm{insightful}(r.\mathrm{p}) \\ \mathrm{s_{dam}} : \mathrm{damaged}(r.\mathrm{x}) \end{bmatrix}$$

This result captures Gotham's intuitions that restrictions on individuation are semantically encoded by modifiers. However, unlike Gotham, on my analysis, there is a caveat: this restriction only kicks in absent any QUD that overrides the one lexically introduced by the polysemous noun. This leaves room for the kinds of case discussed by Liebesman and Magidor (2017) which is one precisely where there is an overriding QUD.

4.9. Double distinctness readings do not arise when there is a more prominent QUD

The context described in (5) intuitively introduces a QUD along the lines of *Which books shall we put on the display?* Clearly, the librarians want to put insightful books on display, but not if they are damaged, since this would not look good. A partial answer to this QUD would therefore be to identify any books that are damaged, even though they are insightful. This

is what Alex's utterance of *Three insightful books are damaged* in the context seems to be addressing.

Now, the context specifies that Alex says *Three insightful books are damaged* in relation to the two piles of books Billie has made. Therefore, there are at least the following two salient properties that could serve as a contextual domain restriction such that Alex's utterance would partially address the contextually set-up QUD: books in the insightful pile and books in the non-insightful pile. A simplified representation of these properties is given in (38).

(38) a. $\lambda r : \left[\begin{array}{l} \mathrm{x} : \mathit{Phys} \\ \mathrm{p} : \mathit{Inf} \end{array} \right] . \left[\begin{array}{l} \mathrm{s_{inl}} : \mathrm{in\_pile\_1}(r.\mathrm{x}) \\ \mathrm{s_{inf}} : \mathrm{insightful}(r.\mathrm{p}) \end{array} \right]$

b. $\lambda r : \left[\begin{array}{l} \mathrm{x} : \mathit{Phys} \\ \mathrm{p} : \mathit{Inf} \end{array} \right] . \left[\begin{array}{l} \mathrm{s_{inl}} : \mathrm{in\_pile\_2}(r.\mathrm{x}) \\ \mathrm{s_{ninf}} : \neg\mathrm{insightful}(r.\mathrm{p}) \end{array} \right]$

We are assuming that it is possible for a contextually specified QUD to be higher on the stack than the QUD lexically introduced by a polysemous noun. Both of the properties in (38) are consistent with restriction on the context placed by *insightful book(s)*, since both are properties of situations that witness something physical and informational. However, only (38a) is consistent with the truth conditions of this construction, Alex has clearly ruled out that they are referring to books in the non-insightful pile. However, we also must account for the contribution of *damaged*. If there are no salient piles/quantities of, say, damaged or not damaged books in the context, then the contribution of *damaged* will not select between contextually provided quantities of books. Therefore *damaged* can instead contribute towards the lexically introduced QUD (*How are we individuating books*?) With (38a) as the contextual domain restriction added by *insightful* and (36b) as the contextual update provided by *damaged*, we get the following:

(39) $\lambda r : \left[\begin{array}{l} \mathrm{x} : \mathit{Phys} \\ \mathrm{p} : \mathit{Inf} \end{array} \right] . \left[\begin{array}{l} \mathrm{s_{pb}} : \phi\_\mathrm{book}(r.\mathrm{x}) \\ \mathrm{s_{ib}} : \iota\_\mathrm{book}(r.\mathrm{p}) \\ \mathrm{s_{co}} : \mathrm{contents}(r.\mathrm{x}, r.\mathrm{p}) \\ \mathrm{cb} : \mathit{PhysPpty} \\ \mathrm{s_{inf}} : \mathrm{insightful}(r.\mathrm{p}) \\ \mathrm{s_{dam}} : \mathrm{damaged}(r.\mathrm{x}) \\ \mathrm{s_{inl}} : \mathrm{pulled\_by\_alex}(r.\mathrm{x}) \end{array} \right]$

Since the contribution of *damaged* has updated the counting base (cb) field to be of type *PhysPpty*, the books must be physically distinct (i.e., single multi-volume editions are ruled out). However, the individuation conditions for (39) are still underspecified, between the double distinctness reading and one that allows for informational duplicates. In other words, we have captured the intuitions of Liebesman and Magidor (2019) that in appropriate contexts, the double distinctness reading does not arise. That is to say, for a two-ways polysemous noun like *book*, even if we have a information-relevant modifier and a physical object-relevant modifier, context can allow for weaker readings than the double-distinctness reading. It should be stressed, however, that the proposal here differs substantially from that in (Liebesman and Magidor, 2017, 2019). I retain standard assumptions regarding selectional criteria for modifiers and so do not need to assume their metaphysical hypothesis of *property inheritance*.

4.10. Adding extra modifiers can restrict readings further

Finally, let us consider the cases where Alex gives more information to Billie as with the utterances in (10) and (11) repeated below.

(10) I memorised the first page of three damaged, insightful books.

(11) I tore out the first page of three damaged, insightful books.

In order to explain these cases, I will need to make some further (pragmatic) assumptions about how Billie is likely to reason about Alex's contributions. For both (10) and (11), we may first assume that the interpretation of *(three) damaged insightful books* is as above. In other words, Billie assumes that (at least) three books from the informative pile are damaged, but that these might be informational duplicates. In (10), Alex also says that they have memorised the first page of these three books. Crucially, memorisation information has no bearing on the main QUD (*Which books shall we put on the display?*), however, it does have a bearing on the lexically introduced QUD. I.e., Billie can infer that *damaged, insightful book(s)* is also being individuated in terms of informational contents. Formally, this means that the counting base (cb) field is updated from cb : *InfPpty* to cb : $\mathit{InfPpty} \wedge \mathit{PhysPpty}$. This counting base is incompatible with counting informational duplicates and physical duplicates. The prediction, then, is that (10) should have only the following double distinctness reading:

(40) Of the books in the informative pile, Alex memorised the first page of three informationally distinct books, each of which was damaged.

In (11), Alex says, in addition to three insightful books being damaged, that they have torn out the first page of these three books. This action clearly further damages the books, but since they are already damaged, it does not add any further to the main QUD (*Which books shall we put on the display?*). Also, this extra information does not further restrict the counting base (cb) field, since this has already been updated to *PhysPpty* via the contribution of *damaged insightful books*. All the page tearing information does, therefore, is update the truth conditions of Alex's utterance. The prediction, then, is that (10) should have one of the following two readings:

(41) a. Of the books in the informative pile, Alex tore out the first page of three informationally distinct books, each of which was (anyway) damaged.
b. Of the books in the informative pile, Alex tore out the first page of three informationally duplicate books, each of which was (anyway) damaged.

In other words, no double-distinctness reading is enforced, the correct prediction.

5. Summary and conclusion

The proposal I have set out here provides a means of generating predictions about available readings of copredication constructions, relative to an ordering of the QUDs: Given a context and an ordering of QUDs, I have shown how one can predict what readings different combinations of modifiers applied to a common noun should have. A central part of this proposal was to characterise in detail how compositional semantic processes interact with the QUD via placing constraints on what properties can be employed as restrictions to the interpretations of common nouns.

One novel part of this proposal is the hypothesis that polysemous common nouns, which underspecify their individuation criteria, lexically introduce a QUD. For instance, for *book*, this was *How are we individuating books?* If this QUD is first in the stack, then modifiers in copredication constructions will constrain the individuation conditions of the relevant noun. Importantly, however, this was not semantically hard-coded as in (Gotham, 2017), but articulated as a constraint on a parameter of a Kaplanian context that governs nominal domain restriction. This means that if the lexically introduced QUD is not on top of the stack, then modifiers may instead make salient other nominal domain restrictions. In our running example, for instance, *insightful* dod not constrain the individuation criteria of *book(s)*, but instead selected between two contextually salient piles of books: the insightful ones and the non-insightful ones.

In terms of opting for a more pragmatics-driven approach, my proposal is, in a sense, in the spirit of Liebesman and Magidor's (2017) discussion of a structurally similar example (from which I took inspiration). However, it is better seen as one that lies between their view and Gotham's semantic analysis. I assume that modifiers can restrict individuation criteria (but unlike Gotham, that this contribution is pragmatically driven). However, unlike Liebesman and Magidor, the semantics I give for modifiers and also my account of polysemous common nouns is far closer to other semantic analyses (e.g., Cooper, 2011, 2007; Chatzikyriakidis and Luo, 2018) insofar as I use a richly typed semantic theory in order to account for the challenges made acute by polysemy and copredication to simply-typed approaches. Liebesman and Magidor claim that, even in copredication constructions, one only ever refers either to an informational book, or to a physical book (and the apparent clashes with selectional restrictions are explained away via their metaphysical account of property inheritance). I have developed the proposal in (Sutton, 2022), which is placed within the situation theoretic tradition of semantics. In this tradition, common nouns denote situations that witness (i.e., contain) individuals of some type. Polysemous nouns such as *book* typically denote situations that witness a physical book and an informational book, such that these two stand in a *contents* relation.

My use of TTR, and specifically the developments within this theory in (Cooper, 2023), is motivated first by my situation theoretic proposal regarding polysemy, and second by the ability one has in TTR to modify and update the arguments to functions (or more accurately, the types of those arguments). Indeed, this was a central component of the semantics I gave for intersective modifiers such as *damaged* and *insightful*: they constrain the types of properties than can be employed as restrictions on the nominal domain.

This initial analysis of contextual effects on readings of quantified copredication utterances leaves open many avenues for future research. First, the subtle compositional differences generated by the constructions in (6), (8), (9) are still to be accounted for. Second, the account has only addressed a few examples with a single common noun (*book*). However, the proposal in this paper should be viewed as a formula for extending this account of the semantics-pragmatics interface for polysemous nouns to a much wider range of cases.

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Just as a scale widener with maximum-standard adjectives: emphatic / precisifying effects[1]

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Abstract. In this paper, we propose a finer-grained classification of adjectives labeled Maximum Standard Adjectives (MSAs) in order to account for two of their properties in interaction with the particle *just*. First is the failure of non-extreme MSAs (*clean*, *closed* etc.) to be interpreted emphatically with *just* – in contrast to MSAs like *perfect* (Beltrama, 2021). The second property has to do with the non-uniform availability of a precisifying reading for MSAs in combination with focused *just*. While we assume (like Rotstein and Winter, 2004 and Lassiter and Goodman, 2013) that threshold values for MSAs are uniformly provided by the context, we show that MSAs also vary with respect to how these thresholds are sourced from the context. The non-uniform behavior of MSAs with *just* in its emphatic and precisifying uses is shown to derive from this variability.

Keywords: adjectives, gradability, precisification, intensification, vagueness.

1. Introduction

In combination with adjectives that have been classified as maximum standard adjectives (henceforth MSAs; see Kennedy and McNally, 2005), English *just* exhibits two uses. (1a) exemplifies what has been labeled the emphatic use (see Beltrama, 2021). Informally, the use of *just* here conveys that the subject referent has the adjectival property (perfection, pristineness, etc.) to the highest level possible relative to the context. This emphatic use is observed not only with MSAs, but with a wider range of predicates that have been classified at least since Morzycki (2012) as extreme predicates (e.g. *amazing, gigantic, gorgeous*). Moreover, not all MSAs sound felicitous with *just* on its emphatic use, as shown in (1b).

(1) a. This room is just **perfect/pristine/jam-packed**!
b. #This room is just **clean/safe/empty/full**!

The second use is what we call the precisifying use. In these cases, *just* combines with MSAs and gives rise to an effect that is (roughly) paraphraseable as *barely* or *exactly*, as shown in (2).

(2) (About an irrigation system) A pressure switch at the pump outlet [...] would have to be a precisely adjustable one to pump until the tank is **just** full and then shut off.[2]

Any account of these two uses of *just* must be able to (a) explain why some (but not all) MSAs are acceptable on the emphatic use; and (b) delineate the contexts in which precisifying uses of *just* arise with MSAs. In this paper, we offer such an account. To do so, we develop a fine-grained classification of the thresholds of MSAs, and then we propose a unified analysis of the uses of *just* with MSAs, which explains both the non-uniform profile of these adjectives in

[1]We would like to thank the OSU Pragmatics Working Group for discussion of this work and three anonymous reviewers for their feedback.

[2]`https://permies.com/t/213913/simple-pumping`

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emphatic uses—the data in (1)—and accounts for the precisifying effect of *just* in the contexts where it occurs.

We begin by discussing previous research on the interaction of *just* with MSAs in §2. We examine the behavior of the emphatic and precisifying uses in detail in §3 and then our analysis of them in §4 before concluding in §5.

2. Background

The emphatic use is well known to arise with "extreme" adjectives (or EAs) — adjectives restricted to the upper end of the scale that they are associated with. These adjectives (e.g. *amazing, enormous*) combine readily with modifiers such as *simply* or *downright*, which Morzycki (2012) calls "extreme degree modifiers". Some examples are shown in (3). Note that the focus-bearing expression in such sentences is typically the predicate.

(3) a. The food was **just**(/simply/downright) [amazing]$_F$!
b. The mountains are **just**(/simply/downright) [breathtaking]$_F$!
c. The Empire State Building is **just**(/simply/downright) [enormous]$_F$!

Morzycki (2012) proposes that the meaning of an EA involves a "zone of indifference". According to him, the speaker has a set C of degrees that they believe to be reasonable degrees to consider as the underlying scale for the EA in the context. The zone of indifference lies beyond C, that is, the speaker takes it to be "off the scale". All degrees in the zone of indifference are taken to be equal to the maximum contextually relevant degree $\mathbf{max}(C)$, so speakers are *indifferent* to distinctions between those degrees.

For example, (4) conveys that the soup's degree of tastiness is so high that it does not register on the contextually relevant scale. The scale associated with *amazing* in (3) is upper-open (there is no maximal degree of tastiness), but there is, nonetheless, a degree $\mathbf{max}(C)$ which the speaker considers to be the maximal degree that could be relevant to a conversation about the tastiness of the soup. (4) conveys that the tastiness of the soup exceeds that degree.

(4) This soup is amazing!

The extreme adjectives that Morzycki (2012)'s analysis considers are similar to those in (3), i.e. open-scale adjectives (there is no maximal degree of amazingness, breathtakingness, or enormity). However, Beltrama (2021) examines the emphatic use of *just* with *perfect* (shown in (5a)), a maximum standard adjective (MSA) that is said to involve an upper-closed scale. According to Kennedy and McNally (2005), MSAs convey that their arguments possess a maximal degree of the property in question. The threshold of an MSA is often taken to be the upper endpoint of the scale and thus not context dependent.[3] Thus the fact that the use of the bare positive form of the adjective in a sentence like *The essay is perfect* conveys that the essay possesses perfection to the maximal degree, is evidence that *perfect* is an MSA. The entailment pattern in (5b) corroborates this.

(5) a. The essay is **just**(/simply/downright) [perfect]$_F$!

[3]But Rotstein and Winter (2004), McNally (2011), and Lassiter and Goodman (2013) (among others) have noted challenges to this assumption. We will revisit these challenges in §3.2.

b. The essay is perfect.
→ The essay is completely perfect.

There are in fact many maximum-standard adjectives that give rise to emphatic readings with *just*, and those that do also combine with extreme degree modifiers like *downright* and *simply*, indicating that they are also classifiable as extreme adjectives. The adjectives in (6) provide some examples with the entailment patterns in (7) supporting their status as MSAs.

(6) a. The train is **just**(/simply/downright) [jam-packed]$_F$!
b. The floor is **just**(/simply/downright) [pristine]$_F$!
c. The office is **just**(/simply/downright) [deserted]$_F$!

(7) a. The train is jam-packed.
→ The train is completely jam-packed.
b. The floor is pristine.
→ The floor is completely pristine.
c. The office is deserted.
→ The office is completely deserted.

Beltrama (2021) offers a precisification-based analysis of emphatic *just* in which the function of *just* is to exclude less precise construals of the endpoint-denoting predicate it combines with. He claims that a sentence containing an extreme predicate, for example, *The essay is perfect*, can be asserted in a context in which the essay is not, strictly speaking, perfect, but nonetheless approximates perfection very closely. On his analysis, *just* conveys that the prejacent is the finest-grained description of the state of affairs under consideration that is "assertion-worthy". In the spirit of prior analyses of *just* that focus on its use as an exclusive ruling out truth-conditionally stronger alternatives, Beltrama takes emphatic *just* to rule out finer-grained descriptions of the property attribution. Thus *The essay is just perfect* rules out more fine-grained descriptions such as *The essay is basically perfect* (which would convey that the essay merely approximates and does not reach perfection), and thereby conveys that the essay is perfect at the highest level of precision.

(8) The essay is **just** perfect.
$\rightsquigarrow$ *The essay is basically perfect* is not assertable.

3. Data

3.1. The emphatic use

Nothing in the analysis that Beltrama (2021) provides for emphatic uses of *just* with endpoint denoting adjectives predicts that this effect is restricted in any way. In principle, all endpoint-denoting adjectives—not just extreme ones—should combine with *just* and give rise to the emphatic effect. After all, such predicates can be precisified by *absolutely* and *completely* (Sauerland and Stateva, 2007), as shown in (9). We therefore take Beltrama's analysis to predict that *just* should also have an emphatic effect in combination with non-extreme MSAs. To the contrary, however, no emphatic effect arises with these adjectives, as shown in (10).

(9) a. The door is **absolutely/completely** closed.
b. This glass is **absolutely/completely** full.
c. This room is **absolutely/completely** clean.

(10) a. #The door is **just** closed!
b. #This glass is **just** full!
c. #This room is **just** clean!

Furthermore, we do not share Beltrama's intuition that *The essay is perfect* can felicitously be uttered in a context where the speaker believes that the essay merely approximates perfection. More generally, it appears that extreme predicates can **never** be used imprecisely. Evidence for this is the fact that such predicates fail to combine felicitously with *roughly speaking* (also *sorta*), as shown in (11). In this regard, they contrast with the canonical maximum-standard adjectives shown in (12), which other authors have also reported can be used imprecisely (see Kennedy and McNally, 2005; Sauerland and Stateva, 2007). We take this to indicate that the emphatic effect that *just* has in combination with *perfect* is not the result of precisification in context.

(11) a. #Roughly speaking, this soup is amazing.
b. #Roughly speaking, the Empire State Building is enormous.
c. #Roughly speaking, this essay is perfect.
d. #Roughly speaking, this train is jam-packed.
e. #Roughly speaking, this hotel room is pristine.

(12) a. Roughly speaking, this tank is full.
b. Roughly speaking, this theater is empty.
c. Roughly speaking, this shirt is dry.

3.2. The precisifying use

Kennedy and McNally (2005) and Kennedy (2007), among others, claim that the threshold of any maximum-standard adjective is a scale endpoint—that is, for any individual x and MSA G, *x is G* conveys that the property denoted by G holds of x to the highest degree on the scale. Other authors have challenged this claim. Rotstein and Winter (2004), for instance, argue that thresholds of MSAs are in fact context-dependent and therefore not always located at scale endpoints. For example, they point out that clean objects can have different degrees of cleanliness, as demonstrated by the felicity of (13), which indicates that the threshold of the MSA *clean* in (13) is not the maximal degree of cleanliness.

(13) Both towels are clean but the red towel is cleaner than the blue one.

McNally (2011) points out that the threshold of *full* for a wine glass is not a scale endpoint, either: A wine glass is usually considered full when roughly half of its volume is occupied. Lassiter and Goodman (2013) use the Rational Speech Act (RSA) framework to model how listeners infer adjective thresholds. According to them, scale structure never determines threshold; rather, thresholds emerge from an interaction between scale structure and listeners' prior beliefs. In view of the observations of all these authors, we assume that all threshold values of

MSAs are supplied by context and are not necessarily scale endpoints.

Given this assumption that threshold values for MSAs are uniformly provided by the context, we observe that there are different ways in which these thresholds might be sourced from the context. Specifically, whether the contextually provided threshold value θ is determinate and whether θ is a scale endpoint may vary across contexts. It turns out that the availability of the precisifying reading for a given MSA combining with *just* depends on these two properties. Since scale endpoints are always determinate values, there are three types of cases to consider:[4]

1. θ is a determinate non-endpoint degree
2. θ is an indeterminate degree
3. θ is an endpoint degree

When we consider MSA-*just* interactions, we see that focused *just* has a precisifying effect in case 1 (§3.2.1), but not in cases 2 (§3.2.2) or 3 (§3.2.3). Before we discuss each case, note that the precisifying reading with *just* is most salient when *just* is prosodically focused. In what follows, we assume that *just* bears focus and ignore any readings that may arise if focus is placed elsewhere.

3.2.1. Case 1: Determinate non-endpoint context-determined θ

Consider (14), in which the context provides a determinate (that is, non-vague) threshold θ: the top of the tank. At first glance, this threshold is felt to be a scale endpoint. However, on closer examination, we see that it cannot be a lexically encoded endpoint because the use of *just* places an upper bound on the threshold, implying the existence of higher degrees. This upper-bounding effect is demonstrated by the contrast between (15a) and (15b).

(14) (Forum discussion about an irrigation system) A pressure switch at the pump outlet would roughly work, though it would have to be a precisely adjustable one to pump until the tank is **just** full and then shut off.[5]

(15) a. The tank is full. In fact, it's overflowing.
b. The tank is **just** full. #In fact, it's overflowing.

(16) and (17) provide more examples of the precisifying, upper-bounding effect of *just* when the context provides this kind of threshold to the MSA. In (16a), the point at which a heater valve is "just closed" is contrasted with the point at which it is fully closed. This makes it clear that for such valves, the threshold of *closed* is lower than the scale endpoint. A valve is "just closed" when its degree of closure meets, but does not exceed, this threshold—as demonstrated by (16b). Similarly, in (17a), *just set* makes reference to the minimal degree of firmness that qualifies as set—that is, the custards are to be removed from the oven as soon as they are set, before they become any firmer.

[4]To be clear, we assume that threshold values are not lexically determined—that is, the same adjective might be construed with a determinate non-endpoint threshold in some contexts, an indeterminate threshold in other contexts, and an endpoint threshold in yet other contexts.

[5]`https://permies.com/t/213913/simple-pumping`

(16) a. (Forum discussion about replacing heater control valves in cars) My advice [...] is to find the point at which the valve is **just** closed. Mark that and that is the point the valve should be at when the heater control is set to the fully closed stop. So, set the control to fully closed and set the valve to the "just closed" position before tightening the cable's trunnion.[6]

b. The valve is **just** closed. #In fact, it's fully closed.

(17) a. (In a custard recipe) Pour boiling water into the pan to reach halfway up the sides of the ramekins. Bake in oven until the custards are **just** set.[7]

b. The custards are **just** set. #In fact, they're completely solid.

The upper-bounding effect distinguishes the precisifying use from the emphatic use, as the emphatic use never exhibits it. That is, there is no food that is too tasty to be described as *just amazing*, no mountains that are too beautiful to be described as *just breathtaking*, and no buildings that are too large to be described as *just enormous*. But as we saw, there can be valves that are too closed to be described as *just closed* and custards that are too set to be described as *just set*.

3.2.2. Case 2: Indeterminate context-determined θ

In this case, the context provides an indeterminate non-endpoint threshold value. In (18a), for example, the threshold for *clean* is arguably not an endpoint—as shown by *but not completely*. The context provides no other salient, determinate degree that could serve as θ, which suggests that *clean* has an indeterminate (i.e. vague) threshold. A precisifying reading with prosodically focused *just* is unavailable here, as shown in (18b).

(18) a. (Hotel review) Rooms were clean **but not completely** and the breakfast very basic.[8]

b. #This hotel room is [**just**]$_F$ clean.

Without a salient, determinate non-endpoint value on that scale, the threshold is indeterminate. Evidence for this is the fact that *clean* gives rise to the Sorites paradox: If one adds grains of dirt to a hotel room one at a time, there is no clear point at which the room transitions from being clean to being unclean.

Note that the type of threshold is provided by the context and not lexically associated with a particular MSA. So, an adjective like *full*, which might be interpreted with determinate, context-determined threshold in some cases, may also be interpreted with an indeterminate threshold in other contexts. As McNally (2011) points out, the standard of fullness for a wine glass is usually far below the rim of the glass and therefore not at the scale endpoint. Such a threshold is vague, as it gives rise to the Sorites paradox: If a wine glass is full, then it is still full if a

[6] https://www.mgexp.com/forum/mgb-and-gt-forum.1/heater-valve-gasket.3828111/

[7] https://www.taste.com.au/entertaining/articles/how-to-make-perfect-custard/dkghsooa?nk=9fd11850d4a0e42a1c594dd95eff2eb5-1693323721

[8] https://www.tripadvisor.com/ShowUserReviews-g190388-d315211-r406407975-Lovers_Nest_Hotel_Apts-Polis_Paphos_District.html

single drop of wine is removed.[9] *Just full* cannot mean *full to exactly the minimum degree that counts as full for a wine glass* in (19), unless that degree has been precisely specified, such as by a fill-line on the side of the glass.

(19) #The wine glass is [**just**]$_F$ full.

The naturally-occurring examples shown in (20a)–(23a) further demonstrate that adjectives that have been classified as MSAs can have indeterminate non-endpoint thresholds in some contexts. In each case, the claim that the adjective's threshold is not an endpoint is evidenced by the fact that the adjective is followed by *but not completely*. As in (18), focused *just* cannot be combined with these adjectives when they have the thresholds provided by these contexts.

(20) a. [The black water tank of my RV] was overfilled accidentally year 1 before I realized the sink flows into the black as well [...] In any event, if you drain when it gurgles it will be full but NOT completely full and you wont have to worry again.[10]
b. #After draining somewhat, the black water tank was [**just**]$_F$ full.

(21) a. The relationship clients have with their promotional agencies has been described as being like a toilet window: clear but not completely transparent.[11]
b. #Toilet windows are [**just**]$_F$ clear.

(22) a. I know for a fact that I love getting salad on a pizza. It allows you to pack whatever lettuce and toppings you want. Some just want to be healthy, but not completely. Just because salad is involved, doesn't mean it is healthy with dough just below it.[12]
b. #Some people want to be [**just**]$_F$ healthy.

(23) a. There are situations when you might feel safe, but not completely safe. Having someone else with you, including a boyfriend, might help reach that feeling of complete safety.[13]
b. #There are situations where you feel [**just**]$_F$ safe.

3.2.3. Case 3: Context-determined endpoint θ

In this case, the context provides a determinate endpoint threshold value. In (24a), for example, the threshold for *pure* is the maximum degree of purity, and so *but not completely* is infelicitous as a follow-up. The scale of purity differs from the scale of fullness in (14) in that it cannot extend *beyond* the threshold of *pure*. As in Case 2, precisification by focused *just* is also infelicitous here, as shown in (24b).

(24) a. This H_2O_2 is pure, #but not completely.

[9] McNally (2011) actually claims that the standard of fullness for a wine glass is not subject to the Sorites paradox and therefore is not vague, but we do not see why that should be the case.
[10] `https://www.keystoneforums.com/forums/showthread.php?t=49309`
[11] `https://www.marketingweek.com/a-case-of-quid-pro-quo/`
[12] `https://spoonuniversity.com/place/10-reasons-why-mod-pizza-is-worth-the-hype`
[13] `https://www.quora.com/Is-it-safer-to-have-a-boyfriend-than-not`

b. #This H_2O_2 is [**just**]$_F$ pure.

Certain similarly has an endpoint threshold in (25) and also fails to combine with focused *just*.

(25) a. John is certain that it will rain tomorrow, #but not completely.
b. #John is [**just**]$_F$ certain that it will rain tomorrow.

3.2.4. Upshot

There are two puzzles that the empirical data discussed in this section present. The first puzzle has to do with the failure of non-extreme MSAs (*clean, closed* etc.) to be interpreted emphatically with *just*. Beltrama's (2021) analysis of the emphatic use of *just* assumes that this use is an effect of precisification of the endpoint standard associated with an MSA. This wrongly predicts that all MSAs (including non-extreme ones) should be able to combine with *just*, giving rise to the emphatic effect. The second puzzle, not noted before in the literature as far as we know, has to do with the non-uniform availability of a precisifying reading for MSAs in combination with focused *just*: Why should this reading only be available in contexts that supply a determinate non-endpoint threshold (case 1)?

4. Analysis

4.1. Preliminaries

4.1.1. Scale granularity

Sentences containing certain kinds of vague expressions are construable at different levels of precision and this construal is context-dependent. At least since Krifka (2007), many researchers have conceptualized levels of precision as related to scale granularities. This notion has been deployed in analyses of (non-)round numerals (Krifka, 2007), approximators (Sauerland and Stateva, 2011), degree modifiers (Sassoon and Zevakhina, 2012), and the interaction of *just* with equative and comparative constructions (Thomas and Deo, 2020).

On this approach, a scale is divided into grains of a fixed width where degrees within each grain are indistinguishable from one another. A finer scale granularity corresponds to a smaller grain size and a higher level of precision, while a coarser scale granularity corresponds to a larger grain size and lower level of precision. Grain size is taken to represent the smallest measurement that is relevant in the discourse context.[14]

We follow Sauerland and Stateva (2007) in assuming that any sentence that is construable at different levels of precision is interpreted with respect to a *granularity function* that specifies how precisely the sentence is to be interpreted. We let each context c provide a set of granularity functions $gran_c$, and for any given utterance, an appropriate member of $gran_c$ is chosen

[14]For example, in a context where height differences of less than one foot are irrelevant, all measurements are rounded to the nearest foot, so *one foot* refers to heights between 0.5 feet and 1.5 feet, *two feet* refers to heights between 1.5 and 2.5 feet, etc. This corresponds to a granular scale with a grain size of one foot.

corresponding to the level of precision intended by the speaker at that context. A granularity function is taken to be a function from points to sets of points that defines a partition on its domain in the manner specified in (26). We refer to the cells of a partition defined by a granularity function as *grains*.

(26) A granularity function γ maps each point p in a set S of points (on a scale, in space, or in time) to a cell I of a partition of S such that $p \in I$.

Granularity functions can be ordered with respect to their *fineness*. Intuitively, a granularity function γ_1 is finer than a granularity function γ_2 if the grains of γ_1 are smaller than those of γ_2. To keep things simple, we only consider granularity functions whose domain is a one-dimensional scale and assume that all grains of a given granularity function are the same size.

(27) Given two granularity functions γ_1 and γ_2 with grain widths ε_1 and ε_2, respectively, γ_1 is finer than γ_2 if and only if $\varepsilon_1 < \varepsilon_2$.

Let d be the semantic type of degrees. Any expression δ of type d has a strict interpretation $[\![\delta]\!]^0$. For example, the strict interpretation of *six feet* is the exact point of six feet on a scale of distance. In context, however, point-denoting expressions do not receive their strict interpretation, but rather a "looser" interpretation that depends on a granularity function. In particular, the interpretation with respect to a granularity function γ of any expression δ, whose strict denotation is a point x, is that cell of the partition defined by γ that contains x. δ is interpreted by applying γ to its strict denotation, as given in (28).[15]

(28) Given a granularity function γ and an expression δ such that $[\![\delta]\!]^0 = x$ for some $x \in D_d$, the interpretation of δ with respect to γ is notated $[\![\delta]\!]_\gamma$ and is defined to be $\gamma(x)$.

4.1.2. Gradable adjectives

A gradable adjective G is standardly taken to denote the function that takes a degree d and an individual x and returns true if the property associated with G holds of x to degree d (see Kennedy and McNally, 2005; and many others). Since we take degree expressions to denote intervals rather than individual degrees, we assume that a gradable adjective denotes a function that takes an interval I and an individual x and returns true if the degree to which the relevent property holds of x lies in I. This is given in (29). The derivation of the meaning of *Mary is six feet tall* relative to $\gamma_{1\text{in}}$ is shown in (30).

(29) For any gradable adjective G encoding a property associated with a measure function m_G, $[\![G]\!] = \lambda I_{\langle d,t\rangle} \lambda x_e \lambda w.\ m_G(x)(w) \in I$.

(30) $[\![\text{Mary is six feet tall.}]\!]_{\gamma_{1\text{in}}}$
$= \lambda w.[\![\text{tall}]\!]([\![\text{six feet}]\!]_{\gamma_{1\text{in}}})(\mathbf{m})(w)$

[15] As an illustrative example, consider the interpretation of the measure phrase *six feet* with respect to the granularity function $\gamma_{1\text{in}}$ that rounds every value on the scale of heights S_{height} to the nearest inch, producing the following partition:
(i) $\{[0'', 0.5''), [0.5'', 1.5''), [1.5'', 2.5''), ..., [5'11.5'', 6'0.5''), ...\}$
Since the strict interpretation $[\![\text{six feet}]\!]^0$ lies in the cell $[5'11.5'', 6'0.5'')$, we have $[\![\text{six feet}]\!]_{\gamma_{1\text{in}}} = \gamma_{1\text{in}}([\![\text{six feet}]\!]) = [5'11.5'', 6'0.5'')$. In other words, *six feet* denotes the interval from $5'11.5''$ to $6'0.5''$.

$= \lambda w.\ \mathbf{tall}(\mathbf{m})(w) \in [\![\text{six feet}]\!]_{\gamma_{\text{lin}}}$
$= \lambda w.\ \mathbf{tall}(\mathbf{m})(w) \in [5'11.5'', 6'0.5'')$

Following Kennedy and McNally (2005), we assume that the interpretation of any gradable adjective without an explicit measure phrase involves a silent *POS* morpheme, which sets the adjective's threshold. We assume (contra Kennedy and McNally, 2005) that thresholds are always contextually supplied, even if the scale under consideration is closed. The meaning we adopt for *POS* is shown in (31), where $\sup(\gamma(d))$ is the supremum of $\gamma(d)$ and $\theta_{G,C}$ is the threshold for G supplied by the context C. ($\sup(\gamma(d)) > \theta_{G,C}$ amounts to saying that d either exceeds $\theta_{G,C}$ or is indistinguishable from $\theta_{G,C}$ at granularity level γ.)

(31) $[\![POS]\!]_\gamma = \lambda G \lambda x \lambda w. \exists d[\sup(\gamma(d)) > \theta_{G,C} \wedge G(\gamma(d))(x)(w)]$

As an illustrative example, the derivation of the meaning of *The tank is full* is shown in (32). According to (32), *The tank is full* in a world w with respect to a granularity function γ if there is a degree d such that the tank's degree of fullness in w lies in $\gamma(d)$ and some degree in $\gamma(d)$ exceeds the contextually-provided threshold.

(32) $[\![\text{The tank is full}]\!]_\gamma$
$= \lambda w. [\![POS]\!]_\gamma([\![\text{full}]\!])([\![\text{the tank}]\!])(w)$
$= \lambda w. \exists d[\sup(\gamma(d)) > \theta_{\text{full},C} \wedge [\![\text{full}]\!](\gamma(d))(\iota(\mathbf{tank}))(w)]$
$= \lambda w. \exists d[\sup(\gamma(d)) > \theta_{\text{full},C} \wedge \mathbf{full}(\iota(\mathbf{tank}))(w) \in \gamma(d)]$

4.1.3. Extreme adjectives

We adopt Morzycki's (2012) analysis of open-scale extreme adjectives and extend it to extreme MSAs such as *jam-packed*, which were discussed in §3.1. The scale of fullness which *full* and *jam-packed* make reference to in (33) has an objective endpoint: the degree of fullness such that passengers' bodies occupy literally every bit of space in the train. This is ordinarily not the threshold for *full*, as (33a) typically expresses that every seat in the train is occupied. The true endpoint of the scale is rarely relevant in ordinary conversation, so there is a contextually relevant set C of degrees whose maximum value $\mathbf{max}(C)$ is the maximum degree of fullness that the speaker can reasonably imagine a train to have. The degrees above it constitute a zone of indifference. (33b) conveys that the train's degree of fullness lies within this zone of indifference, which might be the case if passengers are standing in the train's aisles and exit spaces because there are not enough seats for them.

(33) a. This train is full.
b. This train is jam-packed!

Crucially for our analysis, $\mathbf{max}(C)$ is subjective and may vary from speaker to speaker. A speaker who has only ridden Amtrak trains in the United States, for instance, may have a lower $\mathbf{max}(C)$ than a speaker who has ridden the much more crowded trains of India or Japan. Speakers can faultlessly disagree about the value of $\mathbf{max}(C)$, as shown in (34). Therefore, even if a scale has an objective endpoint, $\mathbf{max}(C)$ may vary because it is subjective.

(34) A: This train is jam-packed!
B: I don't think so. I've seen way more crowded trains in Japan.

It is worth noting that some adjectives seem to have both subjective and objective uses. One such adjective is *perfect*. In the sentences in (35), *perfect* has an objective endpoint threshold and is roughly synonymous with *without flaws*: (35a) conveys that John's score was exactly 100%, and (35b) conveys that the shape Mary drew had exactly the shape of a circle. Consistent with the observations in §3.1, we find that the emphatic use of *just* does not occur with *perfect* when it has an objective threshold.

(35) a. John's score on the exam was **(#just)** perfect.
b. The circle that Mary drew was **(#just)** perfect.

The cases where *perfect* does give rise to an emphatic reading with *just* seem to actually involve open scales. For example, (36) seems to us to mean something stronger than *The essay has no flaws*: It conveys that the essay's degree of quality exceeds the speaker's $\mathbf{max}(C)$. This is not necessarily true of any essay that has no flaws. For instance, if two essays are both objectively flawless (that is, they contain no spelling errors, no factual inaccuracies, etc.), one might still be judged better than the other if it is subjectively more interesting or more enjoyable to read. The lower-quality essay then cannot be described as perfect even though it has no flaws. $\mathbf{max}(C)$ is the degree of essay quality that the speaker takes to be the highest degree under consideration, but the scale of essay quality does not actually have an upper endpoint. Therefore, although the objective uses of *perfect* in (35) involve an upper-closed scale, we take the uses of *perfect* that Beltrama (2021) considers to be subjective and involve an *upper-open* scale.

(36) The essay is **just** perfect. (repeated from (5))

One further example of an adjective with both subjective and objective uses is *wrong*. Its objective use is exemplified in (37a), and its subjective use is exemplified in (37b). On it objective interpretation, *wrong* means *factually incorrect* and does not combine with emphatic *just*. On its subjective interpretation, *wrong* is an extreme adjective that means something like *morally reprehensible*, so (37b) conveys that stealing candy from children is immoral to a degree beyond the speaker's $\mathbf{max}(C)$.

(37) a. John's answer to the multiplication problem was **(#just)** wrong!
b. Stealing candy from children is **just** wrong!

4.2. Proposal

To unify the emphatic and precisifying uses of *just*, we propose that when *just* combines with a gradable adjective, it conveys that the scale (i.e. the set of degrees) under consideration is as wide as possible at the context. Unifying these uses depends on coming up with an appropriate definition of "wideness". On our analysis, precisifying *just* widens the scale by making it more granular, while emphatic *just* widens it by raising $\mathbf{max}(C)$. The **wideness relation** on scales is given in (38).

(38) For any scales S_1 and S_2, $S_1 \sqsupset_w S_2$ if and only if
a. $\forall d \in S_2 : \nexists\, d' \in S_1 : d \subset d'$ (No degree of S_2 is properly contained in any degree of S_1.)
b. $\exists d \in S_1 : \exists d' \in S_2 : d \subset d'$ (Some degree of S_1 is properly contained in a degree of S_2.)

For any gradable adjective G, we assume the context makes available a set of scales $\mathbb{S}_G$ that G

could associate with. The widest member of such a set can then be defined as in (39).

(39) For any set of scales $\mathbb{S}$, S is the **widest** scale in $\mathbb{S}$ iff there is no other scale in $\mathbb{S}$ wider than S.

The proposed contribution of precisfiying/emphatic *just* can then be stated as follows:

(40) For any gradable adjective G, *just* G requires that the scale associated with G is the widest scale in $\mathbb{S}_G$.

4.3. Application

4.3.1. Extreme MSAs: The emphatic use

In §3.1, we observed that extreme MSAs do not allow for imprecise uses (*pace* Beltrama, 2021), as demonstrated by (11), repeated in (41). In view of that observation, we take the members of $\mathbb{S}_G$ for an extreme adjective not to vary with respect to granularity.

(41) a. #Roughly speaking, this train is jam-packed.
b. #Roughly speaking, this hotel room is pristine.
c. #Roughly speaking, this essay is perfect.

They do, however, vary with respect to the value of $\mathbf{max}(C)$ because, as pointed out in §4.1.3, they allow for faultless disagreements about what counts as *pristine, jam-packed, perfect* etc. We model this by keeping the granularity across all scales in $\mathbb{S}_G$ at γ_{finest} while allowing $\mathbf{max}(C)$ to vary. Wider members of $\mathbb{S}_G$ in this case are scales with higher values of $\mathbf{max}(C)$, so *just* conveys that the speaker is using the highest value of $\mathbf{max}(C)$ they can conceive of, which prompts the addressee to consider wider scales than they may have otherwise. To see why, consider the two members of $\mathbb{S}_{\text{full}}$ shown in Figure 1. The scales are partitioned into the degrees specified by γ_{finest}, but the degrees higher than $\mathbf{max}(C)$ are collapsed into a single degree, the zone of indifference (shown as a dashed line). The upper scale in the figure has a lower value of $\mathbf{max}(C)$, so its zone of indifference properly contains some scale degrees that are distinguished by the other scale—namely *very full* and *jam-packed*. The scale with the higher $\mathbf{max}(C)$ is therefore wider, according to (38).

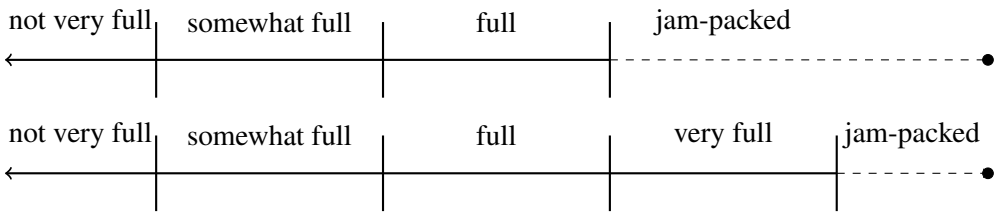

Figure 1: Two members of $\mathbb{S}_{\text{full}}$. The dashed portion of the scale is the zone of indifference.

For any extreme adjective G, the widest member of $\mathbb{S}_G$ is the one whose $\mathbf{max}(C)$ is as high as the speaker can imagine. It follows that in (42) (repeated from (6)), *just* conveys that the speaker believes they are using the highest conceivable value of $\mathbf{max}(C)$. This prompts the

hearer to consider higher scale degrees than they may have otherwise taken to be relevant. This maximization of $\mathbf{max}(C)$, we claim, is the source of the emphatic effect.

(42) a. The train is **just** [jam-packed]$_F$!
b. The floor is **just** [pristine]$_F$!
c. The office is **just** [deserted]$_F$!

We focus on upper-closed scales here, but this analysis applies just as well to open-scale extreme adjectives and can be extended beyond adjectives to other kinds of extreme predicates. See Deo and Thomas (forthcoming) for details.

The emphatic effect with *just*, on this analysis, is the result of an upward manipulation of the zone of indifference, and therefore, it cannot arise with adjectives that do not lexically make reference to a zone of indifference. It follows that only extreme adjectives (based on upper-closed or upper-open scales) can combine with *just* to give rise to the emphatic effect. The failure of non-extreme MSAs (*clean, closed* etc.) to be interpreted emphatically with *just* is thus accounted for – they make no reference to a zone of indifference.

4.3.2. Non-extreme MSAs: Case 1—the precisifying use

When non-extreme MSAs (such as *full*) are interpreted with determinate non-endpoint thresholds, the scales in $\mathbb{S}_D$ vary by granularity level. The widest scale in such cases is the one corresponding to γ_{finest}. To see why, consider Figure 2. The upper scale has a coarser granularity than the lower one. No degree of the finer scale is properly contained in any degree of the lower one, satisfying (38a). At the same time, there some degrees of the lower scale are properly contained in degrees of the upper one, satisfying (38b).

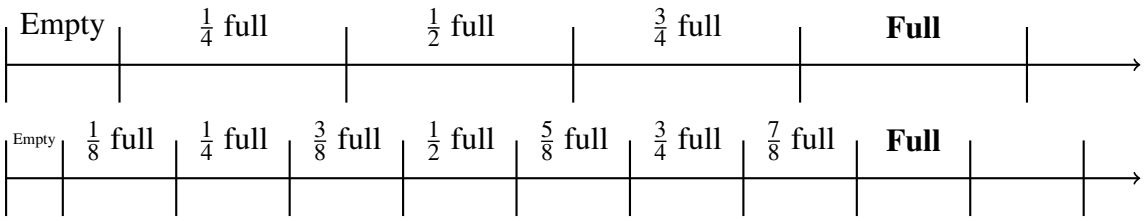

Figure 2: The scale of fullness partitioned according to a coarser granularity function (upper) and a finer granularity function (lower).

Note from (40) that *just G* requires that the scale associated with G is the widest scale in $\mathbb{S}_G$. For (43) (repeated from (15)), this means that the use of *just* leads to the selection of the finest permissible scale granularity for interpretation of the adjective. In other words, *the tank is just full* conveys that the tank's degree of fullness meets the contextually salient threshold (in this case, the fill line) even when measured at the highest permissible degree of precision. This is what *just*'s precisifying effect amounts to.

(43) a. The tank is full. In fact, it's overflowing.
b. The tank is **just** full. #In fact, it's overflowing.

By itself, however, this mechanism does not account for the upper-bounding effect observed in

(43b): If the tank exceeds the threshold by any amount, including the large amount in (43b), then it qualifies as full at γ_{finest} and therefore at all coarser granularities. Why, then, does *just* have this upper-bounding effect?

We suggest that the upper bounding effect observed in (43) is a special variety of conversational implicature – a mandatory implicature (Lauer, 2014). Unlike canonical conversational implicatures Lauer's mandatory or "Need a Reason" implicatures arise when the class of contexts in which the implicature arises is a superset of the class of contexts in which a given implicature-generating expression is felicitous. Naturally, these are not cancellable inferences. Recall from §3.2 that the precisifying use requires focus on *just*. In such cases, it is reasonable to assume that the the Current Question Under Discussion (see Roberts, 2012) that the declarative answers is a quantity ("How much?") question, as shown in (44). In other words, the class of contexts in which precisifying *just* is felicitous is those in which the QUD is a quantity question.

(44) CQ: How full is the tank?
A: The tank is [**just**]$_F$ full.

The fact that the speaker used *just* to select the finest permissible granularity level indicates that the speaker intended to fully answer the question at that granularity level. That means that if the degree of fullness of the tank exceeded the threshold of *full* by any degree that is relevant at γ_{finest}, the speaker would have said so. Thus the hearer infers that the degree of fullness of the tank does not exceed the threshold for *full* by any degree that is relevant at γ_{finest}. This accounts for the upper bound.

It is worth emphasizing that on our analysis, the emphatic and precisifying effects of *just* are distinct phenomena. Whereas Beltrama (2021) takes the emphatic effect to involve a special kind of precisification, we have argued here that the non-uniform behavior of *just* with MSAs calls for a treatment of precisification and extreme degree modification as distinct phenomena. The precisifying use of *just* conveys that the degree to which a predicate holds of an entity is as close as possible to some objective standard—in other words, any "rounding up" that the speaker is doing is negligible. In contrast, the emphatic use conveys that the degree to which the predicate holds of an entity exceeds the highest value that the speaker can conceive of—thereby reducing the amount of "rounding *down*" to the threshold of the zone of indifference.

4.3.3. Non-extreme MSAs: Case 2

Recall from §3.2.2 that the precisifying effect does not arise when *just* combines with an adjective whose contextually supplied threshold is indeterminate, as shown in (45) (repeated from (18a)).

(45) a. (Hotel review) Rooms were clean but **not completely** and the breakfast very basic.[16]
b. #This hotel room is [**just**]$_F$ clean.

What seems to prevent *clean* from combining with *just* in (45b) is the indeterminacy of its

[16] `https://www.tripadvisor.com/ShowUserReviews-g190388-d315211-r406407975-Lovers\_Nest\_Hotel\_Apts-Polis\_Paphos\_District.html`

threshold. In other words, *clean* is vague. In general, precisification is only possible for gradable adjectives whose threshold is taken to be a determinate point on a scale, as the threshold of *full* is when a tank has a visible fill line. Given that precisification involves reducing the amount of uncertainty about the location of a point on a scale, it is simply not possible to precisify to a point that does not have a determinate location.

Therefore, the interpretation of non-extreme MSAs with non-endpoint indeterminate thresholds can only be at low levels of precision. Thus the members of $\mathbb{S}_G$ for such adjectives cannot vary by granularity. Although they may vary by the value of $\mathbf{max}(C)$, the choice between such scales would not affect the interpretation of the adjective since the threshold of a non-extreme adjective does not depend on $\mathbf{max}(C)$. As a result, combination with *just* gives rise to neither a precisifying nor an emphatic effect in this case.

4.3.4. Non-extreme MSAs: Case 3

The last case to consider is *just*'s interaction with non-extreme MSAs whose thresholds are scale endpoints. The value of such a threshold is always determinate and objective. For example, the highest possible degree of purity of H_2O_2 in (46) (repeated from (46)) is an objective fact about the world—not something that interlocutors can faultlessly disagree about. The threshold of *certain* in (47) is also objective: It is the degree of absolute certainty, where doubt is totally absent. In addition, it was noted in §4.1.3 that *perfect* has a use that involves an objective threshold, which is repeated in (48).

(46) a. This H_2O_2 is pure, #but not completely.
b. #This H_2O_2 is [**just**]$_F$ pure.

(47) a. John is certain that it will rain tomorrow, #but not completely.
b. #John is [**just**]$_F$ certain that it will rain tomorrow.

(48) a. John's score on the exam was perfect, #but not completely.
b. #John's score on the exam was [**just**]$_F$ perfect.

In these cases, the objective nature of the endpoint threshold prevents its value from varying between members of $\mathbb{S}_G$. Since our analysis takes the emphatic effect to depend on the subjective nature of $\mathbf{max}(C)$, it correctly predicts the emphatic effect to be absent in this case.

More puzzling is the fact that *just* appears to be unable to effect precisification in (46) and with other adjectives that have objective endpoint thresholds. We leave the explanation of this reading's unavailability to future work. It is possible that there is a competition between *just* and more restricted devices for effecting precisification at the scale endpoint, such as *completely* and *totally*.

5. Conclusion

We have proposed that when it combines with so-called maximum-standard adjectives, *just* uniformly effects a widening of the scale that is chosen for interpretation of the adjective at the

context. In the precisifying use, the scale is widened by making it more granular, while in the emphatic use, the scale is widened by increasing the highest scale degree under consideration at the context. This correctly predicts that the precisifying effect only arises with adjectives that have determinate thresholds. On the other hand, the emphatic effect only arises with extreme adjectives because their thresholds are subjectively variable and depend on what speakers *treat* as the endpoint of a scale. This also accounts for the fact that the same adjective such as *perfect* or *wrong* may or may not give rise to the emphatic effect in combination with *just* depending on whether it is construed subjectively or objectively.

Our analysis offers greater empirical coverage than existing analyses of emphatic *just*, which are unable to account for its non-uniform behavior across the class of MSAs. In this brief discussion, we have only engaged with the precisification-based analysis of the emphatic use that Beltrama (2021) offers, but we note that no other existing analysis (e.g. Warstadt, 2020; Windhearn, 2021) offers an explanation for why *just* gives rise to an emphatic effect with some MSAs in some contexts and a precisifying effect with other MSAs in other contexts. Crucially, there is no MSA whose combination with *just* gives rise to both the emphatic and the precisifying effect in different contexts.

The analysis in Deo and Thomas (forthcoming) is a further generalization of the scale-widening analysis proposed here. The generalization involves the consideration of a set of alternative construals of an underspecified question, and an ordering of this set along a scale of wideness. *Just* is taken to impose a requirement that the widest answerable construal of the underspecified question has been taken up for resolution. The emphatic and precisifying uses (only two among a much wider range of uses for *just*) arise in those contexts where the widest answerable construal is the one that is interpreted with respect to the widest scale.

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Exceptives and cardinality[1]

Tue TRINH — *Leibniz-Zentrum Allgemeine Sprachwissenschaft*

Abstract. There are two schools of thoughts on exceptives. The "Fintelians" take exceptives to be modifiers of the NP argument of the determiner, while the "Anti-Fintelians" take them to be something else. I present the observation that exceptives do not tolerate cardinal determiners. I then discuss the problem it poses for two Anti-Fintelian analyses and propose a Fintelian account. The main idea of the account is that exceptives introduce subdomain alternatives.

Keywords: exceptives, cardinality, alternatives.

1. Introduction

This paper is concerned with grammatical constructions of the kind exemplified by (1).

(1) all students except John and Mary came to the meeting

Here is some useful terminology: *all* is the 'determiner', *students* is the 'NP', *except John and Mary* is the 'exceptive', where *John and Mary*, i.e. the complement of *except*, is the 'exception', and *came to the meeting* is the 'VP'.[2] Basic facts about exceptives pertain to the inferences they license and the constraints on their distribution. There are three inferences associated with (1). Borrowing from Hirsch (2016) and Vostrikova (2021), I name them Containment, Negation, and Otherness.

(2)	a.	John and Mary are both students	Containment
	b.	Neither John nor Mary came to the meeting	Negation
	c.	all other students came to the meeting	Otherness

Containment says that NP is true of the exception. Negation says that VP is not true of the exception. Otherness says that VP is true of the complement of the exception in the NP.

Distributionally, exceptives have been observed to co-occur with universal but not with existential determiners, as evidenced by the contrast between (1) and (3).

(3) #some students except John and Mary came to the meeting

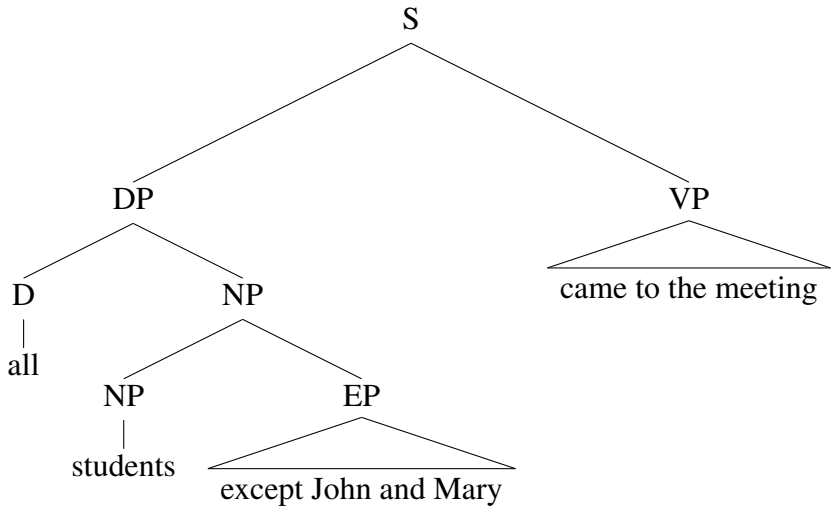
These basic facts set a criterion of observational adequacy for accounts of exceptive constructions. One way to distinguish between these accounts is to consider whether the exceptive is analyzed as modifier of the NP, i.e. whether (4) is the right syntax for (1). I write 'EP' for the exceptive.

[1]I thank Luka Crnič, Naomi Francis, Daniel Goodhue, Manfred Krifka, Clemens Mayr, Stephanie Solt, Katia Vostrikova and the audience at Sinn und Bedeutung 28 for valuable input and discussion. This work is supported by the ERC Advanced Grant "Speech Acts in Grammar and Discourse" (SPAGAD), ERC-2007-ADG 787929. All errors are my own.

[2]I will use these terms with systematic ambiguity: they are to refer to either the linguistic expressions in question or what these expressions denote, depending on the context. I hope no confusion arises.

 In: Baumann, Geraldine, Daniel Gutzmann, Jonas Koopman, Kristina Liefke, Agata Renans, and Tatjana Scheffler (eds.) 2024. Proceedings of Sinn und Bedeutung 28. Bochum: Ruhr-University Bochum, 912-923.

(4)



I will label as 'Fintelian' approaches which assume the structure in (4), alluding to the proposal made in von Fintel (1993).[3] Approaches which take the exceptive to be something other than modifier of NP will be called 'Anti-Fintelian'.

My goal in this note is three-fold. First, I will present an observation which has not been given attention in the literature. Second, I will discuss the problem it poses for two Anti-Fintelian analyses. Third and finally, I will propose a Fintelian account for this observation. The paper, then, can be read as providing an argument for the Fintelian analysis of exceptives.

1.1. A puzzle

So what is the observation in question? It is that exceptives are incompatible with cardinal determiners.[4] To illustrate, let me introduce the Simpson family, which has five members: Homer the father, Marge the mother, and the three children Bart, Lisa, and Maggie. Suppose Marge and the children went to the concert but Homer didn't. Consider the sentences in (5).

(5) a. all members of the Simpson family except Homer went to the concert
b. #all five members of the Simpson family except Homer went to the concert

My intuition, which is shared by native speakers of English I have consulted, is that there is a contrast between (5a) and (5b): the former is unremarkably acceptable, while the latter is decidedly odd.

Here is another example. We are now talking about soccer.[5]

[3]Note that von Fintel (1993) actually ends up analyzing the exceptive as modifier of D, not NP. However, von Fintel's analysis can easily be reconstructed as 'Fintelian' in the sense specified here, and his reasons for letting the exceptive be modifier of D pertain to considerations not relevant to our discussion. Subsequent analyses which acknowledge von Fintel (1993) as precursor and basis also view the exceptive as NP modifier (cf. Gajewski, 2008; Hirsch, 2016; Crnič, 2018).

[4]The observation is mentioned briefly in a footnote in Moltmann (1995: p. 228). Moltman speculates, in the same footnote, that it "may be attributed to a pragmatic condition which prohibits entities which are explicitly mentioned as verifiers (at least in number) not to also be specified as exceptions in one and the same NP." She does not discuss the observation any further.

[5]The common ground is that every soccer team has exactly eleven players and, also, that Messi and Otamendi are

(6) a. all eleven Argentinian players received a yellow card
b. #all eleven Argentinian players except Messi and Otamendi received a yellow card

Again, we observe a contrast, with the sentence containing the numeral being odd. Note a difference between (6) and (5): in (5) both sentences contain an exceptive but only one contains a numeral, while in (6) both sentences contain a numeral but only one contains an exceptive. Taken together, (5) and (6) provide conclusive evidence that it is the *co-occurence* of the numeral and the exceptive that causes oddness. In other words, someone with no intuition about English might conclude from (5) alone that numerals cannot co-occur with *all*, and from (6) alone that exceptives cannot co-occur with *all*. However, confronted with both (5) and (6), she would have to conclude that numerals and exceptives can co-occur with *all* independently but not jointly.

Here is yet another example. This time we will consider a full paradigm with sentences containing (i) no numeral and no exceptive, (ii) a numeral but no exceptive, (iii) an exceptive but no numeral, and (iv) both a numeral and an exceptive.

(7) a. all members of The Beatles gave an interview
b. all members of The Beatles except John Lennon gave an interview
c. all four members of The Beatles gave an interview
d. #all four members of The Beatles except John Lennon gave an interview

I will assume that cardinal determiners such as *all eleven* express a relation between sets and, at the same time, impose a 'cardinality requirement' on their restriction. In other words, *all eleven P Q* is equivalent to *all P Q* if $|P| = 11$, i.e. if P is true of exactly eleven entities, and undefined otherwise.

(8) a. $[\![\text{all}]\!] = \lambda P.\ \lambda Q.\ \forall x : Px \rightarrow Qx$
b. $[\![\text{all eleven}]\!] = \lambda P : |P| = 11.\ \lambda Q.\ \forall x : Px \rightarrow Qx$

Note that we have considered cardinal determiners which are morphologically complex, consisting of *all* and a numeral. What about the morphologically simple *both*, which has the same meaning as *all* provided its complement denotes a set with exactly two elements?

(9) $[\![\text{both}]\!] = \lambda P : |P| = 2.\ \lambda Q.\ \forall x : Px \rightarrow Qx$

The contrast in (10) shows that *both* is also incompatible with exceptives.

(10) a. both parents of the boy came to the meeting
b. #both parents of the boy except his father came to the meeting

1.2. A quick but wrong solution

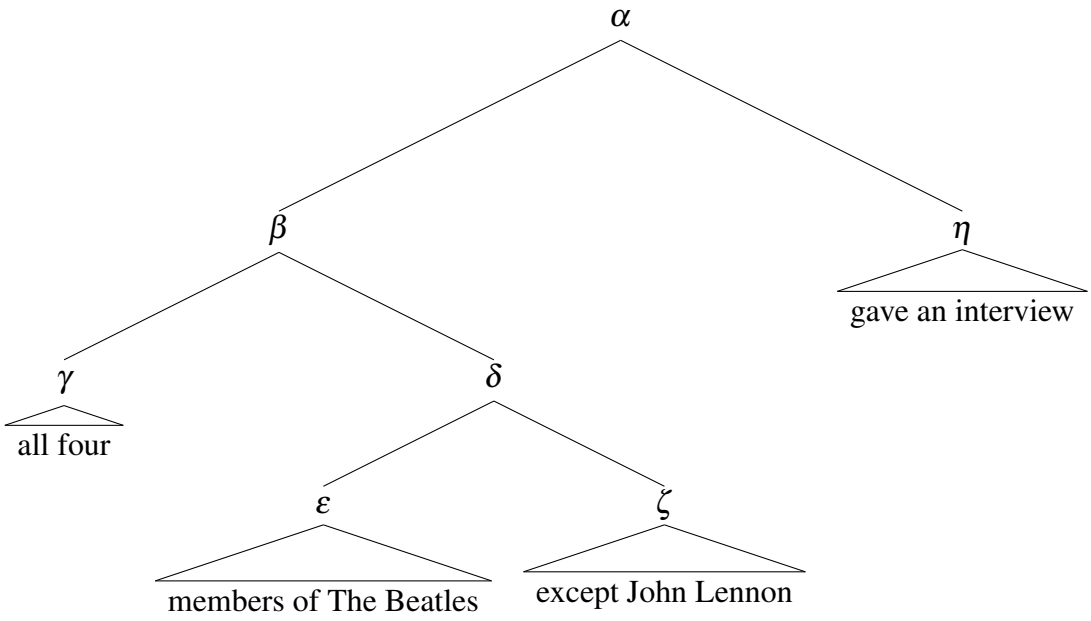
Here's a thought. Suppose the Fintelian structure is correct. Furthermore, suppose exceptives have a 'subtractive semantics' as assumed in several works (cf. von Fintel, 1993; Gajewski, 2008; Hirsch, 2016; Crnič, 2018).

Argentinian. I relegate this information to a footnote because I assume, perhaps wrongly, that readers of this paper are more knowledgable about soccer than about American cartoon series.

(11) $[\![\text{A except B}]\!] = [\![\text{A}]\!] \setminus [\![\text{B}]\!]$
i.e. the set of things that are A but not B

The oddness of (5b), (6b), (7d) and (10b) is now a consequence of these sentences being undefined. To illustrate, consider (7d) again. The syntactic structure is (12).

(12)



We have $[\![\varepsilon]\!] = \{$John Lennon, Paul McCartney, George Harrison, Ringo Starr$\}$, $[\![\delta]\!] = [\![\varepsilon]\!] \setminus \{$John Lennon$\} = \{$Paul McCartney, George Harrison, Ringo Starr$\}$.[6] This means $|[\![\delta]\!]| = 3$, which means β is undefined, which means α is undefined.

Similar arguments can be made for (5b), (6b) and (10b), reproduced in (13a), (13b) and (13c), respectively. I will label the NPs with the cardinality of the set they denote.

(13) a. #all five $[_4$ $[_5$ members of the Simpson family] [except Homer]] went to the concert
b. #all eleven $[_9$ $[_{11}$ Argentinian players] [except Messi and Otamendi]] received a yellow card
c. #both $[_1$ $[_2$ parents of the boy] [except the father]] went to the meeting

As plausible as this story may seem, it does not work. It overgenerates: the incompatibility of cardinal determiners and exceptives persists under changes made to the numeral or to the NP which would give the sister of D the necessary cardinality. Consider the sentences in (14).

(14) a. #all four $[_4$ $[_5$ members of the Simpson family] [except Homer]] went to the concert
b. #all nine $[_9$ $[_{11}$ Argentinian players] [except Messi and Otamendi]] received a yellow card
c. #all three $[_3$ $[_4$ members of The Beatles] [except John Lennon]] gave an interview
d. #both $[_1$ $[_2$ members of the Beaux Arts Trio] [except Menahem Pressler]] went to the meeting

These sentences are as odd as (5b), (6b), (7d) and (10b), even though the sister of D is of the required cardinality.

[6] I assume names can be 'type-shifted' from *e* to *et* (Partee, 1986).

1.3. The generalization

Our hope was to explain the oddness of (15a) as having the same cause as the oddness of (15b), namely a 'cardinality mismatch' between D and its NP complement.

(15) a. #all four members of The Beatles except John Lennon gave an interview
b. #all five members of The Beatles gave an interview

A crucial ingredient in the explanation is the analysis of exceptives as 'subtractive' modifiers of NPs. This analysis squares well with our intuition: when I am talking about *all members of The Beatles except John Lennon*, I am obviously talking about Paul McCartney, George Harrison and Ringo Starr, i.e. about those members of The Beatles who are not John Lennon.

But the hope has been dashed. The problematic data point is the oddness of (16).

(16) #all three members of The Beatles except John Lennon gave an interview

What (16) teaches us is that exceptives are deviant with any cardinal determiners, no matter what the number is. The examples we have considered so far have all involved encyclopedic knowledge: the Simpsons, The Beatles, soccer, reproduction. Such examples were chosen based on the initial assumption that numbers do matter. But they really don't. This is corroborated by the contrast in (17), which does not relate to encyclopedic knowledge.

(17) a. all six students came to the party
b. #all six students except John came to the party

Let us state the generalization we want to derive.

(18) Generalization
Cardinal determiners do not tolerate exceptives

2. Two anti-Fintelian analyses

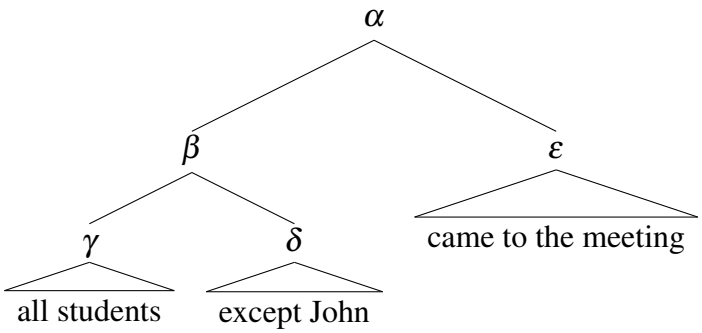
Maybe what has led us astray is our intuition that exceptives are subtractive NP modifiers. In this section I will discuss two Anti-Fintelian analyses according to which exceptives do not modify NP. The first is Moltmann (1995), which takes exceptives to modify quantifiers. The second is Vostrikova (2021), which takes exceptives to be an eliptical adverbial clauses. I will show that while both of these analyses account for the basic facts about exceptives, they do not account for (18).

2.1. The DP modifier analysis

Moltmann (1995) proposes that the exceptive phrase is a modifier of quantifiers. She assigns (19a) the structure in (19b).

(19) a. all students except John came to the meeting

b.



Moltman assumes the standard interpretation of the quantifier γ as the set of predicates which are supersets of the set of students.

(20) $[\![\gamma]\!] = \{P \mid [\![\text{student}]\!] \subseteq P\}$

She then proposes a procedure to interpret the 'modified quantifier' β. For the purpose of this discussion, an informal presentation suffices.

(21) Deriving $[\![\beta]\!]$
- a. take the set of predicates in $[\![\gamma]\!]$
- b. remove John from *each* of those predicates
- c. the result is $[\![\beta]\!]$

Crucially, the step in (21b) is meant to require that John be an element of *each* predicate in $[\![\gamma]\!]$. The idea is that if there is a predicate in $[\![\gamma]\!]$ which does not contain John, β will not be interpretable. This view on how exceptives modify quantifers turns out to explain all the basic facts about exceptives. Suppose a, b, and c are students while d and e are not, and suppose that these five are our universe of discourse. Consider the three cases below.

(22) #[$_\alpha$ [$_\beta$ [$_\gamma$ some students] except b] came to the meeting]
- a. $[\![\gamma]\!] = \{\{a,d,e\},\{b,d,e\},\{c,d,e\},\{a,b,d,e\},...\}$
- b. β is uninterpretable because b cannot be removed from *each* predicate in $[\![\gamma]\!]$

(23) #[$_\alpha$ [$_\beta$ [$_\gamma$ all students] except d] came to the meeting]
- a. $[\![\gamma]\!] = \{\{a,b,c\},\{a,b,c,d\},\{a,b,c,e\},\{a,b,c,d,e\}\}$
- b. β is uninterpretable because d cannot be removed from *each* predicate in $[\![\gamma]\!]$

(24) [$_\alpha$ [$_\beta$ [$_\gamma$ all students] except b] came to the meeting]
- a. $[\![\gamma]\!] = \{\{a,b,c\},\{a,b,c,d\},\{a,b,c,e\},\{a,b,c,d,e\}\}$
- b. $[\![\beta]\!] = \{\{a,\not{b},c\},\{a,\not{b},c,d\},\{a,\not{b},c,e\},\{a,\not{b},c,d,e\}\}$
- c. $[\![\alpha]\!] = 1$ iff $[\![\text{came to the meeting}]\!] \in [\![\beta]\!]$

In (22), we have an existential determiner, and in (23), we have an exception that is not a student. In both cases, step (21b) is undefined, as the exception is not an element of *each* predicate in the unmodified quantifier. Uninterpretability results, and the sentence is deviant. Thus, Moltman accounts for the distributional fact that exceptives are incompatible with existential quantifiers and the inference that the NP must be true of the exception, i.e. Containment. Looking at (24), we can see that Moltman also accounts for Negation and Otherness: (24b) and (24c) together entails that b did not come to the meeting and that every other students did.

Does Moltman account for the generalization in (18)? The answer, as it turns out, is no. Consider (25), keeping to our scenario where the students are a, b, and c.

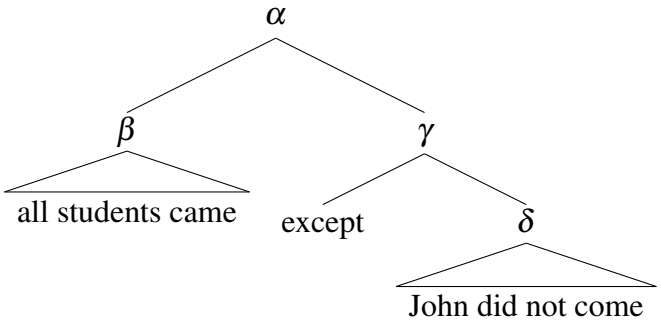
(25) $[_\alpha\ [_\beta\ [_\gamma$ all three students] except b] came to the meeting]
- a. $[\![\text{all three}]\!] = \lambda P : |P| = 3.\ \{Q \mid P \subseteq Q\}$
- b. $[\![\gamma]\!] = \{\{a,b,c\},\{a,b,c,d\},\{a,b,c,e\},\{a,b,c,d,e\}\}$
- c. $[\![\beta]\!] = \{\{a,\cancel{b},c\},\{a,\cancel{b},c,d\},\{a,\cancel{b},c,e\},\{a,\cancel{b},c,d,e\}\}$
- d. $[\![\alpha]\!] = 1$ iff $[\![\text{came to the meeting}]\!] \in [\![\beta]\!]$

As we can see, the sentence is predicted to be fine if there are three students. The problem here is that D imposes its cardinality requirement on NP only. As long as NP satisfies this requirement, modification of DP by the exceptive, and subsequent steps in the interpretation process, can proceed unimpeded.

2.2. The clausal analysis

Vostrikova (2021) takes the exceptive phrase to be an eliptical clause.[7] Specifically, the sentence in (26) has the PF in (26a), where ~~strikethrough~~ indicate phonological deletion, and the LF in (26b).

(26) all students except John came
- a. all students [except John ~~did not come~~] came
- b.



The truth condition of (26b) has three clauses and is given in (27), where w_0 stands for the actual world.[8]

(27) $[\![\alpha]\!]^{w_0} = 1$ iff
- a. $[\![\delta]\!]^{w_0} = 1$
- b. $\forall w.\ [\![\delta]\!]^w = 1 \rightarrow [\![\text{all}]\!]^w([\![\text{students}]\!]^{w_0})([\![\text{came}]\!]^w) = 0$
- c. $\forall w.\ \big([\![\delta]\!]^w = 0 \wedge [\![\text{came}]\!]^w \backslash \{j\} = [\![\text{came}]\!]^{w_0} \backslash \{j\}\big)$
  $\rightarrow [\![\text{all}]\!]^w([\![\text{student}]\!]^{w_0})([\![\text{came}]\!]^w) = 1$

The first clause, (27a), says that John did not come. This is Negation. The second clause, (27b), says that any world where John did not come is a world where not every actual student came, i.e. a world where at least one actual student did not come. For this to hold, John must be an

[7] I will present a simplified version of her theory. The reader is invited to consult the paper to see that the simplification does not affect the point being made.

[8] Vostrikova proposes a way to derive the truth condition compositionally from a much more complicated LF. See note 7.

actual student. This is Containment. And the last clause, (27c), says this: suppose that John had come and, furthermore, suppose that the set of people who are not John and who came remains unchanged, then it would be the case that all students came. This is Otherness, as it amounts to saying that every other student came.

Vostrikova also accounts for the distribution of exceptives, i.e. for the deviance of (28a), whose LF is (28b) and whose truth condition is predicted to consist of the three clauses in (29).

(28) a. #some students except John came
b. $[_\alpha\ [_\beta$ some student came$]\ [_\gamma$ except $[_\delta$ John did not come$]]]$

(29) $[\![\alpha]\!]^{w_0} = 1$ iff
a. $[\![\delta]\!]^{w_0} = 1$
b. $\forall w.\ [\![\delta]\!]^{w} = 1 \rightarrow [\![\text{some}]\!]^{w}([\![\text{students}]\!]^{w_0})([\![\text{came}]\!]^{w}) = 0$
c. $\forall w.\ \big([\![\delta]\!]^{w} = 0 \wedge [\![\text{came}]\!]^{w} \backslash \{\text{j}\} = [\![\text{came}]\!]^{w_0} \backslash \{\text{j}\}\big)$
$\rightarrow [\![\text{some}]\!]^{w}([\![\text{students}]\!]^{w_0})([\![\text{came}]\!]^{w}) = 1$

While (29a) is unprolemantic, (29b) and (29c) together entail that John is the only student. Basically, (29b) says if John did not come then no student came, and (29c) says if John came then some student came. But if there is a unique student, the use of *some* would violate Maximize Presupposition (Heim, 1991). Thus, (28a) is deviant.

Does Vostrikova account for the generalization in (18)? Let us replace *all* with *all seven* and see what happens.

(30) #$[_\alpha\ [_\beta$ all seven students came$]\ [_\gamma$ except $[_\delta$ John did not come$]]$

(31) $[\![\alpha]\!]^{w_0} = 1$ iff
a. $[\![\delta]\!]^{w_0} = 1$
b. $\forall w.\ [\![\delta]\!]^{w} = 1 \rightarrow [\![\text{all seven}]\!]^{w}([\![\text{students}]\!]^{w_0})([\![\text{came}]\!]^{w}) = 0$
c. $\forall w.\ \big([\![\delta]\!]^{w} = 0 \wedge [\![\text{came}]\!]^{w} \backslash \{\text{j}\} = [\![\text{came}]\!]^{w_0} \backslash \{\text{j}\}\big)$
$\rightarrow [\![\text{all seven}]\!]^{w}([\![\text{students}]\!]^{w_0})([\![\text{came}]\!]^{w}) = 1$

The truth condition, simplified, is this: (i) John did not come; (ii) if John did not come, one of the seven students did not come; (iii) if John came, all seven students came. As long as there are seven students, there is nothing wrong with the truth condition, and the sentence is predicted to be acceptable, contrary to fact. Thus, the clausal analysis proposed by Vostrikova (2021) does not account for the generalization in (18).

3. Proposal

In this section I will propose an account for (18). My proposal is in the same spirit as those by Gajewski (2008); Hirsch (2016); Crnič (2018). Specifically, I assume that exceptives are subtractive NP modifiers.

(32) $[\![[_{\text{NP}}$ students [except John and Mary]$]]\!] = [\![\text{students}]\!] \backslash \{j, m\}$

Furthermore, I assume that exceptives associate with EXH, which assigns 1 to its prejacent and assigns 0 to every alternative which is defined and not entailed by the prejacent.

(33) EXH [all students [except John and Mary]$_{\mathrm{F}}$ came]

(34) $[\![\text{EXH S}]\!] = 1$ iff
  a. $[\![\text{S}]\!] = 1$
  b. $\forall \text{S}' \in \text{ALT(S)} : [\![\text{S}]\!] \not\subseteq [\![\text{S}']\!] \wedge [\![\text{S}']\!] \neq \# \rightarrow [\![\text{S}']\!] = 0$

EXH comes with a 'non-idleness' requirement: it gives rise to deviance if it is semantically vacuous (cf. Hirsch, 2016).

(35) Non-Idleness
  [EXH S] is deviant if [EXH S] $\Leftrightarrow$ S

The final, and crucial, ingredient in the analysis is the following claim about alternatives.

(36) Alternatives of exceptives
  Exceptives introduce subdomain alternatives

I understand the term 'subdomain alternatives' in the familiar way: these are alternatives derived by replacing a set with one of its subsets. Using the standard notation for set subtraction, I will represent *students except John and Mary*, at the relevant level of analysis, as '$students\backslash\{j,m\}$', which denote the set of students that are neither John (j) nor Mary (m). The subdomain alternatives of (37) would then be all those propositions in which $\{j,m\}$ is replaced by $\{j,m\}$, $\{j\}$, $\{m\}$, or $\{\ \}$, i.e. those marked with ✓. Those marked with ✗ are not subdomain alternatives of (37): they are not derived from (37) by replacing $\{j,m\}$ with one of its subsets.

(37) all students except John and Mary came = all students$\backslash\{j,m\}$ came
  a. all students$\backslash\{j,m\}$ came ✓
  b. all students$\backslash\{j\}$ came ✓
  c. all students$\backslash\{m\}$ ✓
  d. all students$\backslash\{\ \}$ came ✓
  e. all students$\backslash\{j,b\}$ came ✗
  f. all students$\backslash\{b,m\}$ came ✗
  g. all students$\backslash\{b\}$ ✗

Let us show how this analysis accounts for Containment, Negation and Otherness. Consider, again, the sentence in (38). By hypothesis, (38) has S as its logical form, in which EXH takes A as its prejacent. The subdomains alternatives of A are B, C, and D in addition to A itself.

(38) all students except John and Mary came
  S = EXH [$_{\mathrm{A}}$ all students$\backslash\{j,m\}$ came]
  A = all students$\backslash\{j,m\}$ came
  B = all students$\backslash\{j\}$ came
  C = all students$\backslash\{m\}$ came
  D = all students$\backslash\{\ \}$ came

Given the interpretation of EXH in (34), and the logical fact that A entails none of B, C and D, we derive the following truth condition for S.

(39) $[\![\text{S}]\!] = 1$ iff
  a. $[\![\text{A}]\!] = 1$
  b. $[\![\text{B}]\!] = [\![\text{C}]\!] = [\![\text{D}]\!] = 0$

Otherness follows directly from (39a), which says that every student other than John and Mary came. Let us derive Containment and Negation. Suppose that John is not a student. Then $students\backslash\{j,m\} = students\backslash\{m\}$, which means A = C, which contradicts (39). Thus, John is a student. Now suppose Mary is not a student, then $students\backslash\{j,m\} = students\backslash\{j\}$, which means A = B, which also contradicts (39). Thus, both John and Mary are students. We explain Containment.

Suppose John came. Then $students\backslash\{j,m\} \subseteq came$ if and only if $students\backslash\{m\} \subseteq came$, which means A = C, which contradicts (39). Thus, John did not come. Now suppose Mary came. Then $students\backslash\{j,m\} \subseteq came$ if and only if $students\backslash\{j\} \subseteq came$, which means A = B, which also contradicts (39). Thus, neither John nor Mary came. We explain Negation.

Can we derive the distribution of exceptives, i.e. the fact that they are deviant under existential quantifiers? The answer is yes. Consider (40).

(40) #some students except John and Mary came
S = EXH [$_A$ some students$\backslash\{j,m\}$ came]
A = some students$\backslash\{j,m\}$ came
B = some students$\backslash\{j\}$ came
C = some students$\backslash\{m\}$ came
D = some students$\backslash\{\ \}$ came

The logical form is S, consisting of EXH and its prejacent A. The subdomains alternatives of A are B, C, and D in addition to A itself. Since the determiner is existential *some*, A entails all of its subdomain alternatives, which means that EXH is semantically vacuous. The sentence violates Non-Idleness, which explains its deviance.

Let us now derive the generalization in (18), repeated below in (41).

(41) Generalization
Cardinal determiners do not tolerate exceptives

Consider (42), which has S as logical form.

(42) #all seven students except John and Mary came
S = EXH [$_A$ all seven students except John and Mary came]
A = all seven students$\backslash\{j,m\}$ came
B = all seven students$\backslash\{j\}$ came
C = all seven students$\backslash\{m\}$ came
D = all seven students$\backslash\{\ \}$ came

Suppose there are nine students, i.e. $|student| = 9$. Then B, C, and D are all undefined, because *all seven* requires that its complement denote a set of cardinality 7, but $|students\backslash\{j\}| = |students\backslash\{m\}| = 8$ and $|students\backslash\{\ \}| = 9$. EXH is then semantically vacuous, and the sentence is deviant because it violates Non-Idleness. Now suppose $|student| \neq 9$. Then A is undefined, because $|students\backslash\{j,m\}| = 7$ iff $|student| = 9$. And if A is undefined, S is deviant. Thus, S is deviant if there are nine students and if there are not nine students. We have derived (41).

4. Loose ends

I have proposed an account for the generalization that cardinal determiners do not tolerate exceptives. The account also derive other basic facts about exceptives, specifically the inferences they license (Containment, Negation, Otherness) and their inability to occur under existential quantifiers.

My analysis borrows from several others within the Fintelian approach (Gajewski, 2008; Hirsch, 2016; Crnič, 2018). The novel insight here, I believe, is (36), i.e. the claim that exceptives introduce subdomain alternatives in the sense clarified above. I have shown how it works to give us the right results. The reader may, however, ask whether abandoning the claim would give us the wrong result. Let us address this question. Suppose exceptives introduce standard Katzirian alternatives, which are generated by way of both deletion and substitution and thus include more than just the subdomain alternatives (Katzir, 2007; Fox and Katzir, 2011), as illustrated by (43) below.[9]

(43) #all seven students except John and Mary came
- S EXH $[_{\text{A}}$ all seven students except John and Mary came$]$
- A all seven students$\backslash\{j,m\}$ came
- B all seven students$\backslash\{j,b\}$ came
- C all seven students$\backslash\{b,m\}$ came
- D all seven students$\backslash\{m,b\}$ came
- E all seven students$\backslash\{j\}$ came
- F all seven students$\backslash\{m\}$ came
- G all seven students$\backslash\{b\}$ came
- H all seven students$\backslash\{\ \}$ came

Suppose there are nine students, three of whom are John (j), Mary (m), and Bill (b). Then A, B, C and D will be defined while E, F, G and H will be undefined. EXH will negate the defined and non-entailed alternatives, leaving the undefined alone. This means S will have the following truth condition.

(44) $[\![\text{S}]\!] = 1$ iff
- a. $[\![\text{A}]\!] = 1$
- b. $[\![\text{B}]\!] = [\![\text{C}]\!] = [\![\text{D}]\!] = 0$

We would then not be able to derive the deviance of (43) from Non-Idleness. Thus, the benefit of limiting alternatives of exceptives to subdomain alternatives is that once there is a cardinal determiner, either the prejacent will be undefined or *all* of the alternatives (except the prejacent itself) will be undefined. In the first case, the sentence is deviant because it contains an undefined constituent. In the second case, it is deviant because it violates Non-Idleness.

I will end with some issues for further research. First, it has been reported to me by native speakers that there is a contrast in (45).

(45) a. all four hundred students except John came
b. #all four hundered and one students except John came

[9] Such a view on alternatives of exceptives is adopted by Hirsch (2016), which did not discuss cardinal determiners.

The difference between *four hundred* and *four hundred and one* is that the first can be read as 'approximately 400' while the second has to be read as 'exactly 401'. In other words, *four hundred* can be vague, while *four hundred and one* must be precise (Krifka, 2002, 2007). How precision can be factored in is a question I hope to return to.

Another intriguing observation is that the smaller the ratio NP/EP is, the less acceptable EP is.

(46) a. all members of congress except the most radical leftists voted for the bill
b. #all members of congress except the democrats voted for the bill

I also leave this to future work.

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Effects of iconicity and monotonicity on licensing complement anaphora[1]

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Abstract. Complement anaphora is generally only licensed by downward monotone quantifiers, like 'few' (Nouwen, 2003). Yet, sign language data suggest that the use of iconic "loci" can license complement anaphora with upward monotone quantifiers like 'most' (Schlenker, 2012; Schlenker et al., 2013). This paper tests the hypothesis that the iconic nature of loci would extend to iconic uses of space in co-speech gestures in English. We hypothesised that, when accompanied by iconic co-speech gestures, complement anaphora will be licensed with upward monotone quantifiers, and will be degraded with downward monotone ones. We designed an experiment testing downward and upward monotone quantifiers with and without gesture, and found a significant effect of both gesture and quantifier type, as well as an interaction between the two. Our results show that iconicity affects complement anaphora licensing, and has the inverse effect of monotonicity. We suggest that the iconicity effects are not sign language specific, but are instead more broad, having to do with how humans interpret iconicity in language. We further argue that iconic co-speech gestures trigger an iconic inference of existence, along the lines of what has been suggested for iconic loci in ASL (Kuhn, 2020).

Keywords: complement set, anaphora licensing, co-speech gestures, monotonicity, iconicity.

1. Introduction

Pronouns, like 'they', 'he', 'she', have what we call *anaphoric* uses in the sense that they can co-refer with a previously established *antecedent* in the discourse, via which we resolve the pronoun's interpretation. For example, in the following sentence the pronoun 'she' shares the same referent as 'Mary', indicated by the shared indices i:

(1) Mary$_i$ wore a red dress. She$_i$ was great!

Natural language also makes use of quantifiers, such as 'most' and 'few'. Quantifiers relate two sets, e.g. $Q(R)(S)$, where R is their restrictor and S their scope. In the examples below, R is the set of students and S is the set of people who came to class, and the quantifier Q (most/some) relates these two sets.

(2) Most students came to class.

(3) Few students came to class.

How does pronominal anaphora interact with quantificational noun phrases? A pronoun following a quantified noun phrase can refer to the *reference set* $R \cap S$, i.e., the students that came to class, as below:

(4) Few students came to class. They were at least very active!

[1]We would like to thank Chloe Frey for recording the videos used in the experiment, the audience at the Meaning & Modality Lab, as well as at Sinn und Bedeutung, Amir Anvari and Philippe Schlenker for valuable discussions, and Jon Lamberton for giving us permission to share his ASL video recordings.

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A pronoun can also refer to the *maximal* set R, i.e. the whole set of students/the restrictor.

(5) Few students came to class. But they all submitted a final paper.

Are these the only available sets? Is the *complement* set, i.e. the set that includes elements in $R \cap \neg S$, an available referent?[2] In spoken languages, the claim is that the complement set can be referred to only with negative quantifiers, like 'few', but not with positive ones like 'most'. So, it has been claimed that quantifier *monotonicity* plays a role in licensing anaphora for complement sets (henceforth CA) (Moxey and Sanford, 1993; Sanford et al., 1994; Nouwen, 2003). Interestingly, in sign languages, iconicity has also been argued to support licensing of CA (Schlenker, 2012; Schlenker et al., 2013). This paper tests the hypothesis that iconicity as found in co-speech gestures can support CA in spoken language too.

2. Complement anaphora

It has been claimed that, in contrast to reference or maximal set anaphora, complement Anaphora is in general less available and needs to be forced by the context (Nouwen, 2003). In an out of the blue scenario, we would not interpret a pronoun as being anaphoric to the complement set, unless the only referent that can make the sentence true is the complement set one. Thus, we will focus on examples where a pronoun can only plausibly be anaphoric to the complement set, investigating what factors can influence licensing. In what follows, we examine the role of monotonicity and iconicity in licensing.

2.1. The role of monotonicity

Quantifiers have a restrictor R and a scope S: $Q(R)(S)$. They can be upward (e.g., *most*) or downward (e.g., *few*) monotonic on their scope S:

(6) $Q(R)(S)$ is upward monotonic on its scope S, if for all $S \subseteq S'$ $Q(R)(S')$ also holds.

For example, "most" is such a quantifier, since whenever we have "Most girls run fast" being true, it must also be the case that "Most girls run"; and $\{x : x$ is a girl who runs fast$\} \subset \{x : x$ is a girl who runs$\}$. We will call such quantifiers *positive* quantifiers for short, although it is known that it is their entailment patterns and not any negative valence which has this effect.

A quantifier can also be downward (e.g., *few*) monotonic on its scope S:

(7) $Q(R)(S)$ is downward monotonic on its scope S, if for all $S' \subseteq S$ $Q(R)(S')$ also holds.

For instance, "few" is such a quantifier, since whenever we have "Few girls run" being true, it must also be the case that "Few girls run fast"; and $\{x : x$ is a girl who runs fast$\} \subset \{x : x$ is a girl who runs$\}$. We will call such quantifiers *negative* quantifiers.

Whether a quantifier is positive or negative plays a role in licensing anaphora. More specifi-

[2]Just like in mathematics, a complement set is a set that includes all the elements of the universal set that are not present in the given set. Here, we will use complement set to refer to individuals that are in the restrictor but not in the nuclear scope of the quantifier.

cally, anaphora can be licensed to the maximal (R ∩ S) and the restrictor set (R), but not the complement set (R ∩¬S) with positive quantifiers (Moxey and Sanford, 1993; Sanford et al., 1994; Nouwen, 2003):

(8) Most students came to class. They were very engaged in the discussion. *maximal set*

(9) Most students came to class. But they all submitted a final paper. *restrictor set*

(10) #Most students came to class. They stayed home instead. *complement set*

On the contrary, CA is often reported to be licensed with downward monotonic quantifiers:

(11) (Very) few students came to class. They stayed home instead. *complement set*

Thus, quantifier monotonicity seems to affect CA licensing. Is it the only relevant factor? In what follows, we will see that iconicity has the opposite effect of monotonicity in ASL, licensing CA with positive quantifiers (and will see the same with iconic co-speech gestures too).

2.2. The role of iconicity

Based on data from spoken languages, the correct predictor for the availability of CA seems to be downward monotonicity, i.e., whether a quantifier is negative. However, data from ASL suggest that iconicity plays a role in CA licensing too. To establish an anaphoric antecedent, sign languages like American Sign Language (ASL) make use of *loci*, which are specific locations in signing space. After establishing the loci, the signer then points back at them (an indexical sign IX) to establish pronominal reference. The use of space can be either default, or iconically motivated.

In the case of default loci, the signer establishes a default locus (in the signing space in front of them) and then refers back to it by pointing. CA with default loci that do not take advantage of spatial iconicity in sign language work like in spoken languages. In these cases, positive quantifiers are reported to be degraded with CA (Schlenker, 2012):[3]

(12) *POSS-1 STUDENT MOST a-CAME CLASS. IX-arc-a a-STAY HOME.
Intended: 'Most of my students came to class. They stayed home.'

The relevant sentence can be found between seconds 0:25 and 0:31 in this video. The signer does not use a locus to represent the set of students, but instead simply uses the signs MOST and STUDENT. Then he uses a plural pronoun, IX-arc-a, to refer to the complement set. This is an unacceptable sentence, just like it would be in English with the positive quantifier *most*.

What if non-default and iconic loci, i.e., loci in marked locations of signing space, are used? In this case, another anaphoric strategy would be used. More specifically, the signer would establish a large plural locus *A*, the restrictor, denoting the set of all students, and then a sublocus *a*, the maximal set, denoting the students who came. In contrast to the default case, Schlenker (2012) reports that this strategy makes available a locus for the complement set, i.e.,

[3]Schlenker (2012); Schlenker et al. (2013) gives acceptability judgments on a 7-point Likert scale. (12) received an average of 2.8/7. For the sake of comparison with our previous examples, we notate it as a star (*).

$A - a(= b)$. The notation in the gloss is A as ab (since $A = a \cup b$):[4]

(13) POSS-1 STUDENT IX-arc-ab MOST IX-arc-a a-CAME CLASS. IX-arc-b b-STAY HOME
'Most of my students came to class. They stayed home.'

The relevant sentence can be found between seconds 0:00 and 0:08 in this video. The signer establishes a big set in space, IX-arc-ab, the set of students. Then, he establishes a subset of that big set, IX-arc-a, the set of students who came. Finally, he points, using plural pointing, to the complement set, IX-arc-b.

Interestingly, when the signer explicitly signs the superset that is the restrictor and the subset that is the maximal set, denoting the intersection of the restrictor and the scope, CA becomes available. Choosing this depictive non-default strategy of signing loci makes CA felicitous with positive, upward monotone, quantifiers like *most* which otherwise do not support CA.

3. Testing the effect of co-speech gestures

We have seen that quantifier monotonicity plays a role in CA licensing. We also saw that the depictive use of space makes a locus for the complement set available in ASL. The natural question is whether this is a language specific fact (about ASL), a language modality fact (about sign languages), or a semiotic fact (about depictive iconicity). To this end, we test the effect in iconic co-speech gestures to English sentences and ask: would CA be licensed then?

3.1. Research question

The ASL data show that iconicity found in sign language loci can support licensing of CA. Can we replicate the pattern in spoken language, with *iconic co-speech gestures* playing the role of iconic loci? In other words, can iconicity license CA in spoken languages too?

To address this question, we designed a study involving gestural near-equivalents to the iconic loci used in the ASL examples. We thus had a wide gesture introducing the reference set, a contrastive co-speech gesture to the right introducing the maximal set, and a contrastive co-speech gesture to the left introducing the complement set (see Figure 1 below). This sort of gesture does not depict directly in the way of manner or size and shape depictions (e.g. a gesture for the size of a large a plate for example) but indirectly, via a diagram in space. To interpret any iconicity in the gesture, we need to first map the set-theoretic relations between discourse referents from space to a diagram and then interpret the diagram, mapping it to relations between discourse referents (Schlenker et al., 2013). Thus, we used (indirectly depictive) iconic co-speech gestures directly mirroring what the iconic loci where doing in the ASL case.[5]

[4]Again, for reference the numeric judgments was 6.3/7.

[5]The only difference is that in the co-speech gestures the palm is open rather than using a pointing index finger. This is because pointing in ASL is grammaticalized, but not in co-speech gesture; in fact, our intuitions were that pointing in co-speech gestures has to be directly (or indirectly) referential, and was thus odd in our examples, where the relevant discourse referents are not in front of the speaker.

We hypothesized that CA *is licensed by positive/upward monotone quantifiers only when accompanied by iconic co-speech gestures*. The latter would play the role of iconic non-default loci in spoken language in depictively establishing an antecedent for the complement set. If this is the case, then this would suggest that it is not a property of sign language loci that made CA available in the ASL case. If it replicates with co-speech gestures, then it is rather a property of iconic use of space, which makes the relevant discourse referent available.

We further hypothesized that, *when co-speech gestures are added,* CA *licensing with negative/ downward monotone quantifiers may be less natural* due to the incompatibility of iconic language with negation (Ebert and Ebert, 2016; Kuhn, 2020; Davidson, 2023; Ebert, 2023), which in the case of negative quantifiers is part of their meaning. To test these hypotheses, we designed an experiment testing the acceptability of CA using the presence/absence of iconic co-speech gestures and quantifier monotonicity as the relevant factors.

3.2. Experimental design

We designed an online survey (administered via Qualtrics software) with 4 monotone increasing and 4 monotone decreasing quantifiers in pairs, counterbalanced via Latin square:

Downward monotone	Upward monotone
Few	A few
Not nearly enough	Most
Hardly any	Some
Nearly no	Nearly every

Table 1: Tested quantifier pairs.

Each quantifier appeared with and without gesture, giving rise to four conditions. In the gesture condition, inspired by the use of non-default loci, a wide gesture in the neutral space introduced the reference set, a marked gesture to the right the maximal set, and another gesture to the left the complement set, as shown in Figure 1:

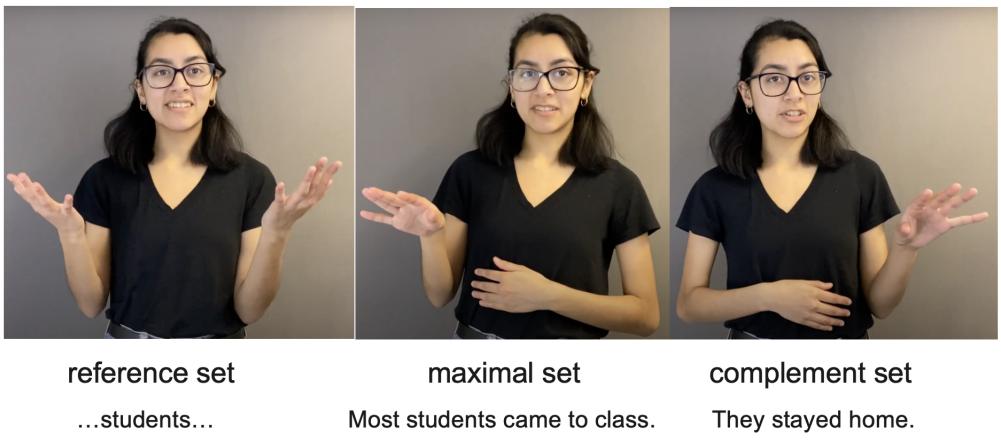

Figure 1: Gesture condition.

So as not to entirely confound the quantifier with the scenario in which it was used, we created pairs of two different scenarios in which it was natural to use each quantifier pair. The semantics of the quantifiers is such that we could not use the same scenario for every quantifier, but by at least having ratings for each quantifier in two different scenarios, and contrasting monotonicity for each scenario, we were able to generalize our findings beyond one specific scenario. Full materials, plots and details of the statistical analysis can be found on our OSF site.

Each participant saw all 8 quantifiers (rotated by scenario 1 or 2) with or without gesture. All items involved incompatible statives, to ensure only a complement set interpretation was targeted. We also had 4 practice and 4 control items, 2 of each involving gesture (mis)match and 2 without gesture, with (in)felicitous sentences. In the practice items, participants were given explicit feedback. For example, if the sentence was entirely grammatical, but the co-speech gesture did not match what is said, participants were given the following feedback:

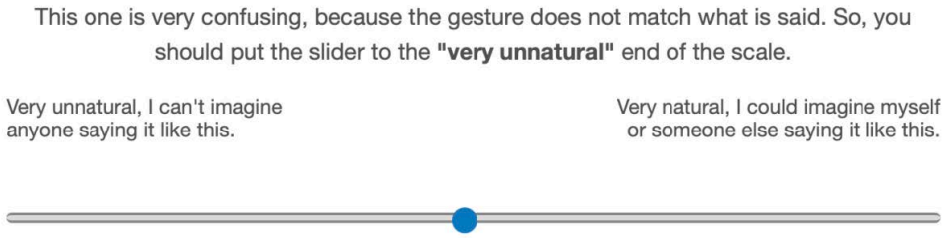

Figure 2: Feedback on practice items

Finally, our exclusion criterion was failing two or more controls, based on which we had 6 exclusions.[6] We collected acceptability judgments using Davidson's (2023) methodology, which is inspired by acquisition research asking children to "teach" their language to puppets; here, we asked adults to "help an alien learn to blend in" to their speech community, using the following scenario:

> An **alien** from another planet has disguised themselves as a human and they're **trying to blend in** among us. They need your help! They are asking **if the following videos seem "natural" to you.** Remember the alien needs to know which video is "natural" and which isn't, so that they can perfectly blend in among us.
>
> You should move the slider bar to the right if you think it's something that you or someone else who speaks fluent English might say. You should drag the bar to the left if you think that it's not something you or someone else who speaks fluent English might say. Use intermediate values when it is neither entirely natural nor entirely unnatural.

Figure 3: Help an alien learn to blend in!

We decided to use the scenario above, because we wanted participants to judge the utterance as a whole, including the co-speech gesture. In this way, something is "natural" if co-speech

[6] 'Failing' is interpreted in terms of directionality, i.e., dragging the slider bar towards the right end of the scale.

gestures and the relevant utterance are aligned, and something may be "unnatural" even if the sentence uttered is grammatical, namely when there is a mismatching co-speech gesture. As explained above, we also gave them explicit feedback during the practice trials, indicating that they should take co-speech gestures into account. Looking ahead, our results, and the variability across quantifiers, show that participants did indeed take co-speech gestures into account, as well as that they used the scale. We collected continuous ratings from "very unnatural" to "very natural", using the scale in Figure 2. Participants (n = 125) were recruited via Prolific and compensated $1.2 ($12.97/hr) for their time.

3.3. Results

The results were along the lines we expected. We found an effect of gesture, an effect of quantifier type as well as an interaction between the two, as visualized in the following graph:

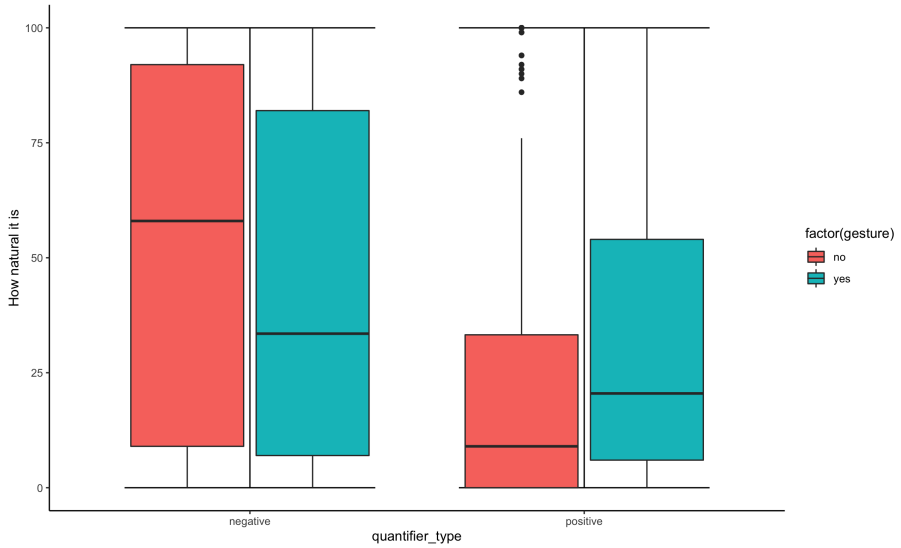

Figure 4: Results by quantifier type.

The main effect of quantifier type is successfully replicated (Moxey and Sanford, 1993; Sanford et al., 1994), since negative quantifiers are acceptable than positive ones. Yet, the presence or absence of an iconic co-speech gesture significantly biases acceptability too. As hypothesized, we found a main effect of gesture: gestures increase acceptability for positive and decrease acceptability for negative quantifiers. There is also an interaction between gesture and quantifier type, which have inverse effects. While gestures increase acceptability for positive quantifiers, quantifier type decreases it, and vice versa for negative quantifiers. Finally, participants successfully used the scale, as evidenced by the variation across quantifiers:[7]

[7]Note that half items in scenario 1 of the positive quantifier 'a few' were recorded with the quantifier 'most' due to an error. These data were relabeled as scenario 3 of 'most'. See the Items section of the OSF site.

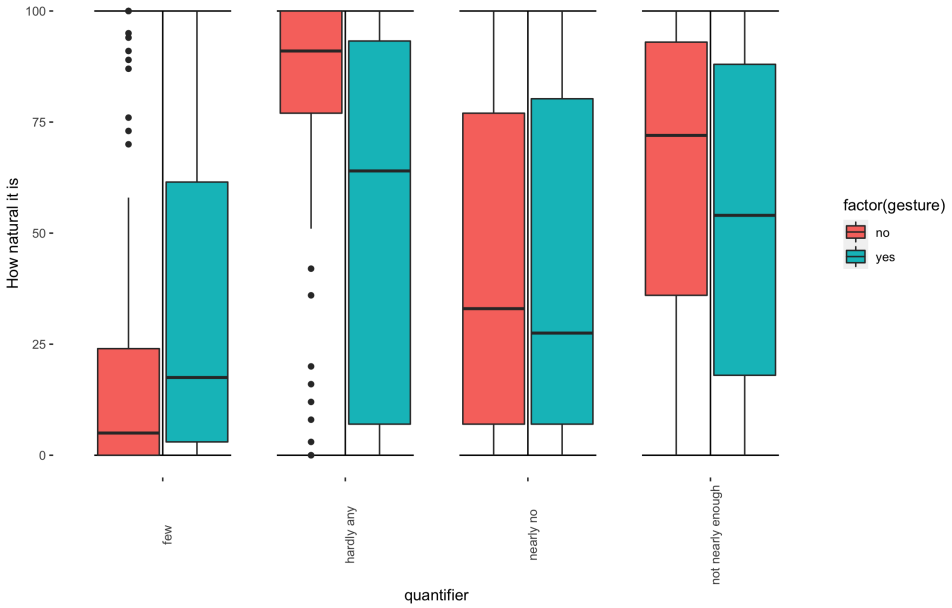

Figure 5: Negative quantifiers.

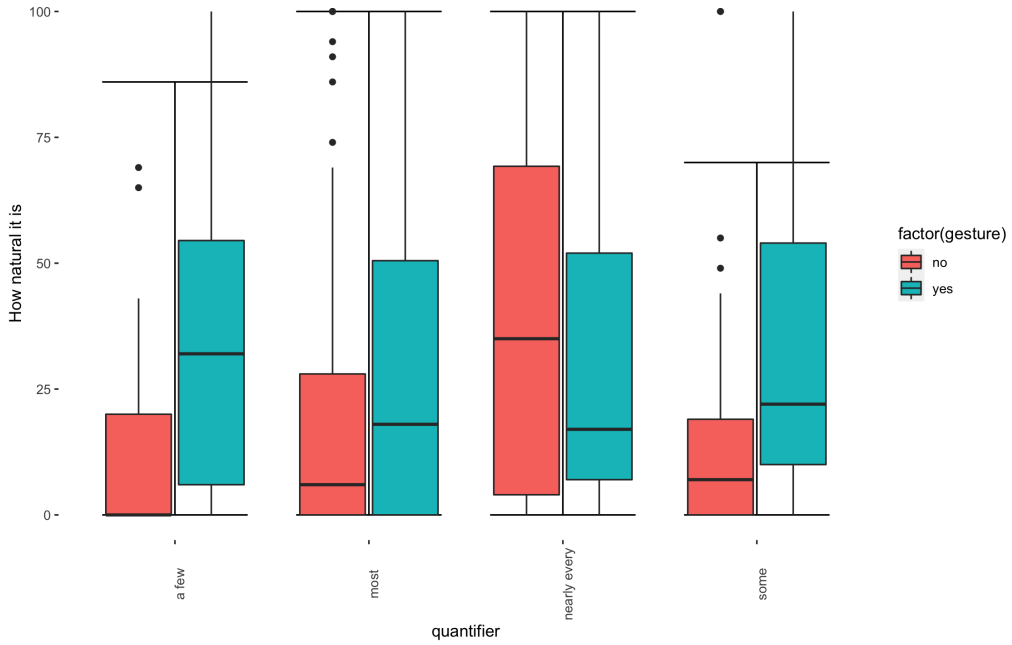

Figure 6: Positive quantifiers.

For our analysis we used a mixed effects linear model in *R* with an interaction between quantifier type (positive/upward monotone vs. negative/downward monotone) and gesture (present/absent). We fit a mixed effects linear model in *R* with an interaction between quantifier type (upward vs. downward monotone) and gesture (present/absent) (*lmer*(*measurement* ~

$Gesture * Quantifiertype + (1|ID)$). Our Anova model comparison found this model significantly improved compared to the model without Gesture ($p < 0.05$). As expected, quantifier type has a significant effect to the model, since our Anova model comparison found the model $lmer(measurement \sim Gesture + Quantifiertype + (1|ID)$ significantly improved compared to the model without Quantifiertype ($p < 0.001$). Finally, there was a significant interaction ($p < 0.01$) between gesture and quantifier type, the model with the interaction $lmer(measurement \sim Gesture * Quantifiertype + (1|ID)$ being better at predicting the results than the model without it $lmer(measurement \sim Gesture + Quantifiertype + (1|ID)$.

Our main hypothesis stated that positive/upward monotone quantifiers will be more acceptable with gesture. We thus subseted the data to positive/upward monotone quantifiers and ran a linear model $lm(measurement \sim Gesture)$, which revealed that iconic gesture has a significant effect ($p < 0.01$) increasing acceptability. Our secondary hypothesis stated that negative/downward monotone quantifiers will be less acceptable with gesture. We thus subseted the data to negative/downward monotone quantifiers and ran the same linear model, which revealed an effect of gesture ($p < 0.05$) decreasing acceptability.

Finally, as already mentioned, each quantifier was tested in two scenarios. More specifically, we had two scenarios for each quantifier pair in Table 1, so as not to entirely confound the quantifier with the scenario in which it was used. We ran a secondary analysis of the data, excluding quantifiers which had an effect of scenario, i.e. N1(=few) and P4(=nearly every), therefore looking only at the subset of quantifiers where scenario had no effect. The results are very similar, with the effect of gesture as well as the interaction between the two factors being even stronger:

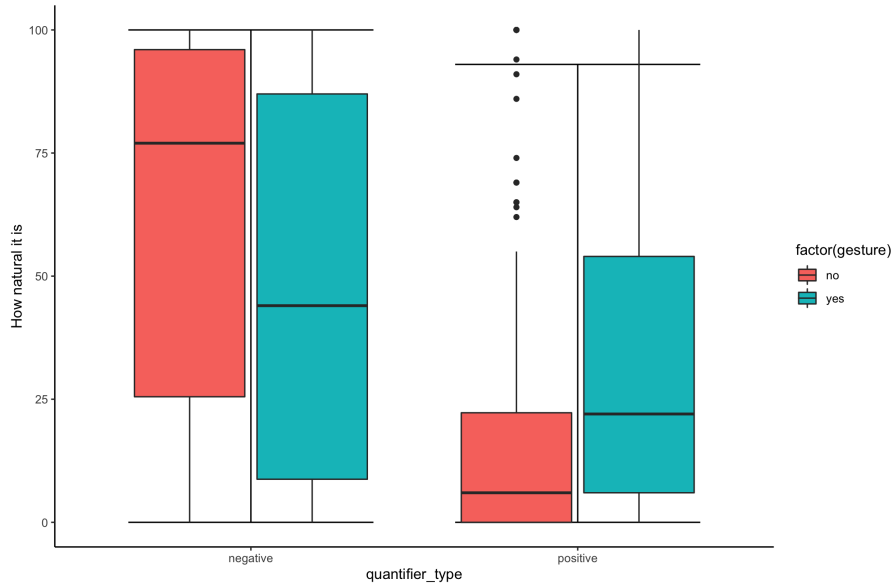

Figure 7: Results excluding quantifiers with effect of scenario.

We again ran the same mixed effects linear model in *R* with an interaction between quantifier type (positive vs. negative) and gesture (present/absent). Our Anova model comparison yielded the same results, the model with *Gesture* being significantly improved compared to the model

without it ($p < 0.001$). Quantifier type had again a significant effect to the model, the model with *Quantifiertype* being significantly improved compared to the model without it ($p < 0.001$). Finally, there was again a significant interaction ($p < 0.001$) between gesture and quantifier type, the model with the interaction being better at predicting the results than the model without it. If we subset the data to positive quantifiers, we find a significant effect of iconic gesture ($p < 0.001$) increasing acceptability. If we subset the data to negative quantifiers, gesture has a significant effect ($p < 0.01$) decreasing acceptability.

3.4. Conclusions

Overall, we replicated the main effect of quantifier type from prior literature, found a new result that gesture also significant affected acceptability, and found an interaction between gesture and quantifier type. These effects are further amplified if we exclude quantifiers with significant variation across scenarios. We conclude that iconic co-speech gestures increase acceptability of complement anaphora with positive/upward monotone quantifiers, and decrease acceptability of complement anaphora with negative/downward monotone ones. To the extent that the same iconicity is at play in both ASL iconic loci and the gestures tested in the experiment, we can conclude that the effect is not specific to ASL or even to sign languages, but is related to iconic use of space more broadly. In other words, the effect of iconicity is modality-independent, since it can be found both in sign and in gesture with spoken language.

What is more, negative/downward monotone quantifiers are overall more acceptable than positive/upward monotone ones, replicating the effect found in other studies (Moxey and Sanford, 1993; Sanford et al., 1994) and reported in the literature from introspective judgments (Nouwen, 2003). Finally, the fact that there is a significant interaction shows that iconicity has the inverse effect of monotonicity; it increases acceptability for positive quantifiers, while monotonicity decreases acceptability for them, and vice versa for negative ones.

4. Interpretation of the results

Our results raise many interesting questions. First of all, why do positive quantifiers become more acceptable with iconic co-speech gestures? There is often a presumption that acceptability stays fixed such that gestures merely affect implications (Tieu et al., 2019), or at most degrade acceptability, as under negation (Ebert and Ebert, 2016; Davidson, 2023; Ebert, 2023). However, in our experiment gestures improved an otherwise unacceptable linguistic structure, namely complement anaphora with positive quantifiers. This implies a mechanism through which the linguistic structure interacts with gesture, and raises the interesting question of how: Is this simply a case of the gesture providing information via a context (e.g. making salient something for reference that was unavailable without gesture) or is this acceptability related to a more tight link integrating gestural and linguistic structure? Through what mechanism does this happen, and what does it suggest for the interaction between gestures and speech?

Secondly, focusing on the effect of gesture on negative quantifiers, we can ask what makes negative quantifiers become less acceptable with iconic co-speech gesture. Contrasting them

with positive ones, one wonders why gesture does not facilitate the structure in this case as well. What we see instead is that gestures decrease acceptability of an otherwise acceptable linguistic structure, lending initial skepticism to the idea that gestures affect acceptability entire via providing possible reference in a context.

One possible interpretation of our results is that we are not dealing with complement anaphora at all but rather that the pronoun receives is interpretation deictically. This depends on how we define deixis; if by deixis we mean that the referent has to be present in the context, the stimuli in our study clearly do not involve deixis, but we might want to allow for a broader/less direct notion of deixis. The challenge then becomes: how does the referent (of deictic pointing) become available only when we point to it? In our view, if we need to expand our notion of deixis to involve this level of abstraction (such that this is no longer "complement anaphora" in the traditional sense), then our results are equally interesting: they suggest that this kind of abstract deixis introduces a discourse referent, namely the complement set. That said, one reason we hesitate to see this exactly as deixis is that the same gesture we used in our experiment could be quantified over, which argues against a deictic analysis:

(14) I usually have [many students]-a in my classes. Whenever I teach a new class, the first week [most students]-b come. [They]-a-b usually have a time conflict.
(Here, $a, b, a-b$ should be read as gestural loci, where b is a strict subset of a and $a-b$ is the complement set.)

Thus, we're inclined to interpret the main effect of gesture as suggesting that spatial iconicity allows for the complement set to become an available discourse referent, as observed for iconic loci in ASL (Schlenker, 2012; Schlenker et al., 2013). This shows, consistent with the approach taken by Schlenker et al. 2013, that the ASL facts are not sign language specific, i.e., they have to do with the properties of space in introducing discourse referents via abstract uses of space ("loci") rather than a sign language specific use of that space. Similarities between loci and gestures have been pointed out in Schlenker and Chemla (2018), and along with our result, this supports research investigating *gestural loci* and their properties to better understand exactly how it is that discourse referents can be iconically introduced via iconic loci or co-speech gestures.

As for the main effect of quantifier type, we replicated results from prior literature, namely that CA is more available with negative than with positive quantifiers. Thus, we conclude that in order to understand CA and the mechanism through which the complement set becomes an available referent, relevant factors will be quantifier monotonicity as well as iconicity, and that in fact these interact.

Finally, we can ask what drives the interaction, i.e., why is it that iconicity and monotonicity have the inverse effect? We suggest that the interaction is the result of the incompatibility of negative quantifiers with iconic co-speech gestures. One might have expected that iconic co-speech gestures would increase acceptability no matter what the quantifier type is. However, what we observe is that iconic co-speech gestures decrease acceptability with negative quantifiers. We suggest that this is the result of an incompatibility between negative quantifiers and iconic depictions, as seen in prior literature for cases of sentential negation (Ebert and Ebert, 2016; Kuhn, 2020; Davidson, 2023; Ebert, 2023). In what follows, we suggest that (a) for CA to be felicitous the complement set must be guaranteed to be non-empty, and (b) iconic co-

speech gestures trigger iconic inferences of existence, following suggestions by Kuhn (2020) for iconic loci in sign languages. The iconic co-speech gestures thus satisfy the non-emptiness requirement through the iconic inference of existence; this in turn explains why they make CA with positive quantifiers more felicitous than they were without the gesture.

4.1. Non-emptiness of the complement set

As noted in Nouwen (2003), CA is dispreferred out of the blue and needs to be supported pragmatically, and in particular the complement set needs to be the only set that can resolve anaphoric reference. Otherwise, there is generally a preference for the reference or the maximal set instead. We designed our experiment with this in mind, constraining the resolution of the pronoun to reference to the complement set by using predicates incompatible due to world knowledge. Our results further suggest that in addition to CA working only when there isn't competition from the maximal or reference set, CA requires the complement set to also not be potentially empty. Nouwen (2003) was working in an Optimality Theory (OT) framework, and he proposed an *Emptiness* constraint to explain the general unavailability of CA with positive quantifiers:

(15) **Emptiness**: As the antecedent of an expression do not choose a set which is potentially empty, except when this set is the reference set of a quantificational sentence.

We suggest that a similar pragmatic constraint is at play, allowing a pronoun to resolve reference to the complement set only when the latter is guaranteed to be non-empty. Indeed, this would predict the quantifier type asymmetry, since given the semantics of the quantifiers, the complement set is guaranteed to be non-empty with negative, but not with positive quantifiers:

(16) Most students came to class. In fact, maybe they all did, I didn't take attendance.

(17) Very few students came to class. #In fact, maybe they all did, I didn't take attendance.

Thus, negative quantifiers are better suited for CA without gesture, since they guarantee the non-emptiness of the complement set. What is more, positive ones cannot satisfy the pragmatic constraint described above, since the complement set is potentially empty. Thus, they are not well suited for CA without gesture. This explains the monotonicity effect. What changes once we add gestures? In the following subsection, we argue that iconic co-speech gestures trigger iconic inferences of existence, thus satisfying the constraint against non-emptiness of the complement set.

4.2. Iconic inferences of existence

Kuhn (2020) proposed for sign language (based on data from ASL and LSF) that there is an *iconic inference of existence* associated with iconic loci. More specifically, he argued that the iconic use of space in sign language invites an iconic inference regarding what discourse referents exist in the global context. A presupposition of existence in the global context is triggered when space is used iconically, i.e., a discourse referent presupposes existence when it involves loci due to their iconicity. He makes use of this presupposition to explain, among

other phenomena, the relationship between negative quantifiers and loci in sign languages.

We suggest that the same iconic inference of existence arises with iconic gestures, and that therefore this inference is not sign language or loci-specific, but more generally stems from how we interpret spatial iconicity. The intuition behind this is, as Kuhn put it, that "one cannot demonstrate the nonexistence of an entity by pointing at something" (Sober, 1976; Kuhn, 2020). The same holds for abstract pointing in space, as seen in iconic loci and co-speech gestures.

Extending Kuhn's proposal for sign language loci to the similar use of space in co-speech gesture, we argue that there is an obligatory pragmatic inference triggered when an iconic co-speech gesture to a locus is used that the set it refers to exists, and thus, is non-empty. The pragmatic principle triggering this presupposition could be the following:

(18) **Non emptiness:** do not iconically depict aspects of something that might not exist.

Such a pragmatic pressure results in a presupposition of existence in the global context whenever space is used iconically both in sign and in gesture. Following this line of reasoning, the use of iconic loci with gestures can support the introduction of a discourse referent; in our case, the complement set. This suggests that gestures interact with the linguistic system, being able to introduce discourse referents iconically. There is a deeper, very interesting question: why is there such a correlation between space and discourse referents, and what property of space triggers it? We leave this open for future research. For our purposes, we argue that the iconic inference of existence triggered by the co-speech gesture introduces the complement set as a discourse referent, satisfying the requirement for non-emptiness of the complement set. Thus, CA becomes more acceptable with positive quantifiers when an iconic co-speech gesture is used.

Why are gestures not increasing acceptability for negative quantifiers as well? One would expect that negative quantifiers should become even more acceptable when co-speech gestures are added, since there are two factors guaranteeing the non-emptiness of the complement set, namely the negative polarity of the quantifier itself and the co-speech gesture to a locus that supports existence of the referent. However, we observe just the opposite; co-speech gestures decrease acceptability for negative quantifiers.

We argue that the oddness of these examples comes from gesturing while uttering a downward monotone quantifier with a negative meaning. For example, it is the overlap of the iconic co-speech gesture with "hardly any" in "Hardly any senators voted in favor of it" that is behind the decreased acceptability. When the gesture occurs at the same time as the quantifier (i.e., hardly any), it has to refer to the maximal set (i.e., the senators who voted in favor), which is potentially empty in the case of negative quantifiers. Just like the complement set was potentially empty for positive, but not for negative quantifiers, the maximal set is potentially empty for negative, but not for positive quantifiers:

(19) Hardly any senators voted in favor of the new bill. In fact, maybe nobody did, I didn't pay attention.

(20) Most senators voted in favor of the new bill. # In fact, maybe nobody did, I didn't pay attention.

However, if the situation was parallel to positive quantifiers and the complement set, we would

predict that the co-speech gesture triggers an iconic inference of existence and thus presupposes that the maximal set is non-empty. In other words, whatever happens with positive quantifiers and the complement set should happen with negative ones and the maximal set. Both should result in increased acceptability and a presupposition that the depicted set is non-empty. The iconic inference of existence from the co-speech gesture should press in favor of a non-empty complement set for positive and a non-empty maximal set for negative quantifiers. This does indeed happen for positive, but not for negative quantifiers. In the case of the latter, we observe decreased acceptability instead. To make this more concrete, when we hear "hardly any senators voted in favor of it" and we see a gesture, we should understand "hardly any senators voted in favor of it but some did". Why do we observe a decrease in acceptability instead?

We argue that there is an additional factor blocking this interpretation, namely the attested incompatibility of negation or negative meanings more in general with iconic depiction. We had hypothesized that this would be the case, since prior literature suggests that such an incompatibility exists for sentential negation (Ebert and Ebert, 2016; Esipova, 2019; Kuhn, 2020; Davidson, 2023). In our data, the same incompatibility seems to extend to decreasing the acceptability of these gestures with negative quantifiers. Why is negation and negative meanings incompatible with iconicity? The answer could again lie in iconic inferences of existence, which introduce a discourse referent iconically; negative quantifiers do not want to introduce a discourse reference, and this conflicts with the iconic inference of existence resulting in decreased acceptability. To illustrate this, we can use the following examples from Kuhn (2020), where the quantifier *all* introduces a functional discourse referent, while *none* blocks such a discourse referent:[8]

(21) All of the students read a different book, and all of them liked it.

(22) *None of the students read the same book, and all of them liked it.

We suggest that iconic inferences of existence guarantee the non-emptiness of the complement set in the case of positive quantifiers, but cannot guarantee the non-emptiness of the maximal set in the case of negative ones, because the iconic inference of existence introduces a discourse referent when the quantifier does not. This results in a conflict, translated into decreased acceptability.

Thus, what might be driving the interaction is the pragmatic pressure for non-emptiness of the complement set, which can be satisfied by the semantics of the downward monotone quantifiers or by the iconic inference of existence from the co-speech gesture, along with the incompatibility of negative meanings with iconicity.

5. Implications for theories of complement anaphora

How can our results inform our theorizing about CA? The are two main strategies in the literature to explain the availability of CA with negative quantifiers. Some theories, what we call as the "illusion account", propose that speakers are confused thinking that the complement set is being referred to; it is rather an instance of restrictor anaphora instead (Corblin, 1996; Geurts, 1997; Kotek, 2008). Other theories, what we call as the "genuine anaphora" account, state there

[8]The two sentences, up to the conjunct, are truth-conditionally equivalent as Kuhn (2020) notes.

is indeed genuine complement set anaphora, but it is a dispreferred anaphoric strategy, surfacing only in certain environments (Kibble, 1997; Nouwen, 2003; Schmitt et al., 2017). This section describes these strategies, arguing that our results support genuine anaphora accounts.

5.1. The illusion account

Illusion accounts claim that reference to the complement set is only apparent, and in reality reference to the *restrictor* set is made instead. Corblin (1996) calls this *pseudo*-reference to the complement set. He observes that reference to the complement set clashes with the generalization of Kamp and Reyle (1993) that subtracting one set from another is not a permissible operation for the formation of pronominal antecedents. Indeed, Kamp and Reyle (1993) give the following example (see also Partee (1989); Heim (1982)):

(23) Eight of the ten balls are in the bag. # They are under the sofa.

Based on this, Corblin (1996) argues that complement anaphora is in reality restrictor anaphora. He suggests that speakers confuse the restrictor with the complement set. For example:

(24) Peu d'électeurs français ont voté pour le canditat du parti communiste. Ils
Few of-voters French have voted for the candidate of party communist. They
ont voté pour le canditat de droite à 40% environ.
have voted for the candidate of right at 40% around.
'Few voters voted for the candidate of the communist party. Approximately 40% of the voters voted for the right-wing candidate.'

He argues that this cannot be complement set reference, since "approximately 40%" would make the sentence with such a reference false. Thus, the idea in Corblin (1996) is that complement set reference is an illusion; what is really going on is restrictor set reference under an implicit restrictive modifier. Geurts (1997) provides an alternative "illusion account" based on *collective reference*. This is a common phenomenon with plural definite descriptions:

(25) The students resisted the police.

(26) The soldiers withstood the attack.

Crucially, these sentences can be true even if they are not true for each member of the plural DP. In other words, the students could have resisted the police, even if one student individually did not. Similarly for the soldiers. Both constitute examples of *sloppy reference*. For Geurts (1997), when CA is possible, there is no genuine reference to the complement set. Instead, reference is *sloppy* in the same way as for plural definite descriptions. The plural pronoun "they" in (11), repeated below as (27) for reference, refers to the set of students as a whole, the restrictor set, which is collectively held responsible for not coming to class.[9]

(27) (Very) few students came to class. They stayed home instead.

All in all, the idea behind "illusion accounts" is that referring to the restrictor set means referring to a majority of things not satisfying the nuclear scope. Consequently, we confuse restricted reference to the restrictor set with complement set reference.

[9]Kotek (2008) also argues that genuine reference to the complement set does not exist. She specifically proposes that it is maximal set anaphora instead, since the maximal set must be independently calculated, and introduced as a presupposition. Thus, she argues, for economy, the maximal is preferred as an antecedent.

5.2. Problems with illusion accounts

Nouwen (2003) provides arguments against an illusion analysis, of which we will mention the most compelling ones. First of all, the example above in (24) merely illustrates that restrictor set anaphora is possible, not that it is the only strategy available. Secondly, it is unclear why speakers should confuse restrictor with complement set reference. In psychological experiments (e.g., Moxey and Sanford (1993)) where people were asked to explicitly give their personal judgment on what they had referred to, they picked the complement set. What is more, the use of *instead* indicates reference to a complementary distribution:

(28) Very few students came to class today. They stayed at home instead.

This complementary distribution is accounted for if this is genuine complement set anaphora as opposed to restrictor anaphora instead. Finally, Nouwen (2003) takes issue with Corblin's (1996) claim that CA is really reference set anaphora reporting on the smallness of the reference set. In fact, the latter does not have to be small. Moxey and Sanford (1993) show that some determiners license CA without a smallness judgment:

(29) Not quite all of the teachers attended the meeting. They stayed home instead.

The analysis of Corblin (1996) predicts that "they" refers to the restrictor set. However, "they" reports on a minority of teachers.

What is more, Schmitt et al. (2017) provide a mixed account, arguing that some instances of CA are illusory and some involve genuine reference to the complement set.[10] Using German data, they show that not all CA cases are illusory. They use *die anderen* 'the others' as a control, assuming it presupposes the maximal set of some plural quantifier to be divided between a salient subset and its complement. Their logic is that if 'the others' can be used, then there is a discourse referent denoting the complement set. Indeed, this is true for the following example:

(30) a. Nicht alle Buben haben ihren Kuchen gegessen.
Not all boys have their cake eaten.
'Not all boys ate their cake.'
b. Sie haben ihn (stattdessen) weggeworfen.
They have it instead throw-away.
'They threw it away (instead).'
c. Die anderen haben ihn (aber) sehr schnell gegessen.
The others have it but very fast eaten.
'The others ate it very fast (however).'

5.3. The genuine anaphora account

Having presented arguments against illusion accounts, we will briefly present Nouwen's 2003 account, arguing that CA involves genuine reference to the complement set. We call this the *genuine anaphora* account. This is not the only genuine anaphora account (see e.g., Schmitt et al. (2017)), but for reasons of space we focus on this one. Nouwen (2003) proposes that

[10] Based on German data, they propose a mechanism to refer to the complement set whenever there is a negation c-commanding the quantifier. For details we refer the reader to Schmitt et al. (2017).

there is pragmatic preference for the reference set as opposed to the complement one. Thus, CA is avoided whenever the anaphoric relation can be resolved in another way. Indeed, in the following example *they* refers to the few balls that are blue rather than the many that are not:[11]

(31) Few of these balls are blue. Can you point them out for me?

However, this pragmatic preference can be overruled by semantic considerations. As we noted above, Nouwen (2003) proposes OT constraints to account for the facts in a semantic OT framework. Roughly, the system is set up so that the domain of quantification of a determiner is preferably the reference set, except to avoid a contradiction with previous discourse. As an illustration, notice that in the following example the reference set is used as a restrictor for *three* in interpreting the second sentence:

(32) Ten students attended the meeting. Three spoke.

Crucially, there is a constraint, which Nouwen calls *Emptiness* and formulates as follows:

(33) **Emptiness**: As the antecedent of an expression do not choose a set which is potentially empty, except when this set is the reference set of a quantificational sentence.

Given this, what can the pronoun 'they' in the CA cases refer to? *Emptiness* blocks it from taking a potentially empty antecedent. In other words, if the complement set is potentially empty, it cannot be the antecedent of the pronoun. What is more, there is a pragmatic preference for the reference set to be the antecedent of the pronoun. However, if resolving the pronoun to the reference set gives rise to a contradiction given the previous discourse, then to avoid a contradiction we resolve the reference to the complement set. The idea is that only to a avoid a contradiction do we resort to the last solution which is complement set anaphora. This would explain why it is in general hard to get, especially if some other kind of anaphora can provide an antecedent for the pronoun. To illustrate how this works, consider the following example:

(34) Most students went to the party. #They went to the beach instead.

Here, to avoid a contradiction we choose the complement set, but *Emptiness* rules this out, since it could be empty: the first sentence could be true in a situation where all the students went to the party. Crucially for Nouwen, the *Avoid Contradiction* constraint is ranked below *Emptiness*. Thus, because of *Emptiness*, we have to interpret the plural pronoun in the second sentence as referring to the reference set. Therefore, the continuation leads to a contradictory reading and infelicity. On the contrary, *Emptiness* does not rule this out with a negative quantifier since the complement set is non-empty thanks to the semantics of the quantifier. Thus, CA is felicitous:[12]

(35) Few students went to the party. They went to the beach instead.

[11] For the authors, this example is not very felicitous, and is significantly improved if the positive quantifier 'a few' is used. This would suggest that the proposed pragmatic preference for the reference set is stronger for positive than for negative quantifiers.

[12] The *Non emptiness* constraint we proposed in (18) is similar to Kuhn's 2020 iconic inferences of existence. Just like a potentially empty set cannot be the antecedent of a pronoun, a potentially nonexistent discourse referent cannot be depicted iconically in space. In other words, placing a discourse referent in a marked location in space is similar to using a pronoun for that referent.

5.4. Support for genuine anaphora accounts

Our results provide support for genuine anaphora accounts, and specifically for Nouwen's 2003 idea behind his *Emptiness* constraint. We saw that in ASL and in English with gestures iconicity can help license CA. If CA is possible with positive quantifiers once iconicity is added, how can it be an illusory reference to the restrictor set? Indeed, illusion accounts assume reference to the complement set is never possible. Adding to the arguments against this assumption (e.g., (29) and (30)), we showed that CA is possible with positive quantifiers. Thus, given the ASL as well as the English data with gestures, we argue that in certain cases genuine reference to the complement set is possible. So far, theories of CA were focused on the monotonicity of quantifiers; a new desideratum we attempted to explain is the effect of iconicity.

6. Conclusion

Inspired by the felicity of CA with positive quantifiers when iconic loci are used in ASL, we experimentally tested the effect of iconic co-speech gestures on CA licensing with positive and negative quantifiers. In addition to replicating the main effect of quantifier type, we found a main effect of gesture, and an interaction between the two factors. We concluded that iconic co-speech gestures can significantly increase acceptability of CA with positive quantifiers. Iconicity had the inverse effect of monotonicity, negative quantifiers having significantly decreased acceptability when co-speech gestures are added. We interpreted the main effect of gesture as suggesting that the complement set can become an available discourse referent via the iconic use of space that supports inference that establish the complement set as available for anaphora, just as has been suggested for iconic loci in ASL (Schlenker, 2012; Schlenker et al., 2013). We further argued that the interaction is the result of a pragmatic pressure for non-emptiness of the complement set (Nouwen, 2003), which can be satisfied by the semantics of negative quantifiers or by the iconic inference of existence (Kuhn, 2020) triggered by the gesture, along with the incompatibility of negative meanings with iconicity. Finally, we argued that our findings support genuine anaphora theories of CA, and that iconicity should be taken into account as a licensing factor of CA. We hope this paper will inspire more work on the interaction between iconicity and anaphora.

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The at-issue status of viewpoint gestures: Evidence for gradient at-issueness

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Abstract. Recent semantic research on the meaning contribution of speech-accompanying gestures has focused on their at-issue status. Empirical evidence suggests they contribute not-at-issue meaning by default (e.g., Ebert et al., 2020). However, there is growing evidence that the notion of at-issueness is better captured as a gradient one instead of a binary one (Barnes et al., 2022; Tonhauser et al., 2018; see Barnes and Ebert, 2023 for a formal implementation). Research investigating differences in at-issueness between different types of co-speech gestures is missing entirely. This paper presents findings from two experimental rating studies investigating differences in the at-issue status and salience of *character viewpoint gestures* (CVGs) and *observer viewpoint gestures* (OVGs). The results of the first experiment suggest that while both viewpoint gesture types contribute not-at-issue meaning by default, CVGs are still more at-issue than OVGs. In the second study, it was investigated whether CVGs are more salient than OVGs. The results tentatively suggest that there are no salience differences between CVGs and OVGs. Overall, the findings provide additional evidence in favor of a gradient approach to at-issueness.

Keywords: gesture semantics, at-issueness, perspective in gesture.

1. Viewpoint gestures

There is a long-standing tradition of investigating perspective-taking phenomena in speech. More recent research has shown that co-speech gestures can also encode perspective (McNeill, 1992). Verbal utterances are often accompanied by gestures, which can either be manual, i.e., performed with the hands and potentially other body parts, or facial, i.e., performed with the face. These gestures are often synchronized with the verbal expressions they co-occur with. The stroke (= the core) of a gesture, for example, is usually aligned with the nuclear accent of a word (Loehr, 2004; Ebert et al., 2011). Moreover, different alignment patterns of gesture and speech have been shown to have different semantic effects (Ebert and Ebert, 2014). This claim has been experimentally validated in a study reported in Ebert et al. (2022).

Previous research has distinguished different gesture types (for an overview, see McNeill, 1992), among them iconic gestures. Iconic gestures visually resemble a property of an object or action they illustrate. Perspective is often encoded in iconic gestures. McNeill (1992) distinguishes between CVGs, OVGs, and so-called *dual viewpoint gestures* (see also Parrill, 2010, 2012; Stec, 2012).

CVGs illustrate an event from a first-person perspective and the whole body is usually involved in the production of the gesture. OVGs, by contrast, illustrate an event as if observed from a distance and therefore only the hands and arms are involved when producing the gesture. For illustration, consider the cartoon scene in Figure 1 (taken from Parrill, 2010). In a study, Parrill (2010) let participants first watch different cartoon clips. Their task was to re-tell the cartoon scene to a friend they had brought to the study. This friend did not watch the cartoon scene before.

In Figure 1 one can see a skunk hopping across the room. If speakers re-tell this cartoon to

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Figure 1: Cartoon scene of a skunk hopping across a room. Taken from Parrill (2010)

their friend, they have several options to include gestures in their description, two examples are given in Figure 2. In Figure 2a, one can see a clear instance of a CVG because the speaker uses their whole (upper) body to depict the skunk's hopping movement from a first-person perspective. Figure 2b, by contrast, describes the same event but by means of an OVG. Here, the speaker only uses their index finger to trace the trajectory of the skunk. In other words, the speaker reports the hopping event from a third-person perspective. CVGs have been argued to be more informative than OVGs (Beattie and Shovelton, 2002). There is a third type of viewpoint gesture, which occurs very infrequently, however. This gesture type encodes multiple viewpoints at the same time and has therefore been dubbed dual viewpoint gesture (Parrill, 2009). Encoding multiple viewpoints in gesture seems to be less constrained than the occurrence of multiple viewpoints in speech since dual viewpoint gestures allow for the presence of two different character viewpoints at the same time, which has not been attested in spoken or written language. Interestingly, this is also possible in sign languages (e.g., Maier and Steinbach, 2022). Therefore, this might be a modality-specific feature. The co-presence of a character's and an observer's viewpoint in a gesture has been argued to be possible although it often produces an ironic effect because the two viewpoints seem to compete with each other (McNeill, 1992). Moreover, dual CVGs are restricted to specific contexts at least for adults (McNeill, 1992: p. 125). More specifically, one of the CVGs always is a deictic gesture to the speaker's body, representing the viewpoint of one character, and the body represents another character viewpoint. It can be noted, in sum, that the expression of multiple viewpoints is more liberal in gesture as opposed to speech.

2. At-issueness

2.1. Multiple meaning dimensions

Certain linguistic items and structures, such as *conventional implicatures* (CIs) and presuppositions, have long been recognized as contributing meaning in a different dimension than asserted content. In contrast to assertions, they have been considered to make not-at-issue contributions (cf. Koev, 2018). Not-at-issue content is overall considered to be a secondary meaning contribution whereas the asserted at-issue content makes the primary meaning contribution in an utterance, i.e., it is on the table for discussion (Farkas and Bruce, 2010).

The two types of meaning contributions differ in their discourse behavior. For example, one cannot directly assent or dissent with not-at-issue content, which is illustrated in (1) for appositives, which are not-at-issue by default. The asserted content, i.e., the proposition expressed by the main clause, by contrast, can be assented or dissented with directly (for further diagnostics testing for the at-issue/not-at-issue distinction see Tonhauser, 2012).

(1) A: My friend Sophie, a classical violinist, played a piece by Bach.
B: # No, she's not a classical violinist.
B': Hey, wait a minute! Sophie's not a classical violinist. (Koev, 2018)

(1) shows that directly denying the appositive's not-at-issue content (cf. the utterance of B) is not possible. Instead, a discourse-interrupting element such as *Hey, wait a minute!* has to be used to target the proposition expressed by the appositive (Shanon, 1976; von Fintel, 2004).

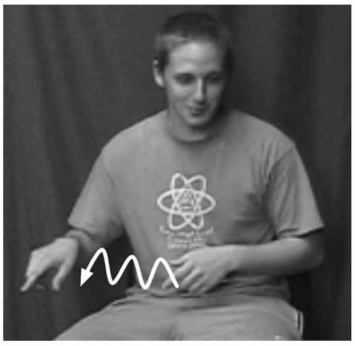
A further defining property of not-at-issue content is that it projects through negation and other entailment-canceling operators (Simons et al., 2010). (2) illustrates this.

(2) It is not the case that my friend Sophie, a classical violinist, played a piece by Mozart.
a. She performed a piece by Bach.
b. # She is a trumpet player.

When hearing an utterance as in (2), listeners have the intuition that the appositive's content escapes the scope of the negation, meaning that only the main clause proposition is targeted by the negation. This is illustrated by the continuations in (2a) and (2b), respectively. The continuation in (2a) picks up the at-issue main clause proposition, whereas the continuation in (2b) picks up the not-at-issue proposition expressed by the appositive. Since the main clause proposition is targeted by the sentential negation, (2a) is felicitous. (2b), by contrast, is infelicitous because it picks up the not-at-issue proposition expressed by the appositive, which projects through negation.

In the literature on at-issueness, at least three different notions of at-issueness can be distinguished (for an overview, see Koev, 2018). In this work, at-issueness will be defined by means of relevance to the *question under discussion* (QUD) (cf. Simons et al., 2010). A definition is given in (3).

(a) CVG used to depict the skunk in Figure 1 (Figure 3 in Parrill, 2010: p. 652)



(b) OVG used to depict the skunk in Figure 1 (Figure 2 in Parrill, 2010: p. 651)

Figure 2: Examples of a CVG and an OVG to depict the event shown in Figure 1

(3) a. A proposition *p* is at-issue iff the speaker intends to address the QUD via *?p*.
b. An intention to address the QUD via *?p* is felicitous only if:
(i) *?p* is relevant to the QUD, and
(ii) the speaker can reasonably expect the addressee to recognize this intention.
(Simons et al., 2010: p. 323)

Simons et al. (2010) thus define QUD relevance by means of a yes/no question that is associated with a proposition *p*, whereby the partition of the set of worlds into *p* and ¬*p* is denoted by *?p*. A question is defined as QUD-relevant iff it entails either a complete or a partial answer to the QUD. This means that *?p* must contain at least a partial answer to the QUD in order to be considered QUD-relevant. Part (ii) means that the at-issue status is determined by a further factor, namely the constraint that the speaker's intention to address the QUD is also recognized by the addressee. This part has to do with information packaging in general. Consider (4):

(4) Q: What is the weather like?
A: # Bob realizes that it's raining.
(Simons et al., 2010: p. 319)

The use of the factive verb *realize* in A's answer implies that the embedded proposition that it is raining is true, thus giving at least a partial answer to the QUD. However, this information is not asserted, but presupposed and thus not intended by the speaker to address the QUD, yielding the infelicity of A's response in (4). This example illustrates that the structural choice of the speaker also influences the at-issue status of a proposition. Projective content, such as the presupposition in (4), is predicted to be not-at-issue by Simons et al.'s (2010) definition.

Coming back to example (1), this means, then, that the proposition expressed by the main clause is intended to make an at-issue contribution by the speaker. The appositive's content, by contrast, is predicted to be not-at-issue. In other words, (1) can only be used felicitously if the QUD is such that the proposition expressed by the main clause (partially) answers it:

(5) Q1: What did your friend Sophie do?
Q2: What instrument does Sophie play?
A: My friend Sophie, a classical violinist, played a piece by Bach.

If A utters the sentence to address Q2, the whole utterance is infelicitous because the QUD targets the information provided by the appositive which are normally not used to address the QUD. However, if A intends to respond to a QUD along the lines of Q1, the utterance is felicitous because the information answering the QUD is provided by the main clause, i.e., the at-issue content.

2.2. The at-issue status of co-speech gestures

Ebert and Ebert (2014) analyze co-speech gestures as conventional implicatures and are thus predicted to behave similar to appositives (Potts, 2005). Therefore, they also make not-at-issue meaning contributions by default and share the projective behavior attested for appositives (cf. Section 2.1). Example (6) illustrates that co-speech gestures, just like appositives, cannot be directly denied in discourse.

(6) A: I brought [a bottle of water][1] to the talk. + "big" co-speech gesture
B: # No, the bottle isn't big.
B': Hey, wait a minute! Actually, the bottle isn't that big.
(cf. Ebert and Ebert, 2014)

Moreover, co-speech gestures also display the projective behavior attested for appositives:

(7) It is not the case that I brought [a bottle of water] to the talk. # A small one is enough for me.
+ "big" co-speech gesture

Here again the continuation is infelicitous as it targets the semantic content contributed by the gesture. Since this content is not-at-issue and therefore projective, the continuation is infelicitous.

The at-issue status of co-speech gestures has been empirically investigated by Ebert et al. (2020). In a rating study, participants had to rate how well a picture matched a videotaped utterance they had previously seen. In the utterance, either a co-speech gesture occurred giving information about an object's size or shape or this information was given by means of an adjective. An example is given in (8).

(8) a. In diesem Bild ist eine Mauer mit [einem Fenster] zu sehen. + "circular" co-speech gesture
b. In diesem Bild ist eine Mauer mit einem runden Fenster zu sehen.
'In this picture you can see a wall with a (round) window.'
(cf. Ebert et al., 2020: p. 173)

The picture participants were presented either matched or mismatched the information provided by the co-speech gesture or adjective. Thus, participants either saw a picture with a round window (matching) or a picture with a rectangular window (mismatching) for (8). Crucially, the match/mismatch only came about via the gesture or adjective. Assuming that not-at-issue content has a less severe impact on the overall truth conditions than at-issue content has (Kroll and Rysling, 2019), Ebert et al. (2020) hypothesized that the mismatch effect, i.e., the difference in mean ratings between the matching and mismatching condition, is higher for items in the adjective condition than for items in the gesture condition. Their results confirm their hypothesis, thus suggesting that co-speech gestures contribute not-at-issue meaning by default, in line with Ebert and Ebert (2014).

In a second experiment, Ebert et al. (2020) tested for the potential of demonstratives as so-called *dimension shifters*. This means that when a co-speech gesture is aligned with a demonstrative (such as German *so* 'such'), it shifts the gesture's semantic content from the not-at-issue to the at-issue dimension. In order to test for this, they compared the gesture and adjective condition from the first study to a third condition where the co-speech gesture was aligned with *so*. It was hypothesized that the ratings for the *so* + gesture condition were equal to the ratings of the (at-issue) adjective condition. The results, however, showed that the mismatch effect for the *so* + gesture condition was lower than for the adjective condition, but higher than for the gesture condition. This and similar findings for so-called *ideophones* (Barnes et al., 2022) eventually lead to the proposal to capture at-issueness as a gradient notion instead of a binary one (Barnes

[1] Square brackets indicate gesture-speech alignment.

and Ebert, 2023). Concretely, Barnes and Ebert (2023) propose that every expression comes with an inherent at-issue status. This can be shifted, however, if this expression addresses the QUD. In Section 5, their approach will be used to account for the results obtained from the experimental studies summarized in Sections 3 and 4 of the present paper.

It has been shown so far that utterances can contribute meaning in multiple dimensions: the asserted at-issue dimension and the backgrounded not-at-issue dimension. In general, projective content has been argued to contribute not-at-issue meaning by default (e.g., Simons et al., 2010). Ebert and Ebert (2014) have proposed to analyze co-speech gestures as conventional implicatures. Therefore, they are predicted to make not-at-issue contributions by default (for experimental validation see Ebert et al., 2020). The question that now arises is why CVGs and OVGs should differ in their at-issue status if they occur as co-speech gestures. A crucial difference between the gestures tested for in Ebert et al.'s (2020) studies is that they only used so-called no viewpoint gestures (Parrill, 2010), i.e., gestures that do not encode viewpoint at all. Moreover, as has been shown above, especially CVGs differ from the gestures used by Ebert et al. (2020) with respect to size as the whole body is involved in the production of a CVG (McNeill, 1992). In addition, it has been demonstrated that CVGs and OVGs also differ in certain ways: CVGs are more informative than OVGs (Beattie and Shovelton, 2002). Finally, in a study investigating the hypothesis that the perspective expressed in gesture and speech should be aligned by default, Hinterwimmer et al. (2021) found a CVG preference regardless of the perspective expressed in the speech signal. This preference might be due to a difference in the at-issue status of CVGs and OVGs. Based on these differences, it is hypothesized that although CVGs and OVGs both contribute not-at-issue meaning by default, the former type of viewpoint gesture is still more at-issue than the latter. This can be captured when assuming a gradient approach to at-issueness (Barnes and Ebert, 2023). Experiment 1 investigates this hypothesis.

3. Experiment 1: The at-issue status of viewpoint gestures

3.1. Method

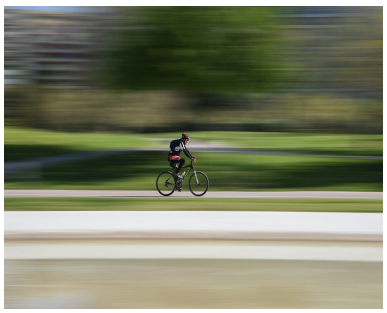
3.1.1. Participants

Participants (n = 60) were recruited via Prolific. All of them were self-reported native speakers of German and naive with respect to the research question.

3.1.2. Materials

Eighteen experimental items were created for the experiment. Each item consisted of two sentences: the first sentence introduced an event by the speaker and the second sentence further described this event. The second sentence contained a word, usually a verb, which was either accompanied by a CVG or an OVG. Alternatively, a phrase paraphrasing the gesture information preceded or followed this word (factor MODE: CVG vs. OVG vs. Verbal). The two gestures differed semantically only with regard to the perspectival information they encoded. An example for an experimental item can be found in (9).

(a) Matching picture



(b) Mismatching picture

Figure 3: The matching and the mismatching picture for the experimental item in ((9))

(9) a. Letzten Mittwoch hatte ich den ganzen Tag Termine überall in der Stadt. Nachdem einer der Termine länger dauerte als gedacht, musste ich mich [richtig beeilen.]
+ **CVG:** running using the whole body, or
+ **OVG:** running using two fingers

b. Letzten Mittwoch hatte ich den ganzen Tag Termine überall in der Stadt. Nachdem einer der Termine länger dauerte als gedacht, musste ich mich richtig beeilen **und rennen**.
'Last Wednesday I had many appointments throughout the whole city. After one of the appointments took longer than expected, I had to hurry a lot (and run).'

The part in bold print in (9b) indicates the paraphrase of the gestures' meaning in (9a).

Additionally, in order to establish either a match or a mismatch, each experimental item was paired with two pictures: a picture matching the utterance and a picture where there was a mismatch between utterance and picture (factor MATCH: match vs. mismatch). The matching picture used for the experimental item in (9) can be found in Figure 3a and the mismatching picture is given in Figure 3b. The study was thus of a 3x2 design which was similar to the design of the studies reported in Ebert et al. (2020).

The experimental items were interspersed with 24 unrelated filler items which were taken from Ebert et al. (2022). In the fillers, lexically ambiguous nouns were either paired with a gesture matching or mismatching the salient interpretation of the noun in the given sentence. These sentences were then also paired with a picture either matching or mismatching the salient interpretation of that noun.

3.1.3. Procedure

Participants had to complete a web-based questionnaire where they had to rate how well a videotaped utterance matched a picture they had seen prior to the video. The completion took approximately 20 minutes and participants were compensated with £3.20.

The questionnaire started with an introductory text describing the participants' task. They were instructed in this text to pay attention to the audio tape and the video tape when watching the videos. Additionally, the text informed them about their data protection and they were

also explicitly instructed that they can stop the questionnaire any time without providing any explanation.

The questionnaire was created using SoSci Survey (Leiner, 2022). Items were split up according to a Latin square design. Participants had to rate how well the utterance in the video matched the picture on a Likert scale ranging from 1 (= 'no match') to 7 (= 'perfect match'). They were asked in the beginning to judge each pair of video and picture individually and intuitively.

3.2. Predictions

Since CVGs differ more from the gestures used in Ebert et al. (2020) than OVGs do (cf. Section 1), first the negation test will be applied to an example with a CVG. The negation test is suitable to determine whether or not gestures or, more generally, parts of an utterance project and therefore contribute at-issue meaning.

(10) a. Simon overslept today. He then had to [hurry] to get to work on time.
+ CVG running (whole body)
b. #No, he did not run, he went by bicycle.
c. Hey, wait a minute! He had to hurry to get to work on time, but he did not run.

Example (10) shows that the denial of the content of the gesture in (10a) is not possible with the direct denial as in (10b). It is possible, however, to target the gesture when one uses the discoruse-interrupting *Hey, wait a minute!*, as in (10c). Therefore, (10) indicates that CVGs project, which has been argued to be behavior that is attested for any kind of not-at-issue content. It is thus hypothesized that CVGs, just as other kinds of speech-accompanying gestures, contribute meaning that is not-at-issue by default. This hypothesis is in line with the findings of the first experiment reported in Ebert et al. (2020). A significant interaction of the pairwise comparison of CVG and Verbal for the factor MODE and the factor MATCH is predicted. In other words, this means that the rating difference between matching and mismatching CVG items is predicted to be significantly lower than the rating difference between matching and mismatching Verbal items. In the terms of Ebert et al. (2020), this means that the mismatch effect is predicted to be stronger for Verbal items than for CVG items.

In order to determine whether there CVGs and OVGs differ with respect to their at-issue status, consider (11), a slightly modified version of (10).

(11) a. Simon overslept today. He then had to [hurry] to get to work on time.
+ **CVG:** running (whole body), or
+ **OVG:** running (with two fingers)
b. #No, he did not run, he went by bicycle.
c. Hey, wait a minute! He had to hurry to get to work on time, but he did not run.

Example (11) shows that direct denial is possible neither for OVGs nor for CVGs. Therefore, the comparison suggests that CVGs and OVGs behave alike concerning their at-issue status. However, due to a general preference of CVGs found by Hinterwimmer et al. (2021), the higher informativity of CVGs (Beattie and Shovelton, 2002), and possibly also due to the

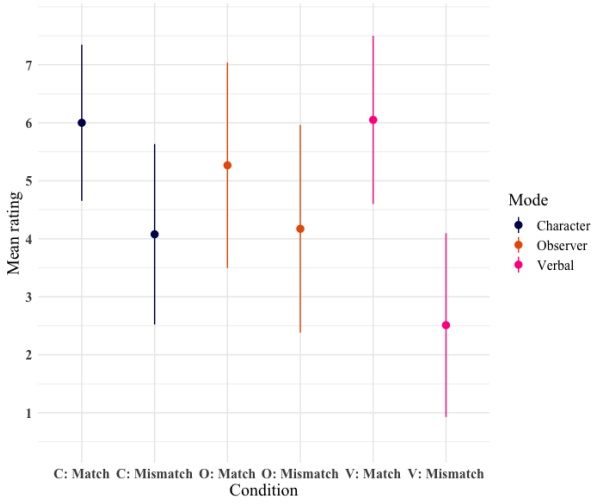


Figure 4: Mean values and SDs for each condition

larger size of CVGs (McNeill, 1992) a difference in the at-issue status of CVGs and OVGs is hypothesized. This hypothesis leads to a problem. Traditionally, as shown above, the notion of at-issueness has been understood as a binary notion, meaning that an expression or a gesture is either at-issue or not-at-issue (e.g., Simons et al., 2010). If it were assumed that at-issueness is a binary notion, this would lead to the prediction that CVGs are at-issue. However, as has been shown above already, this is not a desirable prediction. Therefore, it will be assumed that at-issuness is a gradient notion (Barnes and Ebert, 2023). CVGs and OVGs can thus differ in their at-issue status and still both contribute not-at-issue meaning by default at the same time. A significant interaction of MATCH and the pairwise comparison between CVG and OVG of the factor MODE is thus predicted. This means that the rating difference between matching and mismatching items is predicted to be significantly higher for CVG items than for OVG items, i.e., the mismatch effect is predicted to be stronger for CVG items than for OVG items.

3.3. Results

The statistical analysis was conducted using RStudio (RStudio Posit Team, 2023), an integrated development enviroment for the R statistics software (R Core Team, 2022). For data preparation and visualization, the package 'tidyverse' (Wickham et al., 2019) was used. In order to test for significant effects, the results were analyzed using cumulative link mixed effects models with the function clmm() in the 'ordinal' package (Christensen, 2019). An ordinal mixed effects model was chosen to analyze the data instead of a linear mixed effects model mainly for two reasons: i) linear mixed effects models require the data to be measured at the interval level and ii) linear mixed effects models require the data to be normally distributed. Both is questionable for Likert scale data. Therefore, ordinal mixed effects models are more suitable to analyze this kind of data. For the statistic computation, the two factors and all the interactions between them were entered as fixed effects into the model using effect coding, i.e., the intercept represents the unweighted grand mean while the fixed effects compare the factor levels to each other. For MODE, the three-level factor, two pairwise contrasts were defined. Pairwise contrasts compare two levels of a factor with each other.

Table 1: Ordinal mixed effects model with Mode and Match as fixed effects and participants and items as random intercepts. Formula: 'responseO ~ Match * Mode + (1 | CASE) + (1 | nr)', data = experimental, Hess = T, nAGQ = 1
Signif. codes: *** 0.001 | ** 0.01 | * 0.05 | . 0.1

	Estimate	Std. Error	z value	Pr(> |z|)
Match	-2.857	0.139	-20.60	<2e-16 ***
Mode – CVG vs. OVG	-0.423	0.136	-3.11	0.0019 **
Mode – OVG vs. V	0.394	0.143	2.76	0.0057 **
Match:Mode – CVG vs. OVG	1.176	0.273	4.30	1.7e-05 ***
Match:Mode – OVG vs. V	3.193	0.293	10.90	<2e-16 ***

Table 2: Ordinal mixed effects model with Mode and Match as fixed effects and participants and items as random intercepts. Formula: 'responseO ~ Match * Mode + (1 | CASE) + (1 | nr)', data = experimental, Hess = T, nAGQ = 1
Signif. codes: *** 0.001 | ** 0.01 | * 0.05 | . 0.1

	Estimate	Std. Error	z value	Pr(> |z|)
Match	-2.857	0.139	-20.60	<2e-16 ***
Mode – CVG vs. OVG	-0.423	0.136	-3.11	0.0019 **
Mode – CVG vs. V	-0.816	0.144	-5.65	1.6e-08 ***
Match:Mode – CVG vs. OVG	1.176	0.273	4.30	1.7e-05 ***
Match:Mode – CVG vs. V	-2.018	0.289	-6.99	2.7e-12 ***

Figure 4 shows the mean ratings and the standard deviations (SDs) for each condition. CVG items were rated similar to Verbal items in the match condition (CVG: M = 6.00, SD = 1.35; Verbal: M = 6.05, SD = 1.45). OVG items were rated worse than the other two conditions of the factor MODE in the match condition (M = 5.27, SD = 1.77). In the mismatch condition, CVG and OVG items were rated similarly (CVG: M = 4.08, SD = 1.56; OVG: M = 4.17, SD = 1.79). Verbal items were rated worse in this condition (M = 2.51, SD = 1.58).

The mixed effects model corresponding to the data in Figure 4 is given in Table 1. There is a main effect for the factor MATCH. For the pairwise comparison between CVG and OVG for the factor MODE, there is also a main effect. Moreover, there is a main effect for the pairwise comparison between OVG and Verbal (abbreviated as V in Tables 1 and 2) for the factor MODE. In addition, a significant interaction between MATCH and the pairwise comparison between CVG and OVG for MODE can be observed. Finally, there is an interaction for the factor MATCH and the pairwise comparison for MODE between OVG and Verbal.

For safety reasons, although uncommon, the same model was computed with different pairwise contrasts. While the pairwise contrasts for the factor MODE in Table 1 compared CVG to OVG and OVG to Verbal, the pairwise contrasts for the model presented in Table 2 compared CVG to OVG and CVG to Verbal. Table 2 shows that there is a main effect for the factor MODE for the pairwise comparison between CVG and Verbal. Moreover, a significant interaction between the factor MATCH and the pairwise comparison between CVG and Verbal for the factor MODE can be observed.

3.4. Discussion

The results show a significant rating difference between CVG and Verbal items. Moreover, a significant rating difference in the rating of matching vs. mismatching CVG items and Verbal items can be observed. This is the interaction predicted for Research Question 1, which targets the at-issue status of CVGs. Therefore, the data confirm the hypothesis that CVGs contribute not-at-issue meaning by default. This finding is also in line with the results of the study reported in Ebert et al. (2020) suggesting that co-speech gestures contribute not-at-issue meaning by default.

Concerning the hypothesis that CVGs and OVGs differ with respect to their at-issue status, a significant interaction between MATCH and the pairwise comparison between CVG and OVG for the factor MODE was predicted. Again, the results of the study confirm this prediction. The rating difference between matching and mismatching items in the CVG condition was significantly higher than in the OVG condition. Therefore, it can be concluded that CVGs are more at-issue than OVGs. This interpretation is also in line with gradient approaches to at-issueness (cf. Barnes and Ebert, 2023).

A potential confounding factor is that there might be salience differences between CVGs and OVGs as the former are normally larger in size due to the whole body being involved in the gesture production (McNeill, 1992). Therefore, a second experiment was conducted targeting the research question whether the two viewpoint gesture types differ with respect to salience.

4. Experiment 2: Are there salience differences between viewpoint gestures?

4.1. Salience: An overview

Very broadly, salience can be described as one of the main organizing principles in discourse (Falk, 2014). This means that during discourse processing some parts of an utterance are more activated during discourse processing. These more activated parts are seen as salient units in a discourse.

One can distinguish two notions of salience in linguistic research: *backward-looking* and *forward-looking* salience. The underlying assumption for backward-looking salience is that salient units can be retrieved from memory more easily than discourse units which are not salient. Research on backward-looking salience has in large parts focused on referring expressions. It has been proposed that these are ranked on a hierarchical list, whereby each of them has an accessibility value (Ariel, 1990). Speakers choose referring expressions to refer back to a discourse unit in accordance with that accessibility value:

(12) Adele went to the university library.
  a. She urgently needed a book for her exams.
  b. This institution was one of the oldest in the country.

(Falk, 2014: p. 3)

Adele is highly salient in (12). Therefore, this proper name is picked up with a personal pronoun in (12a) because personal pronouns are used to pick up discourse units which are highly

accessible. In order to pick up *the university library*, a discourse unit which is not salient, by contrast, speakers are predicted to use a demonstrative DP (*this institution* in (12b)) instead of a personal pronoun.

By contrast, forward-looking salience relates to the idea that salience is associated with the allocation of attention (e.g., Grosz et al., 1995). Salience under this notion is seen as means of attentional control (Chiarcos, 2009). This can be illustrated with the so-called *Moses-illusion*:

(13) Moses took two animals of each species to the Ark.

The sentence in (13) is false, since Noah took two animals of each species to the Ark. However, when asked to judge this sentence as true or false, speakers often judge it true. This is because according to the notion of forward-looking salience *Moses* is backgrounded in this example. If, by contrast, speakers are presented with the slightly modified example in (14), they detect the error more frequently and judge the sentence false (Bredart and Modolo, 1988).

(14) It was Moses who took two animals of each species to the Ark.

Thus, foregrounding a discourse unit can affect its salience.

The question that now arises is how these ideas about salience can be applied to the present case of viewpoint gestures. CVGs could in principle be more salient than OVGs at least on the perceptual level because they are larger in size. However, it has been shown in Section 2.2 that co-speech gestures contribute not-at-issue meaning by default. This has been verified for CVGs and OVGs by the results of Experiment 1 (Section 3). Not-at-issue content is generally backgrounded material as it is not asserted (cf. Potts, 2005). Moreover, the manual modality is the backgrounded modality in spoken languages. Therefore, fit is plausible to assume under the forward-looking account of salience that CVGs and OVGs both are non-salient units in a discourse. While the predictions of the backward-looking notion of salience are somewhat less clear, CVGs should be more easily retrievable from memory if they are more salient than OVGs. This is tested for by means of a forced choice study. Due to the high backgroundedness of both CVGs and OVGs, it is hypothesized that they do not differ with respect to their salience, i.e., that they are both not salient.

4.2. Method

4.2.1. Participants

Self-reported native speakers of German were recruited as participants (n = 45) via Prolific. All of them were naive with respect to the research question.

4.2.2. Materials

The same materials as for Experiment 1 were used, i.e., participants were presented videotaped utterances (n = 18) in the style of (9) that were either accompanied by a CVG or an OVG (cf. (9a)) or a verbalized version of the gestures as in (9b) (factor MODE: CVG vs. OVG vs.

Verbal). These utterances were paired with a matching and a mismatching picture. Crucially, as in Experiment 1, the (mis)match came about only via the manipulation of the factor MODE. The experimental items were interspersed with 22 unrelated fillers. In order to increase the overall difficulty of the study and thus to avoid a ceiling effect, a distractor task was included where participants had to memorize a randomly generated digit string consisting of six digits. The questionnaire was thus of a single factor design.

4.2.3. Procedure

Participants had to complete a web-based forced choice questionnaire. There task was to select the picture matching the utterance they were previously presented. The completion took approximately 20 minutes and participants were compensated with £3.20.

The questionnaire started with an introduction where participants were instructed with the task of the study. They were specifically instructed to pay attention to both the audio and the video tape. In addition, they were informed about their data protection rights and had to give informed consent prior to participation.

Each trial started with the presentation of the randomly generated six digit string. Participants saw the digit string for five seconds. Afterwards, the questionnaire automatically proceeded to the next page where the video played after three seconds. The video could only be viewed once. Then, on the next page, participants were presented three digit strings. Their task was to select the string they had seen at the beginning of the trial. On the last page of each trial, two pictures were presented. One picture matched the utterance they were previously presented and one did not match the utterance. The task of the participants here was to select the matching picture.

4.3. Predictions

As has been shown in Section 2.2, co-speech gestures contribute not-at-issue meaning by default (cf. Ebert et al., 2020). Not-at-issue content has been argued to be backgrounded information (Potts, 2005). Moreover, salience is associated with allocation of attention (e.g., Grosz and Sidner, 1986; Grosz et al., 1995) and backgrounded information is never salient. Thus, it follows that not-at-issue content is not salient. Since co-speech gestures are not only not-at-issue but also occur in the visual modality, the backgrounded modality in spoken languages, it is assumed that this makes them even more backgrounded. It is therefore hypothesized that CVGs and OVGs do not differ with regard to their salience as they both are highly backgrounded in a multimodal speech signal. TA main effect for the factor MODE is thus predicted,, i.e., that the proportion of false choices is significantly lower in the condition Verbal compared to the two gesture conditions because spoken material is always more foregrounded than gestural material.

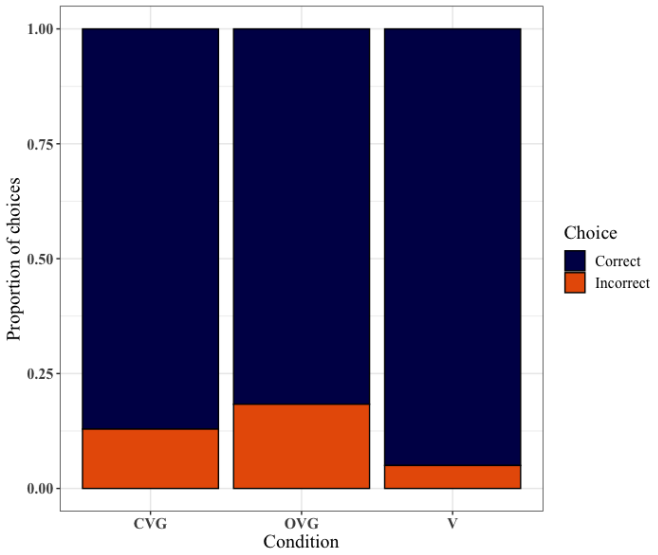


Figure 5: Proportions of choices (correct/incorrect) for each condition

Table 3: Logistic regression model with Mode as fixed effect and participants and items as random intercepts. Formula: mismatch ∼ Mode + (1 | CASE) + (1 | item), control = glmerControl(optimizer = "bobyqa"), family = binomial(link = "logit"), wo_items
Signif. codes: *** 0.001 | ** 0.01 | * 0.05 | . 0.1

	Estimate	Std. Error	z value	Pr(> |z|)
(Intercept)	-2.415	0.246	-9.84	<2e-16 ***
Mode – OVG vs. CVG	0.468	0.27	1.73	0.0831 .
Mode – CVG vs. Verbal	1.126	0.369	3.05	0.0023 **

4.4. Results

The same software as for Experiment 1 was used for statistical analysis, data preparation, and visualization was used. In order to test for significance, the results were analyzed using a logistic regression model with the glmer() function in the package 'lme4' (Bates et al., 2015). For the statistic computation, the factor was entered as fixed effect into the model using contrast coding where two pairwise comparisons were defined, one comparing the OVG with the CVG condition and one comparing the CVG condition with the Verbal condition.

Two items were included from the statistical analysis since participants chose the wrong picture in the OVG condition in the majority of cases, thus suggesting that the gesture was interpreted falsely. The proportions of choices are given in Figure 5. Participants chose the wrong picture most often in the OVG condition (18.3%), followed by the CVG condition (12.9%), and least often in the Verbal condition (5%). The overall accuracy for the distractor task was 95.3%.

The model corresponding to the data in Figure 5 is given in Table 3. The model output shows that there is a significant difference in the pairwise comparison of the CVG and the Verbal condition. In addition, there is a marginally significant difference between the OVG and the CVG condition.

4.5. Discussion

The results show that, in line with the predictions, participants chose the wrong picture least often in the condition Verbal, the condition which was hypothesized to contain the most salient material. Descriptively, the results also suggest a difference between the CVG and OVG condition. However, this difference only reached marginal significance, thus tentatively suggesting that there are no relevant salience differences between the two gesture types, as was hypothesized. Future research is needed, however, to fully clarify this matter.

5. General discussion and conclusion

The results of two experimental rating studies were reported investigating i) the at-issue status of CVGs and OVGs when they occur as co-speech gestures (Experiment 1) and ii) potential salience differences between the two types of viewpoint gestures (Experiment 2). For Experiment 1, it was hypothesized that although CVGs and OVGs contribute not-at-issue meaning by default, they still differ with respect to their at-issue status. More concretely, it was hypothesized that CVGs are more at-issue than OVGs due to the higher informativity of the former gesture type (Beattie and Shovelton, 2002) and potentially also due to their larger size (McNeill, 1992). The results obtained from Experiment 1 (Section 3) lend support to this hypothesis as the mismatch effect was higher for items in the CVG than in the OVG condition. Moreover, the mismatch effect was highest for items in the condition Verbal, thus suggesting the default not-at-issue status of CVGs and OVGs.

A potential confounding factor in the aforementioned interpretation of the results of Experiment 1 is that the two types of viewpoint gestures differ with respect to their salience. Therefore, Experiment 2 was conducted. Since co-speech gestures are in general highly backgrounded not only due to their not-at-issue status but also due to the manual modality being generally the backgrounded one in spoken languages, it was hypothesized that there are no salience differences between the two gesture types. The results of Experiment 2 generally support the hypothesis that co-speech gestures are less salient than verbal material. However, the pairwise comparison between CVG and OVG items yields a marginally significant effect. Although this tentatively suggests that there are no salience differences between the two types of viewpoint gestures, further research is needed to fully clarify this.

Taken together, the results of the two experiments reported in this paper are interpreted as follows: since there seem to be no salience differences between CVGs and OVGs, they arguably differ in their at-issue status. The results of Experiment 1 generally lend support not only to Ebert and Ebert's (2014) theory but also to the experimental paradigm used by Ebert et al. (2020) since the design employed for Experiment 1 in this paper was a slightly adapted version of their design of Experiment 1.

From a theoretical perspective, the results of the studies reported here also substantiate the proposal that at-issueness is a gradient notion and not a binary one (Barnes and Ebert, 2023). In their proposal, Barnes and Ebert (2023) define at-issueness as being related to the QUD. However, they depart from standard QUD-based approaches to at-issueness (e.g., Simons et al., 2010) in that they assume that the at-issue status of a linguistic structure is not fixed but instead

can be shifted on a scale if there is some contextual pressure, i.e., if it addresses the QUD (for potential drawbacks of their approach see Koev, 2023). For speech-accompanying gestures and ideophones, they propose the following scale (p. 212),

(15) Iconic co-speech gestures > sentence-medial adverbial ideophones > DEM + iconic co-speech gestures > DEM + sentence-medial adverbial ideophones

where > reads as 'is less at-issue than'. The proposal put forth in this paper is to split up the first category, iconic co-speech gestures, into several subcategories where OVGs rank lower on the scale than CVGs. From this proposal it follows that when a CVG is aligned with a demonstrative, such as German *so* (cf. Section 2.2 of the present paper), it will shift more toward the at-issue dimension than when an OVG is aligned with a demonstrative. Therefore, CVGs are argued to be inherently more at-issue than OVGs, i.e., the higher mismatch effect for CVGs observed in Experiment 1 is not due to contextual factors. It is left to future research to determine which factors cause the higher degree of at-issueness of CVGs compared to OVGs.

It is for now unclear whether the assumption actually holds that the differences in the at-issue status of CVGs and OVGs are inherent. This unclarity stems from the design of Experiment 1 itself and the fact that the gradient approach to at-issueness proposed by Barnes and Ebert (2023) is a QUD-based one. In Experiment 1, participants were always presented the following question: *Wie passend finden Sie die Äußerung in Bezug auf das Bild?* ('How appropriate do you find the statement in relation to the image?'). Since the match or mismatch always came about only via the manipulation of the MODE factor, this question might have been interpreted as a QUD explicitly targeting the content of the gestures used in the experiment. An alternative interpretation of the results, then, is that the differences in the at-issue status of CVGs and OVGs are not inherent. Rather, both gesture types could be inherently equally not-at-issue, but CVGs can be shifted more toward the at-issue dimension than OVGs. A follow-up study with pending results investigating this alternative interpretation is currently being conducted.

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Belief-in is belief-that with affectivity and evidentiality[1]

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Abstract. Belief-in reports of the form *S believes in O* have been taken to have at least two senses: factual and evaluative. I begin by briefly suggesting that there is no evidence for two distinct senses, then spend most of the paper developing a general semantics for belief-in reports. I explore, and use my semantics to explain, several features of belief-in reports: the context-dependence of what belief-that reports they entail, their widespread lack of equivalence with belief-that reports, and their neg-raising property. Put roughly, my semantics says that *S believes in O* a) asserts that, for some contextually salient property F, S believes that O has F and b) presupposes that S either has a belief that O has F for which they meet an affective and evidential requirement or has a belief that O doesn't have F for which they meet an affective and evidential requirement.

Keywords: Belief reports, Belief-in, Neg-raising.

1. Introduction

When we discuss 'belief reports', ascriptions of belief-that like in (1a) (for the *de se*) or (1b) (for the *de re*) tend to take centre stage.[2]

(1) a. Ayesha believes that she's spilling sugar. (cf. Perry, 1979)
b. Boris believes that the mayor is a spy. (cf. Quine, 1956)

By contrast, reports of belief-in like (2a) and (2b) are hardly ever discussed.[3]

(2) a. Carol believes in sets.
b. Daniele believes in public transport.

Why might this be?

On the one hand, ascriptions like (2a) might appear equivalent to belief-that ascriptions. So, for instance, (2a) might be taken to merely claim that Carol believes that sets exist. Given this, we might then think that, in developing an account of belief reports, (2a) and its ilk need no special treatment. On the other hand, ascriptions like (2b) might appear not to attribute a belief. For instance, (2b) might be taken to attribute to Daniele a pro-attitude of some form towards public

[1]I thank participants of PLM6, Sinn und Bedeutung 28, the joint meeting of SPE12 and OASIS3, and the Dortmund theoretical philosophy reading group for discussion of this or related material. I'm particularly grateful to Leonie Buschhoff, Lelia Glass, Kristina Liefke, Guy Longworth, Friederike Moltmann, Eva Schmidt, William Thomas as well as the reviewers for SuB28 and SPE12/OASIS3 and an anonymous reviewer for Mind & Language for their helpful criticisms and suggestions. Work on this paper was supported by a postdoc stipend from the Fritz Thyssen Foundation.

[2]Recent exceptions are Moltmann (2022); Djärv (2023) who discuss reports of the form *S believes O* and *S believes O that P* and Uegaki (2016) who discusses reports with embedded content DPs like *the rumour that P*.

[3]Notable exceptions include Price (1965; 1969), Szabó (2003); Textor (2013); Kriegel (2018).

 In: Baumann, Geraldine, Daniel Gutzmann, Jonas Koopman, Kristina Liefke, Agata Renans, and Tatjana Scheffler (eds.) 2024. Proceedings of Sinn und Bedeutung 28. Bochum: Ruhr-University Bochum, 961-979.

transport (cf. Price 1965: 6-9 and Szabó 2003: 585-6). For this reason, we might then think that (2b) and its ilk are irrelevant to developing an account of belief reports.

I propose that ascriptions like (2a) aren't simply equivalent to belief-that ascriptions and that reports like (2b) do attribute a belief. The two kinds of ascriptions are more closely related than might appear. On my view, both a) assert that for some contextually salient property F, S believes that O has F and b) presuppose that S either has a belief that O has F for which they meet an affective and evidential requirement or has a belief that O doesn't have F for which they meet an affective and evidential requirement. My overall aim, then, is to present the first general semantics for belief-in reports, covering cases like (2a) and (2b) alike.[4]

Section 2 sketches why I adopt a general semantics for belief-in reports. Section 3 explores how context affects which belief-that a belief-in report entails. Section 4 and 5 defend the affective and evidential requirements. Section 6 argues that belief-in reports have neg-raising interpretations, and exploits a variant of Gajewski's (2007) excluded middle presupposition for belief-that reports (going back to Bartsch 1973) to derive these interpretations. Finally, section 7 uses the availability of neg-raised belief-in reports to reply to an apparent counterexample to my view due to Szabó (2003: 591-4).

2. Why a general semantics?

I aim to provide the first general semantics for belief-in reports. But, one might wonder, why would we want one?

H. H. Price (1965; 1969) influentially distinguishes two senses of belief-in reports. Based on differences between examples like (2a) and examples like (2b), he speaks of a 'factual' and an 'evaluative' sense (e.g. Price, 1965: 12-3). Price thus rejects the idea that a general semantics for belief-in reports, covering cases like (2a) and (2b) alike, is possible.

According to Price, (2a) would be, at least by default, understood to employ the factual sense. That's because it appears to be equivalent to the claim that Carol believes that sets exist. Since (2a) attributes an existential belief to Carol, why doesn't Price label this sense the 'existence' sense? The answer is that the factual sense is also at play in cases that don't (or at least don't merely) entail an existential belief. Consider:

(3) Eylem believes in free will. (cf. Price, 1965: 11)

By default, (3) doesn't, Price remarks, attribute to Eylem the belief that free will exists, but the stronger belief that all humans (or all rational beings) have free will.

For Price, (2b) would be, at least by default, understood to employ the evaluative sense. One distinctive feature of the evaluative sense is meant to be that it reports the subject as evaluating the object of their attitude positively—as having some form of pro-attitude towards that object.

[4]Szabó (2003: 594–606) develops a semantics for cases like (2a) that feature a bare plural (for instance *sets*) as the complement of *in*. Since my semantics explains the data his semantics is intended to explain and more (see especially section 6), I take my semantics to be preferable. For reasons of space, however, I won't explicitly compare his view to mine.

At first, Price (1965: 17) allows this positive evaluation to consist in an attitude of trust or esteem.[5] But he goes on to concede that (2b), for instance, would attribute to Daniele the belief that public transport is a highly efficient way of transporting persons and commodities, and that that's a good thing too (18). A belief-in report's evaluative sense thus attributes a belief that the things one believes in have a certain property, and that it's a good thing that they have that property. In effect, Price concedes that a belief-in report's evaluative sense is reducible to the meaning of a belief-that report attributing an evaluative belief.

Can Price use this data to argue for two distinct senses? No. For one, that (2a) and (2b) entail different non-evaluative belief-that reports—that Carol believes that sets exist and that Daniele believes that public transport is an efficient way of transporting persons and commodities—by itself doesn't argue for two senses. As I'll show in section 3, and as Price (1965: 11-2, 14-6) admits, there's significant variation in what non-evaluative belief-that reports a belief-in report entails even within Price's two alleged senses. And crucially, we can explain this variation if we take belief-in reports to have a single context-dependent meaning. For another, the intuition that (2a) doesn't and (2b) does attribute an evaluative belief-that can also be explained without appeal to two distinct senses. To do this, section 4 introduces a general 'affective' requirement that holds for both (2a) and (2b), but takes different forms in each case.

So, is there any other evidence for two distinct senses?

Ambiguities and polysemies are regularly exploited for comic effect. For instance, *River Ravi flows in what state? Liquid* exploits our expectation that *state* is to be interpreted as 'country or part thereof with government' rather than 'condition or way of being'.[6] Given this, Price might say that the distinction between the factual and evaluative senses is exploited for comic effect too, for instance in Stephen Colbert's joke at the 2006 White House Correspondents Dinner:

> I'm a simple man with a simple mind. I hold a simple set of beliefs that I live by. Number one, **I believe in America. I believe it exists.** My gut tells me I live there. I feel that it extends from the Atlantic to the Pacific, and I strongly believe it has 50 states. And I cannot wait to see how the Washington Post spins that one tomorrow. (my emphasis)[7]

Colbert exploits his audience's expectation that *I believe in America* is to be interpreted as something like 'I believe that it's a good thing that America is so-and-so', rather than as 'I believe that America exists'. This, Price might argue, is similar to how other jokes exploit expectations generated by ambiguity or polysemy.

However, the fact that Colbert's intended interpretation of *I believe in America* as 'I believe that America exists' is unexpected needn't be due to an ambiguity or polysemy in belief-in reports. Colbert's intended interpretation is also unexpected if his belief-in report has one meaning only—a meaning that entails that for some contextually salient property F, he believes that America has F. First, his utterance isn't informative if interpreted as 'I believe that America exists'. For it's already common ground that he believes that America exists. Any number of

[5]For an overview of theories of trust see McLeod (2020).

[6]https://www.ling.upenn.edu/ beatrice/humor/bad-exam.html

[7]I owe the exampleto Lelia Glass. https://abcnews.go.com/Entertainment/video/stephen-colbert-2006-white-house-correspondents-dinner-62298550

other interpretations would be more informative and thus more salient in the context. Moreover, Colbert talks about a "simple set of beliefs that I live by", thereby making salient an evaluative interpretation of his belief-in report. For all Price says, these two factors might be what's causing our expectation that 'I believe that America exists' isn't the intended interpretation.

An alternative way to argue for two distinct senses is to use the contradiction test (e.g., Kroeger, 2022: 85-7): If a sentence of the form *X, but not X* or *Not X, but X* isn't felt to be contradictory and has a true reading, expression *X* is ambiguous. Take one of Kroeger (2022)'s examples: when an aged mother discusses her grown sons and daughters, *They aren't children any more, but they're still my children* isn't felt to be contradictory and has a true reading, and that's because *children* is ambiguous between 'offspring' and 'pre-adolescent human'. However, belief-in reports don't pass this test. (4a) and (4b) feel contradictory. Neither has a true reading, unless we make a special effort to reinterpret them.

(4) a. # Carol doesn't believe in sets any more, but still believes in them.
b. # Daniele doesn't believe in public transport any more, but still believes in it.

Another way to argue for two distinct senses is to show that reducing two full statements to an elided conjunction leads to zeugma (e.g., Chomsky, 1957: 36). For instance, since in (5a) the predicate *know* occurs once in its propositional knowledge reading, once in its acquaintance reading, its elided conjunction (5b) sounds zeugmatic.

(5) a. Hannah knows that penguins waddle, and Ted knows Pingu. (cf. Benton, 2017)
b. # Hannah knows that penguins waddle, and Ted, Pingu.

However, if we control for confounds, such as the contextual relevance of both full statements, reduced conjunctions of belief-in reports don't sound zeugmatic:

(6) QUD: Do sets exist and do Daniele's friends make a good case for them?
a. Well, Carol believes in Daniele's friends, and therefore in sets. So, since Carol is an expert on these issues, I'd say 'yes'.

Admittedly, the fact that belief-in reports don't pass these two tests doesn't mean that belief-in reports don't have two distinct senses. Some polysemous expressions—whose senses are often argued to be more closely related than the readings of merely ambiguous expressions (Vicente and Falkum, 2017)—don't pass these tests either. Consider:

(7) a. David drank and smashed the bottle. (Felappi, 2019: 66)
b. # That's a book, but it's not a book. (Viebahn, 2018: 759)

Bottle licenses so-called co-predication. In (7a) *bottle* occurs once, but with two senses: *drank* triggers its content-sense; *smashed* its container-sense. So, *bottle* having two senses doesn't require it to pass the reduction test. *Book*, in turn, fails the contradiction test. It arguably has two senses: 'physical copy' and 'informational content'. Still, there's no true reading of (7b).

The absence of direct evidence for two distinct senses thus doesn't establish that a general semantics for belief-in reports is required. But by giving a general semantics for belief-in reports that captures several of their properties, including those Price highlights, I'll show that positing two distinct senses isn't necessary. Applying Grice's 1978 modified Occam's razor, we thus have reason not to multiply senses beyond necessity and to adopt a general semantics.

3. Context-dependence

This section argues for clause a) of my view, that is, that *S believes in O* asserts that for some contextually salient property F, S believes that O has F. To argue for this clause, I'll explore how context affects which belief-that a belief-in report entails.

By default, (2a) seems to attribute to Carol the belief that sets exist. But this default interpretation can be overriden by context, for instance the question under discussion.

(8) QUD: {Can sets/What can} act as the foundation for mathematics?
  a. Carol believes in sets.
  ⊨ 'Carol believes that sets can act as the foundation for mathematics.'

Existence interpretations can also be overriden in other ways, for instance by way of lexical material inside the *in*-PP.

(9) a. Alexius Meinong believes in non-existent objects.
  ⊨ 'AM believes that there are non-existent objects.'
  b. Graham Priest believes in impossible objects.
  ⊨ 'GP believes that there are impossible objects.'

If Alexius Meinong believes in non-existent objects, he needn't believe that non-existent objects exist. Read *de dicto* the belief that non-existent objects exist is obviously contradictory in a way in which a belief in non-existent objects isn't. Read *de re*, as the belief that there are non-existent objects such that Alexius Meinong believes them to be existent, the belief that non-existent objects exist isn't contradictory. But the *de re* reading isn't the most natural reading, given that *de re* readings with embedded bare plurals are generally unattested (Carlson, 1977; Dayal, 2013). On the most natural non-contradictory reading, then, (9a) entails that Alexius Meinong's ontology includes objects he believes to be non-existent: he believes *de dicto* that there are (rather than exist) non-existent objects.

Much the same goes for (9b). If Graham Priest believes in impossible objects, he needn't believe that impossible objects exist nor even that they're possible. The most natural non-contradictory reading of (9b) entails that Graham Priest's ontology includes objects he takes to be impossible objects: he believes *de dicto* that there are impossible objects.

Existence interpretations aren't the only ones that can be overriden by context. Following Price, I suggested that the default interpretation of (2b) attributes to Daniele the belief that public transport is a highly efficient way of transporting persons and commodities. But consider:

(10) QUD: {Does public transport/Which things} help cutting carbon emissions?
a. Daniele believes in public transport.
⊨ 'Daniele believes that public transport help cutting carbon emissions.'

To capture the context-dependence in examples (8a) through (10a), I propose that:

(11) $[\![\text{S believes in O}]\!]^c = 1$ only if for some property F salient in c, $[\![\text{S}]\!]^c$ believes that $[\![\text{O}]\!]^c$ has F.[8]

An important complication in applying (11) is that questions make both a property and its negated variant salient (although the property will generally be more salient). In the cases so far, (8a) and (10a), the entailed belief-that was a belief that O has the property, not a belief that it has the negated variant. But this isn't always the case. Consider:

(12) QUD: Is set theory necessarily contradictory?
a. Carol believes in set theory.
⊨ 'Carol believes that set theory isn't necessarily contradictory.'

How do we derive this interpretation of (12a)? We make use of what the next section will call the affective requirement (=(17)). That is, we know that one would have certain feelings should the things one believes in be found to have (satisfaction, gratitude) or fail to have (disappointment, sense of betrayal) the property they're believed to have. Given this, and contextually assumed information about Carol's mathematical preferences, we know that the only interpretation of (12a) that's consistent with the common ground is the interpretation actually attested.[9] On grounds of charity, then, that's how we interpret (12a).

4. The affective requirement

This section develops the first part of my argument for clause b) of my semantics for belief-in reports. I'll focus on motivating what I've called an 'affective' requirement. Subsequently, section 5 will motivate the evidential requirement. Finally, section 6 will show why clause b) is formulated as an excluded middle presupposition.

My argument for the affective requirement starts from data Price takes to motivate his evaluative sense. Price takes (2b) to attribute the belief that public transport is a highly efficient way of transporting persons and commodities, and that that's a good thing. On Price's view, then,

[8]One might wonder how (11) can predict existence interpretations, since it's a substantive question whether there's a property of existence. For present purposes, I'll simply assume that there is such a property. But my view doesn't depend on this assumption. Existence interpretations could also be understood in terms of the property of falling into the range of the existential quantifier, having the property of being identical to something, and so on. See Rami (2017) for possible views. The 'there are' interpretations of (9a) and (9b) raise a similar question about the property of being, and my response runs along the same lines.

[9]The context-dependence of this interpretation becomes clear if we assume that it's common ground that Carol takes contradictoriness to favour, rather than count against, a mathematical theory. In that case, (12a) would entail that Carol believes that set theory is necessarily contradictory.

the belief-in report attributes belief-that with a content that's both factual and evaluative. This accounts for an important phenomenon. Suppose Daniele becomes a 'localist' and now believes that it's a bad thing to transport persons and commodities—people and goods should stay where they are. In that case, Price (1965: 18) thinks, (2b) wouldn't be true, at least not on its default reading. Here's another example:

(13) BVB is playing Bayern. Fara is a committed BVB fan. But she can tell that BVB is doing poorly, and so believes that Bayern will win the match.
QUD: Will Bayern win the match?
a. Fara believes in Bayern. Not true

Fara believes that Bayern will win the match. Thus, for some contextually salient property—winning the match—, Fara believes that Bayern have that property. Yet, it's not true that Fara believes in Bayern.[10]

Price's diagnosis of Fara's and localist Daniele's cases is that they're missing required evaluative beliefs. Localist Daniele doesn't believe that it's a good thing that public transport is a highly efficient way of transporting persons and commodities, and Fara doesn't believe that it's a good thing that Bayern will win the match. So, for Price, the reason why the attributions of belief-in to Fara and localist Daniele aren't true is that they're not taking what they believe to be the facts about public transport and Bayern to be good.

By contrast with evaluative belief-in, what Price would call factual belief-in sometimes goes hand in hand with taking what one believes to be the facts to be neutral or even bad. Consider:

(14) 6-year-old Gino believes it's bad to have monsters in one's wardrobe. Despite his parent's efforts to convince him otherwise, he believes there are monsters in his wardrobe.
QUD: {Are there monsters/Which things are} in Gino's wardrobe?
a. Gino believes in monsters. True

(15) Because he's convinced by the One Over Many argument, Hans believes that universals exists. But, since he takes the existence of universals to make no practical difference, he's indifferent to whether they actually exist.
QUD: {Do universals/Which things} exist?
a. Hans believes in universals. True

Gino is like localist Daniele in taking what he believes to be the facts to be bad, rather than good. Yet unlike localist Daniele, Gino has a belief-in. (14a) is true. Hans is unlike our previous characters in taking what he believes to be the facts to be neither bad nor good—he's indifferent. Nonetheless, (15a) is true.

The contrast between cases like Gino's and Hans' and cases like Fara's and localist Daniele's forces Price to distinguish two senses of belief-in reports. The factual sense is responsible for

[10]The context could also be fleshed out to make (13a) true. Suppose, for instance, that despite being a BVB fan, Fara believes it would be good if the current management was fired and believes this will happen if Bayern win the match. Here, she would believe that it's a good thing if Bayern win the match, and (13a) would be true.

the truth of the reports about Gino and Hans; the evaluative for the lack of truth in Fara's and localist Daniele's cases. However, as we've seen earlier, there's no direct evidence for two distinct senses. And in fact, the difference between the two kinds of case is consistent with a general semantics for belief-in reports.

Our general semantics must impose a requirement on belief-in strong enough to predict that Fara and localist Daniele don't believe-in, yet weak enough to also predict that Gino and Hans do believe-in. A first, but problematic, way to go is to replace Price's evaluative requirement with a desire requirement. Intuitively, this requirement says that one wants the things one believes in to have the property they're believed to have. More formally:

(16) $[\![\text{S believes in O}]\!]^c = 1$ only if for some property F salient in c, i) $[\![\text{S}]\!]^c$ believes that $[\![\text{O}]\!]^c$ has F and ii) $[\![\text{S}]\!]^c$ wants $[\![\text{O}]\!]^c$ to have F.

The desire requirement predicts that Fara and localist Daniele don't believe-in: localist Daniele doesn't want public transport to be a highly efficient way of transporting persons and commodities, and Fara doesn't want Bayern to win the match. However, the desire requirement doesn't predict that Gino and Hans do believe-in. Gino doesn't want monsters in his wardrobe and Hans doesn't want universals to exist. So, like Price's evaluative requirement, the desire requirement is too strong for a general semantics of belief-in reports.

Fortunately, there's a weaker, and better, alternative: the 'affective' requirement. Intuitively, this requirement says that one would have certain feelings should the things one believes in be found to have (satisfaction, gratitude) or fail to have (disappointment, sense of betrayal) the property they're believed to have. More formally:

(17) $[\![\text{S believes in O}]\!]^c = 1$ only if for some property F salient in c, i) $[\![\text{S}]\!]^c$ believes that $[\![\text{O}]\!]^c$ has F and ii) $[\![\text{S}]\!]^c$ would have a positive feeling upon learning that $[\![\text{O}]\!]^c$ has F or a negative feeling upon learning that $[\![\text{O}]\!]^c$ doesn't have F.

Localist Daniele doesn't satisfy the affective requirement, because he wouldn't be satisfied upon learning that public transport is an effective way of transporting persons and commodities, nor would he be disappointed if he learned that it's not. So, we correctly predict that localist Daniele doesn't believe in public transport. Fara doesn't satisfy the affective requirement, because she wouldn't be grateful if she learnt that Bayern will win the match, nor disappointed upon learning that they won't. So, we correctly predict that Fara doesn't believe in Bayern.

Applying the 'hey, wait a minute!' diagnostic to Fara's case, we can see that the affective requirement is, just as my view has it, part of the presupposed content of belief-in reports. That B's response is licensed in (18) suggests that A's utterance has a problematic presupposition, namely that Fara would have a positive feeling if she found out that Bayern will win the match.

(18) Context as in (13)

a. A: Fara believes in Bayern.
B: Hey, wait a minute! Surely, Fara wouldn't be satisfied if Bayern won?

Does the affective requirement also make the right predictions about Gino and Hans? The requirement's crucial innovation is that one can have a positive feeling upon learning that some proposition one believes is true without believing its truth to be a good thing or wanting it to be true. Conversely, one can have a negative feeling upon learning that some proposition one believes isn't true without believing that its truth would be a good thing or wanting it to be true.

With this in mind, consider Gino. Though he wouldn't be grateful if he learnt that monsters are in his wardrobe, there's a sense in which he'd be satisfied. For he'd be proven right, against the 'better judgement' of his parents. Conversely, Gino would be disappointed if he found out that there are no monsters in his wardrobe. For he'd be proven wrong, in line with the 'better judgement' of his parents. The satisfaction or disappointment Gino would feel in either case would concern his role as a knower: it would be 'intellectual' in kind.

Now turn to Hans. Although he's indifferent to whether universals exists, he's not indifferent to whether he correctly assessed the One Over Many argument's strength. So, if he learnt that universals exists, he'd be satisfied; if he learnt that they don't exist, he'd be disappointed; and this satisfaction and disappointment would concern Hans' role as a knower.[11]

Given what I've said about Gino and Hans, one might worry that the affective requirement is too weak to predict the truth-conditions of (13a). In its context, (13a) entails that Fara would be disappointed in her role as a BVB fan, not in her role as a knower. But, to make the right predictions about Gino and Hans, I weakened the affective requirement so that it merely entails disappointment in one role or another.

In reply, I propose that the affective requirement is itself context-dependent. More specifically, I let context determine in what 'role' one must be satisfied or disappointed upon learning that the things one believes in do or don't have the property they're believed to have. This yields the right predictions about Gino, Hans, and (13a). Gino's role as a knower is made salient by his contextually assumed relation to his parents, who try to convince him that there are no monsters in his wardrobe. Hans' role as a knower is made salient by his description as convinced by the One Over Many argument, despite being indifferent to whether universals exists. By contrast, Fara's role as a BVB fan is made salient by her contextually assumed status as a BVB fan.[12]

[11] One might worry that Hans could be so cold-blooded a metaphysician as to be indifferent to whether he correctly assessed the One Over Many argument's strength too, whilst still believing in universals. If that was possible, I'd insist that it wouldn't be appropriate for Hans to be so cold-blooded if he believes in universals. So, I'd reformulate the affective requirement as a normative condition on what feelings would be fitting for someone with a belief-in.

[12] A clarification regarding the scope of the affective requirement. Some belief-that reports carry something like it because of the content of their embedded clause. For instance, if a belief-that report's embedded clause concerns the matrix subject's friends, we'll often get something like the affective requirement. Both (ia) and (ib) sound awkward because their first conjunct comes with an affective requirement. (ia)'s first conjunct does this because the content of Zara' belief concerns her friends, and one expects someone to be disappointed upon learning that their friends won't rescue them. (ib)'s affective requirement, by contrast, is overdetermined. It's there both because (ib) entails, in its context, that Zara believes that her friends will rescue her and because it's a belief-in report.

(i) QUD: Will Zara's friends rescue her?

a. # Zara believes that they'll rescue her, but wouldn't be disappointed upon learning that they won't.

b. # Zara believes in her friends, but wouldn't be disappointed upon learning they won't rescue her.

However, whilst some belief-that reports carry something like the affective requirement, many don't. Sometimes subjects are, in their contextually salient roles at least, indifferent as to whether what they believe is true. For

5. The evidential requirement

This section develops the second part of my argument for clause b) of my semantics for belief-in reports. I'll motivate what I've called an 'evidential' requirement.

In the last two sections, I've given necessary conditions for the truth of a belief-in report. At first glance, one might hope that these conditions are also jointly sufficient. Unfortunately though, they don't appear to be. Here's a counterexample.[13]

(19) The caterer brings coffee into the conference room. The coffee they bring is sometimes hot, sometimes cold. None of us want cold coffee. I believe that the coffee is hot, and would be disappointed if I found out that it isn't.
QUD: Is the coffee hot?
a. # I believe in the coffee.

Although I satisfy the necessary conditions I've given so far, there's something awkward about reporting me as believing in the coffee. This suggests that there's an additional requirement that I don't satisfy. A first, but problematic, way to go is to impose a restriction on the objects of belief-in and so to say that one cannot believe in certain things, such as coffee. However, this requirement is too strong. Given the right context, (19a) doesn't sound awkward.[14]

(20) My barista friend feels like her coffee isn't turning out as well as it should. She asks for my opinion about the coffee she's just made. Even before trying, I believe that the coffee is good enough, and I'd be satisfied if I found out that it is.
QUD: Is the coffee good enough?
a. I believe in the coffee.

How do the contexts in which the two belief-in reports are made differ? In (19), not only can I easily find out the coffee's temperature by trying it, I also don't have a reason to form a belief about the coffee's temperature before trying it. By contrast, whilst I can easily find out the coffee's quality by trying it in (20) too, here I do have a reason for forming a belief about whether the coffee is good enough before trying the coffee:[15] I can thereby signal how much trust I place in my barista friend's skills.[16]

The difference in the two contexts suggests an 'early-belief' requirement on belief-in. Intuitively, this requirement says that one has reason for forming one's belief-in before gathering

instance, based on what I learned in school, I believe that it's 400° Celsius on Venus. But lacking interest in astronomy, and absent any other reason to care, I wouldn't be even be intellectually disappointed if I found out that Venus is a little hotter than 400° Celsius. So, the affective requirement tells us that belief-in reports, whether so-called factual or evaluative ones, sometimes aren't equivalent to belief-that reports.

[13] I owe this case to Friederike Moltmann. An anonymous reviewer for SuB28 gave a similar example.

[14] I owe this example to Leonie Buschhoff.

[15] Compare this to a context where one is served by an unfamiliar barista. In that case, one doesn't have a reason to form a belief about the coffee's quality before trying the coffee. Thus, (19a) sounds awkward in this context.

[16] Note that I'm not saying that I have a non-evidential reason for my belief. The reason here isn't a reason for my belief that the coffee is good enough, but for forming a belief about whether the coffee is good enough.

additional easily available sensory evidence. More formally:

(21) $[\![\text{S believes in O}]\!]^c = 1$ only if for some property F salient in c, i) $[\![\text{S}]\!]^c$ believes that $[\![\text{O}]\!]^c$ has F and ii) $[\![\text{S}]\!]^c$ has reason for forming a belief about whether $[\![\text{O}]\!]^c$ has F before gathering additional easily available sensory evidence.

However, this requirement is too strong. For there are many cases where one believes in something concerning which there is no easily available sensory evidence. Carol, for instance, cannot easily gather sensory evidence for the existence of sets or their ability to act as the foundations of mathematics. So, Carol arguably cannot have reason for forming a belief before gathering additional easily available sensory evidence. Yet she has a belief-in.

How one could follow up on (19a) suggests an alternative to the early-belief requirement:

(22) Context as in (19).
   a. A: I believe in the coffee.
      B: Hey, wait a minute! You know, you can just try the coffee, right?

That B's 'hey, wait a minute!' response is licensed suggests that A's utterance has a problematic presupposition, namely that they can't just try the coffee to find out whether it's hot. This presupposition is problematic, because it's unclear to B how A could themselves believe, let alone take others to accept, that they can't just try the coffee to find out whether it's hot. (19a) is a case of presupposition failure, and for this reason sounds awkward and fails to be true.

Example (19a)'s problematic presupposition follows from a 'no-easy-evidence' requirement. Intuitively, this requirement says that one cannot easily gather sensory evidence concerning whether the things one believes in have the property they're believed to have. More formally:

(23) $[\![\text{S believes in O}]\!]^c = 1$ only if for some property F salient in c, i) S believes that O has F and ii) S cannot easily gather sensory evidence about whether O has F.[17]

The no-easy-evidence requirement gets some, but not all, cases right. Carol satisfies it. So, the evidential requirement allows our belief-in reports about her, (2a) and (8a), to be true. However, like the early-belief requirement, the no-easy-evidence requirement is too strong. In particular, it mistakenly predicts (20a) to be a case of presupposition failure, since it's common ground amongst my barista friend and me that I can easily gather sensory evidence concerning whether the coffee is good enough: I can just try the coffee.

Both the early-belief and the no-easy-evidence requirement are too strong. We need a weaker alternative. Since I take both requirements to be on to something, I propose to disjoin them. This gives us the 'evidential' requirement:

(24) $[\![\text{S believes in O}]\!]^c = 1$ only if for some property F salient in c, i) $[\![\text{S}]\!]^c$ believes that $[\![\text{O}]\!]^c$ has F and ii) $[\![\text{S}]\!]^c$ cannot easily gather sensory evidence about whether $[\![\text{O}]\!]^c$ has

[17] I mark presuppositions by underlying the clauses which state them.

F or has reason to form a belief about whether $[\![O]\!]^c$ has F before gathering additional easily available sensory evidence about whether $[\![O]\!]^c$ has F.

Even with the disjunction, however, we might think that the requirement doesn't cover all cases. Can't Gino easily gather sensory evidence about whether there monsters are in his wardrobe? And doesn't he lack reason to form a belief about whether monsters are in his wardrobe before gathering such evidence? If we answer 'yes' to both questions, Gino doesn't satisfy the evidential requirement, and we mistakenly predict (14a) to be a presupposition failure.

I suggest we answer 'no' to the first question, and say that Gino cannot easily gather sensory evidence about whether there are monsters in his wardrobe. For the monsters he believes in are only rarely detectable. They can't, for instance, be seen when his parents are with him or when he's trying to document their presence with a camera. Perhaps the monsters Gino believes in can only be seen when Gino is close to falling asleep. Thus, even Gino, let alone his parents, cannot easily gather sensory evidence about whether monsters are in his wardrobe.[18]

6. Neg-raising for belief-in reports

This section develops the last part of my argument for clause b) of my semantics for belief-in reports. By looking at neg-raising for belief-in, I'll show why clause b) is formulated as an excluded middle presupposition and give another reason for pushing the affective and evidential requirements into presupposed content. I'll start by arguing that belief-in reports license neg-raising interpretations.

6.1. The neg-raising data

Belief-that reports invite an interpretation of a wide-scope negation as entailing a narrow-scope negation (in this sense the negation is 'raised') (e.g. Crowley, 2019). This is a distinctive feature of belief-that reports. Many reports of other propositional attitudes don't have it.

(25) a. David doesn't believe that Gloria left.
$\rightsquigarrow$ 'David believes that Gloria didn't leave.'
b. David doesn't claim that Gloria left.
~~$\rightsquigarrow$ 'David claims that Gloria didn't leave.'~~

[18] A clarification about the scope of the evidential requirement. Some belief-that reports carry something like the evidential requirement because of the content of their embedded clause. For instance, if a belief-that report's embedded clause concerns sets, we'll (typically) get the first disjunct of the evidential requirement. For one cannot easily gather sensory evidence that sets exist or that they can act as the foundations of mathematics.

But whilst some belief-that reports carry something like the evidential requirement, many don't. Subjects believing that P can often easily gather sensory evidence that P and lack reason to form a belief about whether P before gathering additional such evidence. I, for instance, can easily gather sensory evidence that my tea is over-brewed—by tasting it—or that it's windy outside—by opening the window and listening to the trees, but have no reason to form a belief regarding these matters before gathering that evidence. So, the evidential requirement tells us that belief-in reports, whether they're what Price would have labelled factual or evaluative ones, often aren't equivalent to belief-that reports.

A closely related feature of belief-that reports is that certain Negative Polarity Items (NPIs) are licensed by negation across the matrix predicate and receive the interpretation they would receive if the negation was sitting in narrow-scope. For instance, punctual *until*, which is usually only licensed in negated clauses (as in (26b)), is licensed in negated belief-that reports, even when the embedded clause in which *until* occurs isn't itself negated (as in (27b)), unlike in claim-that reports.

(26) a. *Mary left until yesterday.
b. Mary didn't leave until yesterday. (Gajewski, 2007: 293)

(27) a. *Bill believes that Mary will leave until tomorrow.
b. Bill doesn't believe that Mary will leave until tomorrow. (Gajewski, 2007: 293)
⇝ 'Bill believes that Mary won't leave until tomorrow.'

(28) a. *Bill claims that Mary will leave until tomorrow.
b. *Bill doesn't claim that Mary will leave until tomorrow. (Gajewski, 2007: 293)

Belief-in reports also invite an interpretation of a wide-scope negation as entailing a narrow-scope negation.[19] Here too, that's a distinctive property. Many reports using other attitude predicates with embedded *in*-PPs don't invite such interpretations.

(29) QUD: Will Santa deliver presents in time?
a. Jacinta doesn't believe in him.
⇝ 'Jacinta believes that Santa won't deliver presents in time.'
b. Jacinta doesn't have faith in him.
~~⇝ 'Jacinta has faith that Santa Claus won't deliver presents in time.'~~

In addition, belief-in reports parallel belief-that reports insofar as certain NPIs are licensed by negation across *believe* and receive the interpretation they would receive if the negation was sitting in narrow-scope:

(30) QUD: When are we gonna have soup?
a. Kaysar believes in soups until it's cold.
(i) *Until* can be interpreted as modifying when Kaysar believes in soups:
'At any time before it's cold Kaysar believes in soups.'
(ii) But cannot be interpreted as modifying when we're gonna have soups.
b. Kaysar doesn't believe in soups until it's cold.
(i) *Until* can be interpreted as modifying when Kaysar doesn't believe in soups.
⇝ 'At any time before it's cold Kaysar believes that we won't have soups'
(ii) But it can also be interpreted as modifying when we're gonna have soups.
⇝ '(At speech time) Kaysar believes we won't have soups until it's cold.'

[19]This is despite the fact that, at least at first glance, there's no overt narrow-scope landing site for the negation. So, neg-raising for belief-in reports might pose a challenge to syntactic accounts of neg-raising, on which neg-raising interpretations are due to negation moving from wide- to narrow-scope. I won't pursue this issue and will assume Gajewski's semantic/pragmatic account of neg-raising.

6.2. The explanation

I'll assume Gajewski (2007)'s explanation of belief-that neg-raising and generalize it to cover neg-raising for belief-in. The explanation for the belief-that case goes as follows:

> *S believes that P* asserts that S believes that P and has the excluded middle presupposition that S believes that P or believes that not-P.[20] *S doesn't believe that P* asserts that it's not the case that S believes that P, but continues to presuppose that S believes that P or believes that not-P. So, its presupposed and asserted content jointly entail that S believes that not-P.

We can explain belief-in neg-raising in much the same way. To do this, I propose the following semantics for belief-in reports that builds on the results of earlier sections:

(31) $[\![\text{S believes in O}]\!]^c = 1$ iff

a. for some property F salient in c, $[\![\text{S}]\!]^c$ believes that $[\![\text{O}]\!]^c$ has F, and

b. for every property G salient in c, (i) $[\![\text{S}]\!]^c$ believes that $[\![\text{O}]\!]^c$ has G or believes that $[\![\text{O}]\!]^c$ doesn't have G, (ii) $[\![\text{S}]\!]^c$ meets the affective requirement for this belief, and (iii) $[\![\text{S}]\!]^c$ meets the evidential requirement for this belief.

On this view, *Jacinta believes in Santa*, uttered in the earlier context, asserts that Jacinta believes that Santa will deliver presents in time and presupposes (i) that she either believes that Santa will do so or believes that he won't do so, (ii) that whichever of these two beliefs she has, she meets the affective requirement for it, and (iii) that whichever of these two beliefs she has, she meets the evidential requirement for it. This means that in interpreting the wide-scope negation in *Jacinta doesn't believe in Santa* as targeting the asserted, but not presupposed, content of *Jacinta believes in Santa*, we assert that it's not the case that Jacinta believe that Santa will deliver presents in time. And for this reason, the asserted and presupposed content jointly entail that Jacinta believes that Santa won't deliver presents in time. Thus, the wide-scope negation has been 'raised' to narrow-scope.[21,22]

[20] A clarification to pre-empt a potential worry. The excluded middle presupposition might strike us as too strong, since we often neither believe that P nor that not-P. But, crucially, this presupposition is 'soft' and therefore cancellable. That's why in contexts where the alternative of neither believing that P nor believing that not-P, for instance having suspended judgement about whether P, is salient, neg-raising is suspended.

[21] For this explanation to work it's crucial that the affective and evidential requirements are both part of the presupposed content of belief-in reports. For suppose that the affective requirement is part of the asserted content of belief-in reports. Given this, a belief-in report asserts two conjuncts. For instance, *Jacinta believes in Santa*, uttered in the earlier context, will assert (i) that Jacinta believes that Santa will deliver presents in time and (ii) that Jacinta would be (intellectually) disappointed if he won't. So, in interpreting the wide-scope negation in *Jacinta doesn't believe in Santa* as targeting the asserted, but not presupposed, content of *Jacinta believes in Santa*, we assert only that at least one of the two conjuncts is false. We thus leave open that one of the conjuncts, for instance that Jacinta believes that Santa will deliver presents in time, is true. And for this reason, the asserted and presupposed content of *Jacinta believes in Santa* don't jointly entail that Jacinta believes that Santa won't deliver presents in time. Thus, the wide-scope negation won't have been 'raised' to narrow-scope. Evidently, we get this result also if we make the evidential requirement or, indeed, both requirements part of the asserted content of belief-in reports. It's fortunate, then, that, as we saw earlier, there's independent reasons to make both the affective and evidential requirements part of the presupposed content of belief-in reports.

[22] For reasons of space, I'll leave the explanation of the Negative Polarity Item data to the reader. As far as I can see, the explanation again generalizes from Gajewski's explanation of belief-that neg-raising.

6.3. Multiple property contexts

So far, I've focused on contexts where just one property (and its negated variant) is salient. But that's an idealization. Often more than one property is salient. What happens then?

Since I use an existential quantifier ranging over salient properties to describe the asserted content of belief-in reports, I predict that if, for instance, two properties F and G are salient, belief that O has F for which one meets the affective and evidential requirements and belief that O has G for which one meets these requirements are both individually sufficient for one to believe in O. So, a belief-in report in a two property context is expected to be ambiguous between three readings. So, we expect that, for clarity's sake, belief-in reports uttered in a two property context will typically be conjoined with information about which of the three readings is intended. This is the correct prediction:

(32) Jacinta believes that Santa will reward good kids, would be disappointed if he won't, and cannot easily gain sensory evidence for this. But she doesn't believe that Santa will deliver presents in time.
QUD: Will Santa reward good kids (=F) and deliver presents in time (=G)?
a. Jacinta believes in Santa, though, since she never got her presents on Christmas day, she doesn't believe that he will deliver presents in time. True

By contrast, since *S doesn't believe in O* asserts that there's no salient property for which S believes that O has that property and presupposes that for every salient property, S has a belief that O has it for which S meets the affective and evidential requirements or has a belief that O doesn't have it for which S meets the affective and evidential requirements, in a two property context the asserted and presupposed content of *S doesn't believe in O* jointly entail that S has a belief that O has neither F nor G. Fortunately, this prediction too appears to be correct:

(33) QUD: Will Santa reward good kids (=F) and deliver presents in time (=G)?
a. Jacinta doesn't believe in Santa.
$\rightsquigarrow$ Jacinta believes that Santa will neither reward good kids nor deliver in time.

7. A challenge from Szabó 2003

Now that we've explored and explained the neg-raising interpretations of belief-in reports, I'll use the availability of these interpretations to reply to an apparent counterexample to my view due to Szabó (2003: 591–4).

Based on an example, Szabó argues that what Price would call the factual sense of a belief-in report isn't equivalent to *S believes that O exists*. Such belief-in reports don't, Szabó suggests, attribute a belief with a propositional content, but a belief whose content is a term. Since I agree with Szabó's opponent that such belief-in reports attribute a belief with a propositional content, Szabó's argument also threatens my view.

Szabó's example involves Horatio, of whom Hamlet said "There are more things in heaven

and earth, Horatio, Than are dreamt of in your philosophy". Horatio reasonably holds that his ontology misses some things that in fact exist. That is, according to Horatio, the things he takes to exist don't exhaust what does exist. Now contrast a belief-that with a belief-in report:

(34) QUD: What exists?

a.	Horatio believes that things he doesn't believe in exist.	True
b.	Horatio believes in things he doesn't believe in.	Not true

The belief-that (34a) attributes is a reasonable one, and one that, given the case description, Horatio holds. (34a) is true. By contrast, the belief-in (34b) attributes is an unreasonable one—there's something incoherent, Szabó suggests, about believing in things one doesn't believe in. So, since it's part of the case description that Horatio is reasonable, Horatio doesn't have this belief-in. (34b) isn't true. Because (34a) and (34b) differ in truth-values, Szabó concludes that belief-in reports aren't equivalent to belief-that reports of the form *S believes that O exists*.

Given the context in which we're interpreting (34a) and (34b)—a context in which the salient property is existence—my view predicts that (34b) entails (34a). So whatever makes the belief attributed in (34b) an unreasonable one, and so one not held by Horatio, must be something (34b), but not (34a), entails. On my view, there's two such things: the affective requirement and its evidential counterpart. First, that Horatio would be (intellectually) satisfied/disappointed if he found out that things he doesn't believe in exist/don't exist. Second, that Horatio cannot easily gather sensory evidence that things he doesn't believe in exist or has reason to form a belief about whether they exist before gathering additional easily available sensory evidence about whether they exist.

Szabó's case can be extended so that Horatio satisfies both the affective and the evidential requirement. Take the evidential requirement first. Depending on what specific things Horatio already takes to exist, it might be very difficult for him to gather sensory evidence that things he doesn't believe in exist. For instance, if Horatio's ontology already contains all things for which there can be perceptual evidence, he won't be able to easily gather sensory evidence that things he doesn't believe in exist. Thus, he satisfies the evidential requirement. Regarding the affective requirement, one could describe the case so that he'd be at least intellectually disappointed upon finding out that things he doesn't believe in don't exist. This disappointment can, moreover, be reasonable. For his modesty prevented him from holding the much more informative and, in this scenario, ultimately correct belief that his ontology exhausts what exists. So, he'd have been closer to the truth if he had committed. And this can give Horatio good reason to be intellectually disappointed upon finding out that the things he took to exist actually exhaust what exists. In sum, my semantics predicts Horatio, on some extensions of Szabó's case, to reasonably believe in things he doesn't believe in, contrary to Szabó's intuitions.

My reply to this apparent counterexample turns on the fact that both (34a) *and* (34b) have neg-raising interpretations. Thus, in evaluating our truth-value and reasonableness intuitions about the case, we need to control for these neg-raising interpretations.

On (34a)'s neg-raising interpretation, Horatio believes that things such that he believes them not to exist do exist. This belief isn't inconsistent: it can be true that things such that one believes them not to exist do exist. Still, it can seem just as unreasonable and incoherent as the

belief-in attributed by (34b). Indeed, it's closely related to the 'commissive' form of Moore's paradox, which arises if one believes that P and that one believes that not-P.[23] The content of one's belief isn't inconsistent here either: P can be true even if one believes that not-P. Yet this doesn't exonerate one. One is still being unreasonable.[24] By contrast with (34a)'s neg-raising interpretation, the interpretation Szabó intends interprets the negation as wide-scope, as in *Horatio believes that things such that it's not the case that he believes them to exist do exist*. On this interpretation, (34a) reports a reasonable belief.[25]

So, the belief (34a) reports is only unreasonable on (34a)'s neg-raising interpretation. This suggests a hypothesis about (34b): that the belief-that (34b) reports is only unreasonable on (34b)'s neg-raising interpretation. One part of this hypothesis is true: on its neg-raising interpretation, (34b) entails an unreasonable belief-that. Given the contextually salient property of existence and (34b)'s neg-raising interpretation, (34b) entails that Horatio believes in things such that he believes them not to exist. This in turn entails that Horatio believes that things such that he believes them not to exist do exist. So, (34b)'s neg-raising interpretation entails the same unreasonable belief-that as (34a)'s neg-raising interpretation.

Is the remainder of the hypothesis also true? That is, is the belief-that (34b) reports reasonable on (34b)'s non-neg-raising interpretation? On this interpretation, (34b)'s negation is read as wide-scope. So, given the contextually salient property of existence, this reading of (34b) entails that Horatio believes in things such that it's not the case that he believes them to exist. This entails that Horatio believes that things such that it's not the case that he believes them to exist do exist. Thus, (34b)'s non-neg-raising interpretation entails the same reasonable belief-that as (34a)'s non-neg-raising interpretation.[26] So, we have systematic reasons (cf. Szabó, 2003: 592-4) for thinking that (34b) has an interpretation that Szabó's argument from Horatio's reasonableness hasn't shown to be false, even if (34b) wouldn't normally be used that way.

Now, Szabó could raise an explanatory challenge at this point. Both (34a) and (34b) have neg-raising and non-neg-raising interpretations. In either case the belief the neg-raising interpretation reports is, whilst the belief the non-neg-raising interpretation reports isn't, unreasonable. So, why do we have different intuitions about (34a) and (34b)? On the assumption that the

[23]For an overview of Moore's paradox and its various forms see Williams (2015)

[24]The difference between Horatio's unreasonable belief and the commissive Moore paradoxical belief seems to turn on the fact that the negative belief Horatio believes himself to have is self-ascribed *de re* rather than *de dicto*:

(i) a. What Horatio believes: $\exists$x [x exists $\wedge$ I believe ($\neg$ x exists)]
b. Its Moore paradoxical variant: $\exists$x [x exists $\wedge$ I believe ($\neg$ $\exists$x x exists)]

[25]Interestingly, that's despite great similarity with the 'omissive' form of Moore's paradox, which arises if one believes that P and that it's not the case that one believes that P. Horatio's reasonable belief, however, doesn't have the same logical form as the omissive Moore paradoxical belief. The belief he believes himself not to have is understood *de re*, not *de dicto*:

(i) a. What Horatio believes: $\exists$x [x exists $\wedge$ $\neg$ I believe (x exists)]
b. Its Moore paradoxical variant: $\exists$x [x exists $\wedge$ $\neg$ I believe ($\exists$x x exists)]

[26]Szabó could argue that, although the belief-that (34b)'s non-neg-raising interpretation entails is unproblematic, something else (34b) entails makes Horatio's belief-in unreasonable, and therefore one he doesn't hold. But what might this be? For instance, as we saw earlier, him being intellectually disappointed upon finding out that things he doesn't believe in don't exist can be reasonable.

neg-raising and non-neg-raising interpretations are equally available in both cases, we expect no such difference. I admit that this remains an explanatory challenge for my view. But to address it more space is needed than I have here. So stay tuned for more.

8. Concluding remarks

Belief-in reports of the form *S believes in O* have been taken to have at least two senses: factual and evaluative. I began by briefly suggesting that there's no evidence for two distinct senses, then spent most of the paper developing a general semantics for belief-in reports. I explored, and used my semantics to explain, several features of belief-in reports: the context-dependence of what belief-that reports they entail, their widespread lack of equivalence with belief-that reports, and their neg-raising property. Put roughly, my semantics says that *S believes in O* a) asserts that for some contextually salient property F, S believes that O has F and b) presupposes that S either has a belief that O has F that meets the affective and evidential requirement or has a belief that O doesn't have F that meets the affective and evidential requirement.

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Conditional *then* and the QUD-approach to conditional perfection[1]

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Abstract. In this paper, we (re)consider the role of conditional *then* in bringing about *conditional perfection* (CP; Geis and Zwicky (1971) and much subsequent work): the pragmatic step from a conditional *if p, q* to *if **and only if** p, q*. Our starting point is von Fintel (2001), according to whom CP depends on the type of *question under discussion* (QUD) preceding the conditional. Particular attention is devoted to focus placement on conditional *then* in German (*then*$_{\text{F}}$), which we argue to come with an *exhaustive presupposition* (Bassi et al., 2021): *if p, then*$_F$ *q* 'exhaustively presupposes' no previously considered antecedent p′ to make the consequent q true. A challenge is raised by *cataphoric* uses of German *then*$_{\text{F}}$, where said presupposition does not (always) seem to be triggered.

Keywords: conditionals, presuppositions, exhaustivity, conditional perfection

1. Introduction

Bare conditionals of the form *if p, q* often exhibit what Geis and Zwicky (1971) call **conditional perfection (CP)**: the tendency (or 'invitation') to be interpreted as *if **and only if** p, q* or simply *iff p, q*.[2]

(1) If you mow the lawn, I'll give you \$5. Geis and Zwicky (1971)
If **and only if** you mow the lawn, I'll give you \$5.

The 'perfectioning' of such bare conditionals is widely seen as a pragmatic step detached from the semantics (Geis and Zwicky (1971), van der Auwera (1997), Horn (2000), von Fintel (2001), Herburger (2015) a.o.). Under this view, which we share, CP should be subject to much **variability** due to contextual and grammatical factors (H1). Based on this assumed variety of factors, we further predict CP to be **gradable** (H2), i.e. more or less salient, or harder or easier to cancel, depending on how many factors come together, and how strong these factors are.[3]

(H1) variability:
CP is subject to both contextual and grammatical factors, as well as their **interaction**. There are **CP-favoring**, **CP-disfavoring** and **CP-neutral** factors.

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[2]More acccurately, Geis and Zwicky (1971) call the *only if* component an *invited inference*, and describe it as *if not p, then not q*.

[3]There sure may be factors that are so strong in and of themselves that their presence or absence alone determines whether we have CP or not. The arguably clearest case of this sort are *even if* conditionals, whose additivity clashes with the exclusiveness of CP. One may thus classify the presence of *even* as CP-*canceling*, rather than just -*disfavoring*.

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(H2) gradability:
The more CP-favoring factors are satisfied, the stronger the CP-inference becomes.

This paper's overarching goal is to probe into factors that (dis)favor CP, with special attention to the semantics and pragmatics of (focused) conditional *then*. Our theoretical starting point is a simplified version of von Fintel (2001)'s **QUD-approach to CP**. Under this account, the presence or absence of CP is linked to an implicit **question under discussion (QUD**; Roberts (2012)). CP is favored under what we follow Cariani and Rips (2023) in calling a *consequent-directed* QUD1, which asks for the conditions under which the consequent q holds, (2a). By contrast, CP is *not* favored under an **antecedent-directed** QUD2, which asks about the antecedent p's consequences, (2b).

(2) a. QUD1 (consequent-directed, CP-favoring): Under which conditions q?
b. QUD2 (antecedent-directed, CP-neutral): What if p?

It follows that a conditional *if p, q* is more prone to being perfected under QUD1 than under QUD2: the former 'favors' CP to a higher degree than the latter does.

(3) **Effect of context on CP:** QUD1 $>_{\text{CP}}$ QUD2

As promising as von Fintel's QUD-approach is, recent experimental work testing it has found mixed results (Cariani and Rips, 2023; Grusdt et al., 2023); but see Farr (2011) for some confirming evidence. To some extent, this paper is also a theoretical contribution to the question how well the QUD-approach fares in the light of certain CP-favoring strategies.

One potential such strategy is the insertion of the particle known as 'conditional *then*' into the consequent clause (*if p, then q*). At least since Iatridou (1993), conditional *then* has been linked to some form of CP in previous work. The arguably strongest link of this sort is entertained by Izvorski (1996). Iatridou (1993) and von Fintel (1994) entertain the idea that a *then*-conditional *asserts* all p-worlds to be q-worlds (as is standard under a Kratzerian approach), but more crucially *implicate* (or alternatively *presuppose*) not all non-p worlds to be q-worlds, equivalently: *some* non-p-worlds *not* to be q-worlds. This implication is strongly reminiscent of CP (McHugh, 2023: 40). Due to the existential quantification, we refer to it as a **weakly exhaustive implication**, leaving open whether it is an implicature or a presupposition.

Building on Iatridou (1993) as well as Izvorski (1996), Schlenker (2004) treats conditional *then* as a world pronoun that anaphorically relates to the antecedent-clause. He also discusses cases with intonational focus on conditional *then*. With the additional parameter '±focused', we now have three possible conditionals, illustrated for German *dann* in (4): conditionals without *then*, with unfocused and with focused *then*.

(4) Wenn du den Rasen mähst, {Ø/dann/dann$_{\text{F}}$} wirst du belohnt.
if you the lawn mow {Ø/then/then$_{\text{F}}$} get you rewarded
'If you mow the lawn, {Ø/then/then$_{\text{F}}$} you will get a reward.'

Schlenker proposes that focus on conditional *then* (*if p, then*$_{\text{F}}$ *q*) triggers the *scalar implicature* that among all of p's contextually relevant alternatives, **only** p-worlds are q-worlds. This derives CP in its strongest form, given that there is no possibility for some non-p world to be a q-world. So if we understand Schlenker's proposal correctly, it takes intonational focus to attain this strong CP-effect, although Izvorski (1996) seems to tentatively ascribe it to *then* in all its

versions, focused or not. We refer to this implication as a **strongly exhaustive implicature**.

In line with the graded notion of CP as stated under (H1), Iatridou's and Schlenker's observations jointly lead to a **scale of CP** in terms of exhaustive strength, with *then*-less conditionals at the lower and *then*$_{\text{F}}$-conditionals at the higher end:

(5) **Effect of grammar on CP:** *then*$_{\text{F}}$ $>_{\text{CP}}$ *then* $>_{\text{CP}}$ Ø

Based on the scales in (3) and (5), we generate the following predications:

- **(P1)** All three variants { Ø / then / then$_{\text{F}}$ } are compatible with the CP-favoring QUD1.
- **(P2)** Ø and *then* are compatible with the CP-neutral QUD2.
- **(P3)** *Then*$_{\text{F}}$, coming with strong CP, requires the CP-favoring QUD1, and is incompatible with the CP-neutral QUD2.

The idea behind (P2) and (P3) is that with the strongly exhaustive implicature triggered by *then*$_{\text{F}}$, a CP-favoring QUD is a better match than a CP-neutral one. But (P3) additionally follows from a need for *question-answer congruence* (Rooth, 1992): QUD2 leaves q open, so it requires focus on q in the answer. Focus on *then* (anaphorically) reflects focus on p, thereby violating this need.

We observe (P2) and (P3) to be borne out, insofar as Ø and *then* are fine under QUD2, but *then*$_{\text{F}}$ is not:

(6) a. QUD2: What if I mow the lawn?
b. Wenn du den Rasen mähst, **{Ø/dann/??dann$_{\text{F}}$}** wirst du belohnt.
if you the lawn mow **{Ø/then/??then$_{\text{F}}$}** get you rewarded

(P1), by contrast, is only partially borne out. Despite QUD1, *then*$_{\text{F}}$ is still slightly odd out of the blue:

(7) a. QUD1: Under which conditions do I get a reward?
b. Wenn du den Rasen mähst, **{Ø/dann/?dann$_{\text{F}}$}** wirst du belohnt.
if you the lawn mow **{Ø/then/?then$_{\text{F}}$}** get you rewarded

One may conclude from (7) that QUD1 is just necessary, not sufficient, for *then*$_{\text{F}}$ to be licensed. Inspired by Bassi et al. (2021) [BDPS], we will argue in this paper that the missing requirement is an *exhaustive presupposition* triggered by focus on *then*.

The paper is organized as follows. Section 2 lays out the main idea and discusses further data in its support. Section 3 is an attempt at a compositional implementation of the exhaustive presupposition, using a silent exhaustive operator proposed by BDPS. Section 4 discusses open issues, and section 5 concludes.

2. Focus on conditional *then*

What in addition to a CP-favoring QUD1 must hold in order for *then*$_{\text{F}}$ to be licensed? On our intuitions, a conditional like *if you mow the lawn, then$_{F}$ you'll get a reward* presupposes that some action other than mowing the lawn – say, washing the dishes – has been previously

considered and **rejected** as a truthful answer to the QUD1 *under which conditions do I get a reward?*. This amounts to a rejection of the alternative antecedent *that you wash the dishes* as insufficient for the consequent *that you get a reward*. A bit more precisely, conditionals of the form *if p, then$_F$ q* are taken by us to come with an **exhaustive presupposition** that each previously considered antecedent p′ (unless it entails p) must have been rejected as insufficient for the consequent q to be true. This presupposition explains why *then*$_{\text{F}}$ does not merely relate to the already CP-favoring QUD1, but comes with the additional 'rejection-requirement' just outlined: at least one possible answer must have been brought up and rejected as false. These are *anaphoric* uses of *then*$_{\text{F}}$, which we are largely concerned with in this paper. The same presupposition does not seem to be triggered by *cataphoric then*$_{\text{F}}$; see section 4.3 for an illustration.

With *then*$_{\text{F}}$, we do seem to have a form of CP, but its two components, sufficiency and necessity, are located at two different levels of meaning: *if p, q* (p's sufficiency for q) is *asserted*, but the exclusion of alternatives of the form *if p′, q* (roughly: p's necessity for q) is *presupposed*. Taking the alternatives at play to be alternative conditional antecedents rather than entire conditionals, one may put this division of labor between presupposition and assertion as follows:

(8) *if p, then$_F$ q*
   a. **asserted:**
      if p, q
   b. **presupposed:** (there is a previously considered p′ &) **[∃-component]**
      for each such p′: if p′, <u>not</u>-q **[EXH-component]**

The presupposition in (8b) comes in two parts. The exhaustive rejection of all previously considered p′ is preceded by the 'existential' part in brackets, according to which there are such p′ to begin with. One might think of this as the presupposition of the 'actual' presupposition, which quantifies over all these p′. As far as we can see, the existential requirement follows from a *non-triviality* principle proposed by (Schlenker, 2004), to be brought into play in section 4.1.

We illustrate our presuppositional claim with the stretch of discourse in (9). Anna raises a 'global' QUD1, which sets the goal of the dialogue that follows. Chris's questions are attempts at finding an answer to that QUD, but these questions are of the QUD2-type.[4] In Chris's second question (9b), *then*$_{\text{F}}$ relates to the preceding rejection, i.e. Benni's negative answer to Chris's first question whether washing the dishes will get him a peach. As indicated by the #, *then*$_{\text{F}}$ is near-obligatory in such a context – it is odd not to 'refer back' to the preceding rejection.

(9) a. Anna: Under which conditions will Chris get a peach? **= (global) QUD1**
   Benni: Let me think.
   Chris: If I wash the dishes, will I get a peach?
   ⇒ alternative [$_{\text{p}'}$ Chris washes the dishes] activated
   Benni: I'm afraid not. **= rejection**
   b. Chris: ... (und) wenn ich den Rasen mähe, bekomme ich #(dann$_{\text{F}}$) einen?
   ... (and) if I the lawn mow get I #(then$_{\text{F}}$) one

[4]They obviously don't have the form *what if p?*, but the 'polar' form *if p, q?*, which narrows down the number of possible true answers considerably. Still, they clearly are *antecedent-directed* by virtue of keeping the antecedent stable.

From (9), it can be seen that the exhaustive presupposition of *then*$_{\text{F}}$ *projects* under polar questions like (9b). This observation relativizes a claim about CP that has been made based on examples like (10). Ducrot (1969) and Horn (2000) present this example to show that CP-readings do not survive under polar questions, and are hence implicatures rather than presuppositions. von Fintel (2001) argues that the QUD-approach can explain this lack of CP: the question is of the QUD2-type, hence requires us to consider alternative *consequents*, not *antecedents*.

(10) Est-ce que, si Pierre vient, Jacques partira?
is-this that if Pierre comes Jacques leave-FUT
'If Pierre comes, will Jacques leave?' cf. Ducrot (1969: 35)
$\not\rightarrow$ if Pierre doesn't come, Jacques won't leave

With *then*$_{\text{F}}$ in (9b), however, one might argue the exhaustive component of CP to be present in a polar question, but at the level of presupposition: Chris presupposes the insufficiency of all other conditions mentioned in the context so far, which is the single condition [$_{\text{p}'}$ you wash the dishes]. As a result of this presupposed insufficiency, would an affirmative answer to (9b) identify mowing the lawn as *necessary* for Chris to get a peach? On the one hand, we are hesitant to say so, since such an answer doesn't preclude other sufficient conditions from being named in the further course of the conversation; see section 4.2 for an illustration. On the other hand, we may have necessity in a weaker 'scalar' sense: every salient p′ *scalarly lower* than p is presupposed to falsify q.

The context in (9a) raises a global QUD1 asking for the antecedent(s) making [$_{\text{q}}$ Chris gets a peach] true. It also provides a **rejection** of an alternative antecedent ($_{\text{p}'}$ Chris washes the dishes) as insufficient for q. By virtue of this rejection, *then*$_{\text{F}}$'s exhaustive presupposition as stated in (8b) is satisfied, and it is even infelicitous *not* to use it, cf. (9b). This infelicity is predicted under the pragmatic maxim *Maximize Presupposition* [MP] originating with Heim (1991) and elaborated on in much subsequent work. MP roughly says that when a presupposition trigger *can* be used in a given context, it *must* be.[5]

In the remainder of this section, we look at further examples, and try to explain them in terms of the analysis just sketched. We start with what looks like the *accommodation* of the exhaustive presupposition triggered by *then*$_{\text{F}}$, and then turn to the interaction of *then*$_{\text{F}}$ with additive particles.

2.1. Accommodation

As seen in (6) and (7) above, it is infelicitous to use (anaphoric) *then*$_{\text{F}}$ without having brought at least one alternative condition p′ into play. Under the present view, this infelicity can be ascribed to the fact that the more basic existential part of the presupposition stated in (8b) is not satisfied. But as we are going to see now, the second part of the presupposition, p′'s 'exhaustive' rejection as insufficient for the consequent, need not have been established in the preceding discourse, but can actually be contributed by *then*$_{\text{F}}$ itself: in other words, this rejection can be *accommodated*.

[5]Heim's (1991) idea is based on the contrast between definite and indefinite noun phrases. We thus have {a, the} as (lexical) alternatives (Sauerland, 2008). What are the alternatives for focused *then*? Is it (just) unfocused *then* or (also) a 'zero-alternative' (Ø), whose existence is assumed by some MP-based theories reviewed in Bade (2016)? How do these alternatives vary cross-linguistically?

In the discourse in (9), Benni need not explicitly state that for Chris to get a peach, washing the dishes is insufficient. The *then*$_{\text{F}}$-conditional is enough to convey this message. This can be seen in (11), which differs from (9) only in the absence of the explicit rejection.

(11) a. Chris: Under which conditions will I get a peach? = (global) QUD1
Benni: Let me think.
Chris: If I wash the dishes(, will I get a peach)?
⇒ **alternative [$_{\text{p}'}$ Chris washes the dishes] activated**
~~Benni: I'm afraid not.~~ **= ~~rejection~~**

b. Wenn du den Rasen mähst, dann$_{\text{F}}$ bekommst du einen Pfirsich.
if you the lawn mow then$_{\text{F}}$ get you a peach
⇝ if [$_{\text{p}'}$ Chris washes the dishes], you won't get a peach

Asking the dishwashing-(sub)question, Chris brings an alternative antecedent p′ into play, in satisfaction of the exhaustive presupposition's existential component. By uttering (11b), Benni gives two answers at the same time: not only to the global QUD1 – naming a condition sufficient for Chris to get a peach –, but also to the dishwashing-subquestion, which is answered negatively. Under the present account, the first answer is *asserted*, but the second one is *presupposed*. The presupposition is that all salient alternatives p′ to [$_{\text{p}}$ Chris mows the lawn] are insufficient for [$_{\text{q}}$ Chris gets a peach] to be true. The only such p′ being the dishwashing-alternative, Benni thus presupposes washing the dishes to be insufficient for getting a reward.[6] Since p′ is not explicitly rejected in the previous discourse – (11b) immediately follows the dishwashing-question after all – Benni must (and can) count on Chris to *accommodate* this presupposition, thus need not say 'no' explicitly, nor separately from giving the (only) true answer to QUD1.

In short: anaphoric *then*$_{\text{F}}$'s exhaustive presupposition – the rejection of a salient p′ – can be accommodated, hence need not be contextually given. What cannot be accommodated, hence must be contextually provided, is the existential requirement that p′ was made salient in the first place.

2.2. Additive particles

In this subsection, we look at one case in which *then*$_{\text{F}}$'s exhaustive presupposition is kept from being triggered, hence revealed to be a *pragmatic default*, perhaps in the sense of Stalnaker (1999): the possibility for *then*$_{\text{F}}$ to serve as the focus associate of an additive particle like *too*. *Then*'s compatibility with additives has long been observed in the literature. Izvorski (1996) and Schlenker (2004) discuss (12). There is what can be called an 'unconditional' context (as soccer will be played no matter what), which violates even a weakly exhaustive implication for *then*. Interestingly, 'bare' *then* is observed to be infelicitous in this context, but combined with the additive *too*, *then* is fine.

(12) We will definitely play soccer. If the sun shines we will. If it is cloudy and cold we will.

[6] Put a little more technically, the conditional alternative with the dishwashing-antecedent is presupposed to be excluded from the *question set*, the set of true answers to QUD1.

a. And if it rains, (#then) we will.
b. And if it rains, then too we will.
cf. Izvorski (1996): ex. (28) [based on von Fintel (1994): 99]

Such examples cast strong doubt on an analysis that incorporates exhaustivity into the semantics of *then*. Parallel observations can be made for *then*$_{\text{F}}$ in German:[7]

(13) a. We will definitely go for a hike. If it's cloudy, we will. If it drizzles, we will.
b. Und wenn es Katzen hagelt, #(selbst/auch) dann$_{\text{F}}$ gehen wir wandern.
and if it cats hails #(even/also) then$_{\text{F}}$ go we hike
'And if it rains [lit. hails] cats and dogs, {even then/then too} we'll go for a hike.'

The oddity of *then*$_{\text{F}}$ in the absence of an additive can again be taken to show that exhaustivity arises per default, but remains a pragmatic inference. This is not in conflict with the view that it is presupposed, as long as we allow some presuppositions to be pragmatic (Stalnaker, 1999). Since exhaustivity is pragmatic, it is also expected to be *cancelable*, which is something we witness in (13b). Additivity clashes with exhaustivity, at least under a perhaps too narrow construal of the latter as exclusive: a conflict discussed, among possible others, in Crnič (2012), Bade (2016) and Wimmer (2022). We have semantic additivity (contributed by the additive), but pragmatic exhaustivity (qua *then*$_{\text{F}}$). Only the latter is cancelable, so it must 'give way'.

Why is it odd not to use the additive in (13b)? The additive-containing version of (13b) requires a context in which some condition p′ other than [$_{\text{p}}$ it rains cats and dogs] has been established to suffice for [$_{\text{q}}$ we go hiking]. Such an 'additive' context necessitates the insertion of an additive. This is explained under *Maximize Presupposition* [MP].[8] It is also explained, however, under the competing theory *Obligatory Implicatures* (Bade 2016 a.o.), according to which the obligatory insertion of additive presupposition triggers comes from a contextual pressure to keep an obligatory exhaustivity implicature from arising: such an implicature would be inconsistent with an additive context like the one just described. The slight extension that *Obligatory Implicatures* receives in the case at hand is that the exhaustivity-inference to be canceled is pragmatically *presupposed* rather than implicated.

What do sentences like (13b) mean for the claimed connection between *then*$_{\text{F}}$ and a CP-favoring QUD1 (*under which conditions q?*)? We observe that this connection is weakened in the sense that QUD1 is no longer necessary for *then*$_{\text{F}}$ to be licensed. For one thing, (13b) is licensed in the following dialogue, in which only two CP-neutral QUD2s (*what if p?*) have been asked, but no QUD1:[9]

(14) a. – What (happens) if I wash the dishes? = QUD2
– If you wash the dishes, you'll get a peach.
– And what if I mow the lawn? = QUD2

[7] An even more natural way of expressing (13b) would be to have the consequent containing *then*$_{\text{F}}$ to the left of the antecedent, making *then*$_{\text{F}}$ *cataphoric*. This is illustrated in section 4.3.

[8] The additive could then be seen as having a lexical zero-alternative Ø. This relates to the discussion in footnote 5.

[9] There is a slightly more natural way to express (14b): focus is shifted from *then* to the additive, which now precedes the direct object, rather than forming a constituent with *then*:
(i) (Wenn du den Rasen mähst,) dann bekommst du auch$_{\text{F}}$ einen.
(if you the lawn mow) then get you also$_{\text{F}}$ one

b. (Wenn du den Rasen mähst,) auch (?)dann$_{F}$ bekommst du einen.
(if you the lawn mow) also (?)then$_{F}$ get you one

At the same time though, (13b) remains compatible with a QUD1:

(15) a. – Under which circumstances will I get a peach? = QUD1 If I wash the dishes? = QUD2
– Yes.
– And what if I mow the lawn? = QUD2
b. (Wenn du den Rasen mähst,) (?)auch dann$_{F}$ bekommst du einen.
(if you the lawn mow) (?)also then$_{F}$ get you one

Under the QUD-approach to CP, the weakened connection between QUD1 and *then*$_{F}$ is not unexpected: QUD1 was classified as CP-favoring. As long as *then*$_{F}$ comes with the special kind of CP proposed here, it needs a QUD1. As an associate of an additive particle, *then*$_{F}$ no longer comes with CP, so it no longer needs a QUD1.

2.3. Interim conclusion

In this section, we proposed *if p, then*$_{F}$ *q* to come with p's asserted sufficiency for q, but any previously mentioned p′'s pragmatically presupposed *in*sufficiency for q. Together, assertion and presupposition add up to a special kind of CP. The presupposition – its exhaustive component, to be precise – can be accommodated as well as canceled by an additive particle, in confirmation of its pragmatic status.

3. Towards a compositional implementation

In this section, we take steps towards a compositional implementation of the ideas outlined in the preceding section. Two ingredients will be crucial: Schlenker's (2004) treatment of conditional *then* as a world pronoun, as well as the silent presuppositional exhaustifier pex, which Bassi et al. (2021) propose as a twist to the grammatical approach to scalar implicatures (Chierchia et al. 2012 a.m.o.). Based on these ingredients, we will analyze two simple cases involving (anaphoric) conditional *then*$_{F}$, once with and once without an additive particle.

Ingredient 1: *then* as a world pronoun (Schlenker, 2004)

Schlenker (2004) develops his analysis of conditional *then* in the context of his treatment of *conditionals as definite descriptions*, a view inspired by previous work including Stalnaker (1968).[10] If-clauses are treated as the unique plurality of closest antecedent-worlds – worlds in which the antecedent holds true, and which come closest to (or differ minimally from) the actual world. The meaning of the conditional as a whole arises via collective predication of the consequent q to (each member of) that unique plurality. With Kaufmann (2017), we schematize

[10]We hope to do justice to more recent work in this vein, including Muyi Yang's, on a future occasion (Yang, 2020, 2022, 2023).

this predication as in (16), where the consequent q (a world predicate) takes the if-clause as its argument:[11]

(16) ⟦ if p, q ⟧ = q(⟦if p⟧)
q holds true of the unique plurality of closest p-worlds

Schlenker argues this analysis to be supported by the referential nature of conditional *then*. He treats conditional *then* as a world pronoun which refers to the very same world-plurality he takes the if-clause to denote. The if-clause is thus represented within the consequent, so to speak. In the following, coindexation between the if-clause and *then* reflects coreference of the two. In the case at hand, *then* anaphorically relates back to the if-clause, which hence becomes an *antecedent* in the double sense of the word.

(17) $[\text{if p}]_i\ \text{then}_i\ \text{q}$

Under this view as far as we understand it, a compositional interpretation of a *then*-conditional ignores the if-clause, and boils down to a collective ascription of the consequent proposition q to the plurality referred to by *then*:[12]

(18) ⟦ $[\text{if p}]_i\ \text{then}_i$ q ⟧
= q(⟦then_i⟧)

Of course, the if-clause remains crucial in that it acts as the 'referential source' for *then*. To do some justice to this dependence (and still oversimplifying matters), we are going to endow *then* with 'p' as a subscript, which is meant to reflect the fact that the antecedent p defines the unique plurality that conditional *then* refers (back) to:

(19) ⟦ $[\text{if p}]_i\ \text{then}_i$ q ⟧
= q(⟦then_p⟧)

Ingredient 2: `pex` (Bassi et al. (2021))

The second main ingredient to the analysis is the silent exhaustifier `pex` proposed by Bassi et al. (2021). `pex` is a variant of the exhaustivity-operator `exh`, a silent kind of *only* which figures in many works that take a grammatical rather than a pragmatic approach to scalar implicatures. Applied to a proposition p, `exh` entails (i) p and (ii) the negation of p's (excludable) alternatives. Call (i) the prejacent-implication and (ii) the exclusive implication. The crucial twist `pex` comes with is that (i) and (ii) are split across two different levels of meaning. The prejacent-implication remains entailed, but the exclusive implication becomes *presupposed*. A strongly simplified entry for `pex` in the notation of Heim and Kratzer (1998) thus looks as in (20). `pex` is indexed with a contextual variable C: a set of contextually salient alternatives to

[11] This seems to presuppose a treatment of the world-plurality denoted by the if-clause as one single, yet internally complex world, rather than a set of worlds. In contrast with the perhaps more conservative *restrictor approach* developed in work by David Lewis and Angelika Kratzer, there is no covert necessity modal *must* restricted by the antecedent. However, Kaufmann (2017) hypothesizes a silent distributive operator to be involved in certain cases.
[12] As far as we can tell, the view sketched by Izvorski (1996) is different in that *then*, being a wh-like element, acts more like an *abstractor*, perhaps over propositions. At a semantic level, it is thus closely related to the composition rule *predicate modification* in Heim and Kratzer (1998).

the prejacent p, including p itself.[13]

(20) $[\![\text{pex}_C]\!] = \lambda p$: each q in C that is not entailed by p is false.
p

cf. Bassi et al. (2021) [simplified]

What makes pex promising for given purposes might seem obvious: it comes as a tool to compositionally derive the exhaustive presupposition taken by us to be triggered by anaphoric *then*$_F$. The restriction of excluded alternatives to ones that are not entailed by p is quite common in work on exhaustivity, including overt *only*. Entailment is also evoked in Cariani and Rips's (2023) characterization of the alternatives excluded qua CP. This is in line with our view of the exhaustive presupposition as having a 'perfectioning' effect.

Putting the ingredients together

We now want to put the two ingredients together, and insert pex into the LF of a conditional featuring anaphoric *then*$_F$. Under the above assumption that in a conditional of the form *if p, then q*, it is just the consequent clause that enters compositional interpretation. It seems hence reasonable to assume that it is the consequent clause that pex attaches to. More concretely, a *then*$_F$-conditional of the form in (21a) gets an LF like (21b), with the if-clause surrounded by round brackets being ignored in the interpretation process.[14]

(21) a. if p, then$_F$ q
b. ([if p]) pex_C [$_\phi$ then$_{p,F}$ q]

We concretize this analysis, including some elaboration on the alternatives for pex, by directly applying it to a simple example from above.

3.1. Application to a simple example

In the example in question, there was just a single alternative to be rejected by the *then*$_F$-conditional repeated in (22b) – an alternative consisting in (or at least involving) the antecedent proposition [$_{p'}$ 'you' wash the dishes]. This p′ was referred to as the dishwashing-alternative.[15]

(22) a. – Will you give me a peach if I wash the dishes?

[13]Under the chosen notation, colons introduce presuppositions. A period separates the presuppositions from content that is entailed/asserted.

[14]Strictly speaking, there is a *type mismatch* in (21b) in that pex wants a propositional argument (type *s,t*), but the constituent ϕ it attaches to denotes a truth-value (type *t*). There is, however, a standard solution to this issue, involving abstraction over a world-variable w, which in this case stands for the world that each p-world referred to by the if-clause comes closest to.

[15]The reduced setup in (22) appears to falsify the above claim that a *then*$_F$-conditional requires a QUD1, which would be of the form *under which conditions do 'you' get a peach?*. However, this QUD1 can be taken to be implicitly present in (22), given the (obligatory) focus structure of the overt question in (22). For (22b) to be felicitous, focus must be on the antecedent clause, and this in turn is only compatible with an implicit QUD1; see von Fintel (1994) and references cited therein.

b. – (Nein.) Wenn du den Rasen$_{(F)}$ mähst, dann$_{F}$ gebe ich dir einen Pfirsich.
– (no) if you the lawn$_{(F)}$ mow then$_{F}$ give I you a peach

Based on the analysis sketched above, the conditional in (22b) gets the LF in (23). The if-clause refers to a plurality of closest worlds in which the addressee mows the lawn, abbreviated as 'mow.lawn'. This same plurality is anaphorically picked up by *then*. The presuppositional exhaustifier pex applies directly to the consequent clause, which amounts to the proposition that the consequent proposition *that you get a peach* holds true throughout the plurality of closest lawnmowing-worlds.

(23) ([if mow.lawn]) pex$_{C}$ [$_{\phi}$ peach(then$_{mow.lawn,F}$)]
a. mow.lawn = the proposition that you mow the lawn
b. peach = the proposition that you get a peach

What are the alternatives for pex? It is intuitively clear that there are alternative antecedents at play. In our case, this translates into different anaphoric resolutions for *then*. In the scenario provided above, the only salient alternative is *that you wash the dishes*. So we have two alternatives in C: the prejacent with *then* referring to a plurality of closest lawnmowing-worlds, and a second one with *then* referring to a plurality of closest dishwashing-worlds:

(24) C = { **peach(then$_{mow.lawn}$)**, peach(then$_{wash.dishes}$) }

With these alternatives and the way pex was defined above, the LF in (23) is interpreted as in (25). The assertion is given in (25a): since pex is 'assertorically inert', all we have at the assertive level is the denotation of the proposition labeled ϕ in (23) – essentially mowing the lawn being *sufficient* for getting a peach. The presupposition in (25b) excludes ϕ's only alternative in C: washing the dishes is thus presupposed to be *insufficient* for getting a peach.

(25) ⟦ (23) ⟧ is
a. true iff peach(then$_{mow.lawn}$) is true;
b. defined iff each q in { **peach(then$_{mow.lawn}$)**, peach(then$_{wash.dishes}$) } that is not entailed by peach(then$_{mow.lawn}$) is false
⇒ **peach(then$_{wash.dishes}$) is presupposed to be false**

The single other alternative 'peach(then$_{wash.dishes}$)' is not entailed by the prejacent of pex [$_{\phi}$ peach(then$_{mow.lawn}$)]: getting a peach in all closest lawnmowing-worlds does not entail also getting a peach in all closest dishwashing-worlds. Since pex as defined above excludes all alternatives not entailed by its prejacent, the single alternative is therefore presupposed to be false. This, we believe, derives what we informally described as the presuppositional *rejection* of salient alternatives above.

We now turn to a case in which pex is obligatorily absent, and *then*$_{F}$ serves as the focus associate of an additive particle.

3.2. Adding additive particles

As seen in section 2.2 above, it can be perfectly fine, and even obligatory, for an additive particle to associate with *then*$_{F}$. The example provided above is repeated in (26b), subtracting *selbst*

'even', and preceded by an utterance by the same speaker stating that washing the dishes is sufficient for getting a peach. Without the additive, the sentence is infelicitous in this context.[16]

(26) a. If you wash the dishes, you'll get a peach.
b. Und wenn du den Rasen mähst, #(auch) dann$_F$ bekommst du einen Pfirsich.
and if you the lawn mow #(also) then$_F$ get you a peach

As a possible explanation for the obligatoriness of the additive particle *auch* 'also', we considered *Obligatory Implicatures* (Bade, 2016): *then*$_F$'s exhaustive presupposition, which comes as a mere pragmatic default, would be in conflict with the context. The insertion of an additive effectively cancels this presupposition, so no conflict arises. Our task in this subsection is to outline in some more detail in how far an additive has this canceling effect. Again, this heavily relies on previous work cited in section 2.2, not only Bade (2016).

Under the present analysis, the exhaustive presupposition being a default amounts to a default-insertion of the silent exhaustifier pex at LF; so if an additive particle keeps the presupposition from being triggered, it rules out pex's presence at LF. The contribution of an additive contradicts that of exclusive operators like pex or overt *only*, granted both have access to the same alternatives. This is sketched in (27), where add stands for (the operator spelled out by) an additive particle. Put simply, while additives presuppose (at least) *some* alternative to the prejacent ϕ to be true (27a), pex presupposes *none* of them to be true (27b). The additive in (26b) is overt, so its contribution cannot be ignored at LF; in this sense, it 'wins' over pex, which would trigger a conflicting presupposition.

(27) (if ...) (#pex$_C$) add$_C$ [$_\phi$ ...]
a. add $\rightsquigarrow$ *some* C-alternative not entailed by ϕ is true
b. pex $\rightsquigarrow$ *no* C-alternative not entailed by ϕ is true

A fairly standard entry for add is given in (28). Little surprisingly, the additive presupposition is the exact opposite of the one ascribed to pex above. This opposition is presuppositional: pex and add share an assertoric 'inertia', returning their prejacents on condition that their respective presuppositions are met.

(28) $[\![\text{add}_C]\!] = \lambda p$: some q in C that is not entailed by p is true.
p

With this definition in place, and (again) taking 'peach(then$_{\text{wash.dishes}}$)' to be the only salient alternative, we derive the following interpretation for (27). The assertion remains the same as if the additive were absent, and pex present: mowing the lawn is asserted to be sufficient for getting a peach (29a). The presupposition crucially changes, and amounts to washing the dishes being equally sufficient for getting the peach, (29b).

(29) $[\![(27)]\!]$ is
a. true iff peach(then$_{\text{mow.lawn}}$) is true;
b. defined iff *some* q in { peach(then$_{\text{mow.lawn}}$), peach(then$_{\text{wash.dishes}}$) } that is not entailed by peach(then$_{\text{mow.lawn}}$) is *true*
$\Rightarrow$ **peach(then$_{\text{wash.dishes}}$) is presupposed to be true**

[16] As pointed out in footnote 7, the sentence even improves when *then*$_F$ is used cataphorically. See section 4.3 for an illustration.

As seen above, pex, if present, would presuppose washing the dishes to be *in*sufficient for getting the peach. This would clash not only with the presupposition triggered by add, but also with the context given for (26b) above.

3.3. Interim conclusion

In this section, we sketched a compositional analysis of two kinds of *then*$_{\text{F}}$-conditionals, the first one lacking and the second one containing an additive particle associating with focus on *then*: cases without the additive were treated as having the silent exhaustifier pex at LF, which captures what we argued to be a *then*$_{\text{F}}$-conditional's exhaustive presupposition. In cases with the additive, pex was taken to be absent, as its contribution conflicts with that made by the additive. The next section addresses some open issues pertaining to focused conditional *then* and its 'perfectioning' effect.

4. Open issues

In this section, we discuss three open issues for the view developed in this paper.

4.1. Non-triviality

In (7), repeated in a modified form in (30), the insufficiency of QUD1 to license *then*$_{\text{F}}$ was observed.

(30) a. QUD1: Under which conditions do I get a reward?
b. Wenn du den Rasen mähst, (?dann$_{\text{F}}$) wirst du belohnt.
if you the lawn mow (?then$_{\text{F}}$}) get you rewarded

This motivated our core claim that a conditional of the form *if p, then$_F$ q* triggers an exhaustive presupposition that all previously considered conditions p′ be insufficient for q. However, we also endowed such conditionals with a more basic existential presupposition that such p′s have been made contextually salient to begin with:

(31) *if p, then$_F$ q*
a. **asserted:**
if p, q
b. **presupposed:** (there is a previously considered p′ &) **[∃-component]**
for each such p′: if p′, not-q **[EXH-component]**
repeated from (8b)

In section 2.1, we further saw that the EXH-component can be accommodated, but the ∃-component cannot. This might be taken as an indication of the even more basic status of the latter, which apparently comes as the 'presupposition of a presupposition'. The ∃-component was no longer involved in the compositional analysis put forth in section 3. So one may wonder whether this analysis falls short of capturing the subtlety of the data, and whether the semantics

of the presuppositional exhaustifier pex has to be revised accordingly.

This question can be answered negatively: there is no need to put the ∃-component into the analysis, as it is independently guaranteed by a 'non-triviality' principle put forth in Schlenker (2004). The principle is formulated as a felicity condition for (obligatory) scalar implicatures, but may be rooted in a more general ban on vacuous quantification in natural language:[17]

(32) **Non-triviality**, Schlenker (2004): 443
Some element of the focus value should not be entailed by the asserted sentence.

Schlenker observes that one type of cases in which non-triviality is (trivially) violated are cases in which no focus alternatives have been made salient to begin with. With the asserted sentence S being the single alternative to itself, there clearly are no alternatives that do not entail S, hence none to be excluded by a scalar implicature. This is clearly the case in (30), where no alternative antecedent p′ was previously considered as a possible verifier of the consequent [$_{q}$ you get rewarded]. There is hence no salient conditional proposition involving a p′ sufficient for q. But such a proposition is needed for the exhaustive presupposition triggered by pex to apply non-vacuously.

A non-trivial way to violate non-triviality would be to make salient a conditional with an 'entailing' antecedent, i.e. one that is logically stronger than the *then*$_{F}$-conditional's antecedent. Conditional antecedents are (Strawson) downward-entailing von Fintel (1999); to strengthen a conditional antecedent is hence to weaken the conditional as a whole. So the single alternative having been raised prior to the *then*$_{F}$-conditional is entailed by the asserted conditional, in violation of non-triviality. We indeed find a *then*$_{F}$-conditional to be quite odd in such a context. Mowing the lawn *with nail scissors* entails mowing the lawn (as atypical of a lawnmowing-instrument nail scissors may seem), so (33b) entails its single alternative, the proposition that mowing the lawn with the scissors suffices for being rewarded.

(33) a. Under which conditions do I get a reward?
If I mow the lawn with these nail scissors?
b. Wenn du den Rasen mähst, (#dann$_{F}$) wirst du belohnt.
if you the lawn mow (#then$_{F}$) get you rewarded

We find a conditional with unfocused *then* or even no *then* at all to be considerably less deviant in such a context. Given the scale of CP from (5) repeated in (34), this seems expected: *then*$_{F}$ is the most strongly CP-favoring variant among the three conditional options. The less a given conditional form favors CP, the weaker the underlying exhaustive implication should be, be it an implicature or a presupposition; and the weaker this implication is, the less should an assertion of the corresponding conditional be subject to non-triviality.

(34) *then*$_{F}$ $>_{CP}$ *then* $>_{CP}$ Ø repeated from (5)

Admittedly though, in postulating (34), we were a little vague about the underlying notion of implicational strength: is this a matter of quantificational strength, of cancelability, or of both? The view that unfocused *then* is more weakly CP-favoring than focused *then* was mainly moti-

[17] Another area in which this ban potentially comes to the surface are indicative conditionals and a *compatibility presupposition* that von Fintel (1998) proposes for them; thanks to Frank Sode (pc) for discussion of this presupposition in a different context.

vated by apparent differences in quantificational strength. But even under a weak form of CP – the 'existential' implication that *some* alternative antecedent does not verify the consequent –, we could assume non-triviality to apply, i.e. a conditional *if p, then q* to be infelicitous without any alternative p′ having been made contextually salient. It hence seems that the difference between focused and unfocused *then* cannot be reduced to a difference in quantificational strength between the two.

4.2. Alternatives to be excluded[18]

It has become clear that conditional *then*$_{\text{F}}$ comes with the exclusion of alternatives having been made salient *before* the time of utterance. It does not seem to come with the exclusion of alternatives potentially mentioned *later on*. To our ears, the following sequence of sentences (the first one being preceded by a suitable context) sounds coherent if uttered by the same speaker:[19]

(35) a. Wenn du den Rasen mähst, dann$_{\text{F}}$ wirst du belohnt.
if you the lawn mow then$_{\text{F}}$ get you rewarded
b. Aber auch, wenn du stattdessen Pilze sammelst.
but also if you instead mushrooms collect

The *then*$_{\text{F}}$-conditional in (35a) asserts the sufficiency of mowing the lawn, but presupposes the insufficiency of *previously considered* actions for getting a reward. It does not rule out the *subsequent* identification of collecting mushrooms, an action that doesn't entail mowing the lawn, as sufficient for being rewarded. By contrast, this follow-up becomes quite infelicitous if the preceding *then*$_{\text{F}}$-conditional is replaced by an *only if* conditional:

(36) a. Nur wenn du den Rasen mähst, wirst du belohnt.
only if you the lawn mow get you rewarded
b. ??Aber auch, wenn du stattdessen Pilze sammelst.
??but also if you instead mushrooms collect

There is an apparent contrast between (35) and (36). *then*$_{\text{F}}$, despite coming with strong CP, allows for other sufficient conditions to be mentioned later on in the discourse. An overt exhaustifier like *only* doesn't seem to allow this, at least not to the same degree. A possible take on this contrast could be the respective status of the exhaustive inference: with *then*$_{\text{F}}$, the insufficiency of other conditions is *presupposed*, but it is *asserted* with *only*. The term *presupposition* itself appears to suggest a limited attention to the discourse *preceding* the utterance, a limitation clearly not shared with assertions – but one that (in the case at hand) should come

[18]We thank Muyi Yang for comments on the topic discussed in this section.

[19]A potentially related observation is that one can probably come up with a context in which the following example featuring *then*$_{\text{F}}$ and *beispielsweise* 'for example' sounds natural:

(i) Wenn du beispielsweise den Rasen$_{\text{(F)}}$ mähst, dann$_{\text{F}}$ wirst du belohnt.
if you for.example the lawn$_{\text{(F)}}$ mow then$_{\text{F}}$ get you rewarded

Manfred Krifka (pc) suggests to us that *beispielsweise* [BSPW] may cancel a CP-implicature. This requires BSPW to take narrow scope. In that case, *if* BSPW *p, q* conveys p to be one condition *among possible others* that makes q true. We don't see how BSPW could have a wide-scope reading in this case. So one might predict (i) to be inherently odd, given a clash between *then*$_{\text{F}}$ and BSPW. But on our intuitions, (i) exhibits no such oddity.

with a restriction on C, the set of contextually salient alternatives. We have to leave this matter to future research, unless it has already been addressed somewhere else.[20]

4.3. Ana- vs. cataphoricity

Up to this point, we have been concerned with *anaphoric* uses of conditional *then*$_F$: uses in which *then*$_F$ follows the if-clause it refers to. But German also has *cataphoric* uses, in which *then*$_F$ precedes, i.e. 'anticipates' the if-clause.[21] The two uses differ in at least two respects. First, the cataphoric variant sounds slightly more natural than the anaphoric one when it serves as the associate of a focus-sensitive particle, as illustrated by the contrast between (37a) and (37b).

(37) a. Du bekommst { nur / auch / selbst } dann$_F$ ein Eis, wenn du den Rasen mähst.
you get { only / also / even } then$_F$ an ice if you the lawn mow
b. Wenn du den Rasen mähst, { ?nur / ?auch / ?selbst } dann$_F$ bekommst du ein Eis.
if you the lawn mow { ?only / ?also / ?even } then$_F$ get you an ice

What is more, cataphoric *then*$_F$ does not seem to come with the same presuppositional requirements as its anaphoric counterpart. With the cataphoric variant, no alternative to the asserted conditional's antecedent must have been made salient, and the 'consequent-directed' QUD1 suffices for cataphoric *then*$_F$ to be licensed, see (38b). This slightly contrasts with the anaphoric variant, as can (again) be seen in (38c).

(38) a. – Under which condition(s) will I get a doughnut?
b. – Du bekommst dann$_F$ einen Doughnut, wenn du den Rasen mähst.
– you get then$_F$ a doughnut if you the lawn mow
c. – ?Wenn du den Rasen mähst, dann$_F$ bekommst du einen Doughnut.
– ?if you the lawn mow then$_F$ get you a doughnut

What further complicates the picture is the sequence of questions in (39), intended to be uttered by the same speaker. (39b) is a polar question containing cataphoric *then*$_F$, but it strikes us as slightly infelicitous following the QUD1 in (39a): cataphoric *then*$_F$ now appears to come with the same presuppositional requirements as its anaphoric counterpart.

(39) a. Under which condition(s) will I get a doughnut?
b. ?Bekomme ich dann$_F$ einen, wenn ich den Rasen mähe?
?get I then$_F$ one if I the lawn mow

[20] At least this 'attentional limitation' of presupposed content to the discourse preceding the presupposing sentence doesn't strike us as unparalleled. The unlikelihood-presupposition of *even* might be a case in point: *even* is widely taken to presuppose its prejacent to be the least likely among all contextually salient alternatives. But with the sentence containing *even*, that same prejacent is asserted to be true. With this factuality (which doesn't survive under embedding), the prejacent's unlikelihood is presupposed to hold *before the time of utterance*. With conditional *then*$_F$, the rejection of alternative condition(al)s seems temporally restricted in a similar way.

[21] Cataphoric uses of *then*-like particles are more restricted in languages like English (Schlenker, 2004) or Chinese (Pan and Paul, 2018); thanks also to Johan van der Auwera (p.c.) for discussion.

If these intuitions are correct, we are facing a partial contrast between cataphoric and anaphoric *then*$_{\text{F}}$: at least in non-interrogative environments, only the anaphoric variant requires alternatives to the antecedent of the asserted conditional to have been considered (if not rejected, given the possibility of accommodation). How can this contrast and its apparent absence in (39b) be explained?

We start by observing that anaphoric *then* can be left unfocused, but cataphoric *then* cannot.[22] Anaphoric *then* is only sometimes focused, but then comes with the exhaustive presupposition. What in the structure could contribute to this presupposition? It seems intuitive to regard the *if*-clause preceding anaphoric *then*$_{\text{F}}$ as a kind of *contrastive topic* (in a rather atheoretical, literal sense of the term, ignoring for a moment the vast literature there is on this topic): after all, there is something contrastive about the anaphoric cases in that the asserted conditional's antecedent is asserted to verify the consequent, *in contrast to* all previously considered antecedents. It remains to be seen whether this is a viable way of dealing with the subtle contrast observed in (38); but even if so, this would still leave unexplained (39b), where cataphoric *then*$_{\text{F}}$ surprisingly comes with the exhaustive presupposition it didn't come with in (38b).

5. Conclusion

Since its emergence in the linguistic literature, conditional perfection (CP) has received various accounts with revived interests in more recent years in linguistics and cognitive science. However, the empirical picture remains puzzling as to the precise roles of grammar and pragmatics. The theoretical starting point of the present study was a QUD-approach to CP developed by von Fintel (2001). Generalizing this approach, the type of *question under discussion* (QUD) constitutes an overarching pragmatic factor: all other CP-favoring factors are indicative of what Cariani and Rips (2023) call a *consequent-directed* QUD, referred by us as QUD1, which keeps the consequent q stable (*under which conditions q?*). It focuses on conditional *then*, aiming to serve as a window into the grammatical factors favoring CP inferences. The study adds pieces to a whole battery of factors, which can be roughly divided into grammatical and pragmatic factors, and sheds light on their interplay.

Crucially, we proposed the CP of *then*$_{\text{F}}$ to be special in that the exclusion of alternative condition(al)s is (pragmatically) *presupposed* rather than implicated. The presence of a QUD1 was identified as necessary, but not sufficient, for *then*$_{\text{F}}$ to be licensed: in addition, at least one potential answer to that QUD is presupposed to have been rejected as false in the preceding discourse. This amounts to the presupposition that at least one alternative antecedent is insufficient to make the consequent true. These observations strike us as supportive of the recent view by Bassi et al. (2021), according to which silent exhaustification is presupposed rather than asserted.

Some issues left open by our account were identified in the preceding section, the most puzzling of which might be the differences between anaphoric and cataphoric uses of *then*$_{\text{F}}$. With the aim of a more general view of CP in mind, other potentially CP-favoring or -disfavoring factors need

[22] Obligatory focus on cataphoric *then* may have to do with a strongly exhaustive interpretation that would also arise in its absence: conditionals with right-adjoined antecedents appear to be more readily perfected than conditionals with left-adjoined antecedents, an observation that van der Auwera (1997) ascribes to Bolinger (1952).

to be looked into, and the crosslinguistic picture to be taken into account as well. What is more, the more subtle linguistic judgments reported in this paper deserve to be tested experimentally.

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Semantic opposition coordination: An argument for question settlement[1]

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Abstract. This paper studies coordination by *whereas* and "semantic opposition" *but*, and asks to what extent the conjuncts should parallel and differ from each other. I argue for a question-based analysis in line with Jasinskaja and Zeevat (2008, 2009) and Toosarvandani (2014) but also with key differences from them: the conjuncts of *whereas* should *settle* a question under discussion (QUD), with *question settlement* being defined in the partition theory of questions as selecting precisely one of the cells created by the partitioning question, or a subpart of the cell. This analysis is based on novel data that point to a strong correlation between the felicity of *whereas*-sentences and the felicity of its conjuncts as direct answers to the QUD. The finding of a dedicated lexical item *whereas* for semantic opposition suggests that semantic opposition is a distinct use of *but* and differs from its other uses, supporting Toosarvandani (2014). *Whereas*- and *but*-coordination shows the linguistic and cognitive reality of the notion of question settlement proposed in this paper, which the felicity of these coordinated structures depends on. This paper also provides a new diagnostic of question-answerhood that relies not on question-answer pairs, but on *whereas*- and *but*-sentences, declarative sentences that are nevertheless closely related to question-answering.

Keywords: question under discussion, semantic opposition, settlement of questions, partition theory of questions, *whereas*, *but*, coordination.

1. Introduction

Whereas combines clauses that contrast with each other in two parts. I call those clauses *conjuncts*. (1) is an example of a *whereas*-sentence whose conjuncts contrast in the subject and polarity (contrasts are underlined).

(1) Oleg bought a Ferrari, whereas Roma didn't.

This paper investigates the constraints on the clauses coordinated by *whereas* by asking how much contrast is allowed and required between them. I will argue for a question-based analysis in line with Jasinskaja and Zeevat (2008, 2009) and Toosarvandani (2014) but also with key differences from them: the conjuncts of *whereas* should *settle* a question under discussion (QUD), with *question settlement* being defined in the partition theory of questions as selecting precisely one of the cells created by the partitioning question, or a subpart of the cell. This analysis is based on novel data that point to a strong correlation between the felicity of *whereas*-sentences and the felicity of its conjuncts as direct answers to the QUD. For example, I will argue that (1) is felicitous because its conjuncts are felicitous answers to the questions in (2)–(3). And crucially, a felicitous answer is one that settles the question in the sense defined in this paper.

(2) Q: Who bought a Ferrari? Did Oleg buy a Ferrari?
A: (Yes,) Oleg bought a Ferrari.

[1]I would like to thank Amir Anvari, Danny Fox and Maziar Toosarvandani for helpful comments. All errors are my own.

(3) Q: Who bought a Ferrari? Did Roma buy a Ferrari?
A: (No,) Roma didn't buy a Ferrari.

Conversely, if there is no QUD that the conjuncts of a *whereas*-sentence can answer felicitously, then the *whereas*-sentence is also infelicitous. This analysis has three implications. First, I observe that *whereas* has the same meaning as a use of *but* called *semantic opposition*. My finding that *whereas* is dedicated for semantic opposition suggests that semantic opposition is a distinct use of *but*, and is distinct from its other uses, supporting Toosarvandani's (2014) three-way distinction of the meanings of *but*.

Second, there have been many different proposals about how well an answer may address a question. This paper provides a new approach based on question settlement, and argues for its linguistic and cognitive reality by showing that the felicity and infelicity of semantic opposition coordination crucially depends on this notion.

Finally, judgments in question pragmatics have traditionally relied on intuitions about question-answer pairs. Using the observation of a close correlation between the felicity of *whereas*-sentences and the felicity of question-answer pairs, I provide a new diagnostic of answerhood based on *whereas*-sentences, declarative sentences that are nevertheless closely related to question-answering, adding to the growing literature that does so (e.g. AnderBois 2016).

Section 2 shows that *whereas* has the same meaning as semantic opposition *but*, and thus the current analysis also applies to semantic opposition *but*. Section 3 discusses two main approaches in the literature to semantic opposition *but*, and section 4 previews the current proposal and provides a definition of question settlement in the partition theory of questions. Section 5 presents novel data that suggest that the two approaches in the literature are either too strict or too relaxed, and thus motivate the current analysis based on question settlement. Section 6 concludes the paper.

2. *Whereas* is equivalent to the semantic opposition use of *but*

English *whereas* has not been discussed before to my knowledge, but it is closely related to the semantic opposition use of *but*, which was examined in many languages (e.g. Blakemore 1989; Lakoff 1971; Sæbø 2003; Umbach 2004, 2005; Jasinskaja and Zeevat 2008, 2009; Jasinskaja 2010, 2012; Winterstein 2010a, 2010b). The previous proposals for that use of *but* are relevant to the current analysis of *whereas*, but before introducing them, I first provide some background on *but* that will be relevant to that discussion.

But in English can have many different meanings. Toosarvandani (2014) claimed that *but* has at least three different uses: *counterexpectation* (4), whose first conjunct creates an expectation that is rejected by the second conjunct, *correction* (5) and *semantic opposition* (6), whose first conjunct does not have to create an expectation that is rejected. For example, the first conjunct of (4a) creates the expectation that the player is clumsy, and the second conjunct rejects this expectation. But the first conjunct in (5a) does not necessarily give rise to the expectation that Liz doesn't sing, and neither does the first conjunct of (6a) have to lead to the expectation that Roma bought a Ferrari. According to Toosarvandani (2014), the conjuncts of correction and semantic opposition are *doubly distinct*–they involve contrasts in polarity and

a constituent. Correction and semantic opposition differ in where negation occurs: the first conjunct of correction has to contain negation, while there is no such requirement in semantic opposition.

(4) *Counterexpectational* but
  a. The player is tall but agile. (Toosarvandani, 2014: 6)
  b. We were hungry, but the restaurants were closed.
  c. It's raining, but I'm going to take an umbrella. (Winter and Rimon, 1994: 369)

(5) *Corrective* but
  a. Liz doesn't dance, but sing. (Toosarvandani, 2014: 3)
  b. #Liz dances, but sings.

(6) *Semantic opposition* but
  a. Oleg bought a Ferrari, but Roma didn't.
  b. Oleg bought a Ferrari, but he didn't buy a Chevy.
  c. Oleg bought a Ferrari, but Roma bought a Chevy.

A piece of evidence that counterexpectation and correction are distinctive uses is that many languages use distinct lexical items for these two meanings (e.g. German *aber* vs. *sondern,* Pusch 1975; Abraham 1979; Lang 1984; Hebrew *aval* vs. *ela,* Dascal and Katriel 1977; Spanish *pero* vs. *sino*, Schwenter 2000; Vicente 2010; Persian *vali / amma* vs. *balke*, Toosarvandani 2010). Winter and Rimon (1994) observed that within English, *yet*, *although* and *nevertheless* are dedicated for counterexpectation. But to my knowledge, lexical items dedicated for semantic opposition have not received much discussion.[2] This paper claims that English *whereas* is precisely such a lexical item–it has identical behavior to semantic opposition *but*:

(7) a. Oleg bought a Ferrari, whereas Roma didn't.
  b. Oleg bought a Ferrari, whereas he didn't buy a Chevy.
  c. Oleg bought a Ferrari, whereas Roma bought a Chevy.

Crucially, *whereas* does not have the counterexpectational or corrective use. The first conjunct of *whereas* cannot give rise to an expectation that is rejected by the second (8). Also, *whereas* doesn't require its first conjunct to contain negation like corrective *but* does (7).

(8) a. #The player is tall, whereas he is agile.
  b. #We were hungry, whereas the restaurants were closed.

The fact that there exists a lexical item dedicated for semantic opposition lends support to Toosarvandani's (2014) three-way distinction of the meanings of *but*, in particular that semantic opposition is a distinct use from the other two. Furthermore, because *whereas* only has the semantic opposition use, this makes *whereas*-sentences a better place to study the behavior of semantic opposition than *but*-sentences because we do not have the confounds of the other uses of *but*.

Therefore, this paper will use *whereas* in all the examples for clarity, but my analysis applies to semantic opposition *but* as well. The literature on semantic opposition generally assumes that it requires its conjuncts to be doubly distinct, and one of the contrasts is often in polarity

[2]Jasinskaja and Zeevat (2009) described Russian *a*, which has both semantic opposition and corrective uses.

(Jasinskaja and Zeevat 2008, 2009; Toosarvandani 2014). This generalization applies to the semantic opposition examples we have seen so far (6)–(7). But this paper also investigates felicitous and infelicitous semantic opposition examples that look less parallel than (6)–(7) (e.g. (9) and (10)), and argues that the conjuncts of semantic opposition not only need to be doubly distinct, but they need to settle the polar questions contained in the QUD.

(9) Oleg bought a Ferrari, whereas Roma couldn't even find a car dealer.

(10) #Oleg met a girl who bought a Ferrari, whereas she (=the girl Oleg met) didn't buy a Chevy.

3. Background and the literature

Before presenting evidence for my analysis, in this section I discuss two main approaches to semantic opposition in the literature (Jasinskaja and Zeevat 2008, 2009; Toosarvandani 2014). They both related the conjuncts of semantic opposition to a conversational topic that is represented by a question. Toosarvandani followed Roberts' (1996/2012, 2004) QUD framework, an approach that uses questions to model the structure of the discourse. While Jasinskaja and Zeevat (2008, 2009) did not follow the QUD framework per se, it can still be converted into it for a direct comparison with Toosarvandani. Therefore, to understand these two approaches to semantic opposition, I first review the background on QUD.

3.1. Background on QUD

Following Stalnaker (1978), Roberts' (1996; 2006) QUD framework assumed that the main goal of discourse is to discover and share information about the world we live in (i.e. to answer the big question *What's the way things are?*). As interlocutors look for the answers to that big question, they may follow a *Strategy of Inquiry* that involves subinquiries. They may divide the QUD into logically related subquestions that are easier to answer. Subquestions are *entailed* by the superquestion: the complete answer to the subquestion contextually entails the partial answer to the superquestion. For example, in a context with two salient individuals, Oleg and Roma, and two types of cars to buy, Ferrari and Chevy, the QUD may be a double-*wh*-question *Who bought what?*, which can be divided into two single *wh*-questions, which can be further divided into four polar questions:

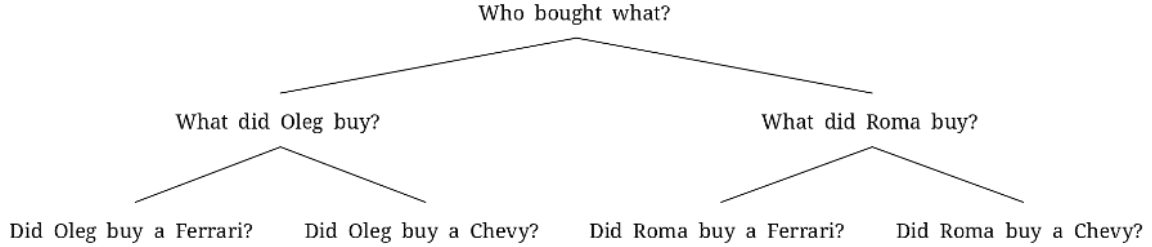


Figure 1: Strategy of Inquiry example

Besides this Strategy of Inquiry involving subquestions, Roberts also proposed a QUD stack: when an interlocutor poses a question, and this question is accepted by the other interlocutors as answerable, it is added to a stack of QUDs, committing everyone to the common goal of finding the answer. Once it has been answered or is no longer considered answerable, it is removed from the QUD stack.

3.2. Existing analyses of semantic opposition

3.2.1. Jasinskaja and Zeevat's (2008, 2009) set-membership approach

Having provided the necessary background on QUDs, I present the two approaches to semantic opposition in the literature (Jasinskaja and Zeevat 2008, 2009; Toosarvandani 2014). While their proposals were meant for "semantic opposition" *but*, I assume they also apply to *whereas*. The first approach is my interpretation of Jasinskaja and Zeevat in the QUD framework. They claimed that the conjuncts of semantic opposition must be doubly distinct answers to the QUD, and one of the contrasts must be polarity.

Jasinskaja and Zeevat did not provide a formal definition of what an answer is, but a possible interpretation is set membership. Assuming that a question denotes the set of propositions corresponding to its complete answers (Hamblin, 1973), we can think of Jasinskaja and Zeevat's proposal as a requirement that the conjuncts be doubly distinct members of the set denoted by the QUD (I call this *the set-membership approach*).

To ensure double contrast, Jasinskaja and Zeevat required the conjuncts of semantic opposition to be answers to a *whether-wh*-question that can be paraphrased as a disjoined *wh*-question. For example, the conjuncts of (1) should be answers to the question *Who bought or didn't guy a Ferrari?* Toosarvandani converted this analysis into the QUD framework: the big QUD the conjuncts should answer is a single *wh*-question (in the case of (1), *Who bought a Ferrari?*), which is divided into two polar questions by the Strategy of Inquiry (for (1), *Did Oleg buy a Ferrari? Did Roma buy a Ferrari?*), and each conjunct should contrast in polarities, and answer a polar question (i.e. the first conjunct should be the positive answer to *Did Oleg buy a Ferrari?*, and the second conjunct should be the negative answer to *Did Roma buy a Ferrari?*).

Many semantic opposition examples in the literature were presented without explicit context or QUD because QUDs are often implicit in conversations. Furthermore, as we will see later in section 3.1, even when the example does provide an explicit leading question, the semantic opposition sentence can still shift the QUD to a slightly different question, and answer that instead. Therefore, when a linguist tries to find out Jasinskaja and Zeevat's prediction for a *whereas*-sentence, they try to find a QUD that would satisfy Jasinskaja and Zeevat's condition given the *whereas*-sentence. If they can find at least one QUD that could satisfy Jasinskaja and Zeevat's condition, then the sentence is predicted to be good (in at least the context with that QUD). If they cannot find *any* QUD that could satisfy Jasinskaja and Zeevat's condition, then the sentence is predicted to be bad. Therefore, it only takes a good QUD for a *whereas*-sentence to be good, but it requires rejecting every potential QUD to predict a *whereas*-sentence to be bad. It may thus seem like a lot of work to rule out a *whereas*-sentence, but as we will see later, we only need to reject the most promising QUDs, which are usually just two QUDs due to the shape and form of the conjuncts.

I develop and demonstrate a procedure for a linguist to check Jasinskaja and Zeevat's predictions for *whereas*-sentences, with (7a) as an example. First, they choose a potential QUD, a single *wh*-question that (7a) may address–*Who bought a Ferrari?* In a context with two salient individuals, Oleg and Roma, this QUD can be divided into two polar subquestions *Did Oleg buy a Ferrari? Did Roma buy a Ferrari?* Then they check if each conjunct is an answer to the polar question that contrasts in polarities. The first conjunct is indeed the positive answer to the first question because it is a member of the set denoted by the question, and the second conjunct is the negative answer to the second question because it is a member of the set denoted by the question. Because we can find at least one QUD that can satisfy Jasinskaja and Zeevat's condition, they would predict (7a) to be felicitous, as is the fact.

(11) *The set-membership approach to (7a)*
Oleg bought a Ferrari, whereas Roma didn't.
Step 1. *Find a potential QUD*: Who bought a Ferrari?
Step 2. *Divide the QUD into two polar questions*: Did Oleg buy a Ferrari? Did Roma buy a Ferrari?
Step 3. *Check if the first conjunct is the positive answer to the first polar question*: ✓
Step 4. *Check if the second conjunct is the negative answer to the second polar question*: ✓

3.2.2. Toosarvandani's (2014) entailment-of-set-membership approach

Toosarvandani (2014: fn 19) observed that if we think of answerhood as membership of the set denoted by the question, then Jasinskaja and Zeevat's proposal fails to account for semantic opposition sentences that have antonyms rather than polarity contrast like (12)).

(12) John is quick, whereas Bill is slow. (Based on Winter & Rimon 1994:373)

According to Toosarvandani, there is no QUD such that the conjuncts of (12) can be members of the set denoted by this QUD. He did not provide further explanation, but here is my interpretation of his point, following the stepwise procedure I developed: a potential QUD is *Who is quick?*, which can be divided into two polar questions *Is John quick?* and *Is Bill quick?* The second conjunct of (12), *Bill is slow* is not equivalent to *Bill is not quick* because not quick is not necessarily slow, as someone can be neither quick nor slow. Thus, *Bill is slow* is not a member of the set of propositions denoted by the second polar question. The same problem occurs for the other potential QUD *Who is slow?* because the first conjunct is not a member of the set of propositions denoted by *Is John slow?* Therefore, there is no QUD such that both conjuncts can be members of the set denoted by its polar questions.

Due to this issue, Toosarvandani revised Jasinskaja and Zeevat's proposal to the following: the conjuncts must *entail* doubly distinct members of the set of propositions denoted by the QUD (I call this *the entailment-of-set-membership approach*). This can account for (12) because the first conjunct is (and trivially entails) the positive answer to the first polar question *Is John quick?* The second conjunct entails that Bill is not quick, which is the negative answer to the second polar question *Is Bill quick?* Following is the complete stepwise derivation of the prediction:

(13) *The entailment-of-set-membership approach to (13)*
John is quick, whereas Bill is slow.
Step 1. *Find a potential QUD:* Who is quick?
Step 2. *Divide the QUD into two polar questions*: Is John quick? Is Bill quick?
Step 3. *Check if the first conjunct entails the positive answer to the first polar question*: ✓
Step 4. *Check if the second conjunct entails the negative answer to the second polar question*: ✓

To summarize, Jasinskaja and Zeevat's set-membership approach claimed that the conjuncts must be doubly distinct answers to the question, where the conjuncts must contrast in polarities, and be members of the sets of propositions denoted by the polar questions contained in the QUD. Toosarvandani instead proposed the entailment-of-set-membership approach: the conjuncts must *entail* doubly distinct members of the set denoted by the QUD.

4. Proposal preview: Semantic opposition conjuncts must settle the QUD

Section 5 will provide novel data suggesting that the set-membership approach is too strict because it predicts felicitous semantic opposition sentences to be bad. I will also provide data suggesting that the entailment-of-set-membership approach is too weak because it fails to rule out infelicitous semantic opposition sentences.

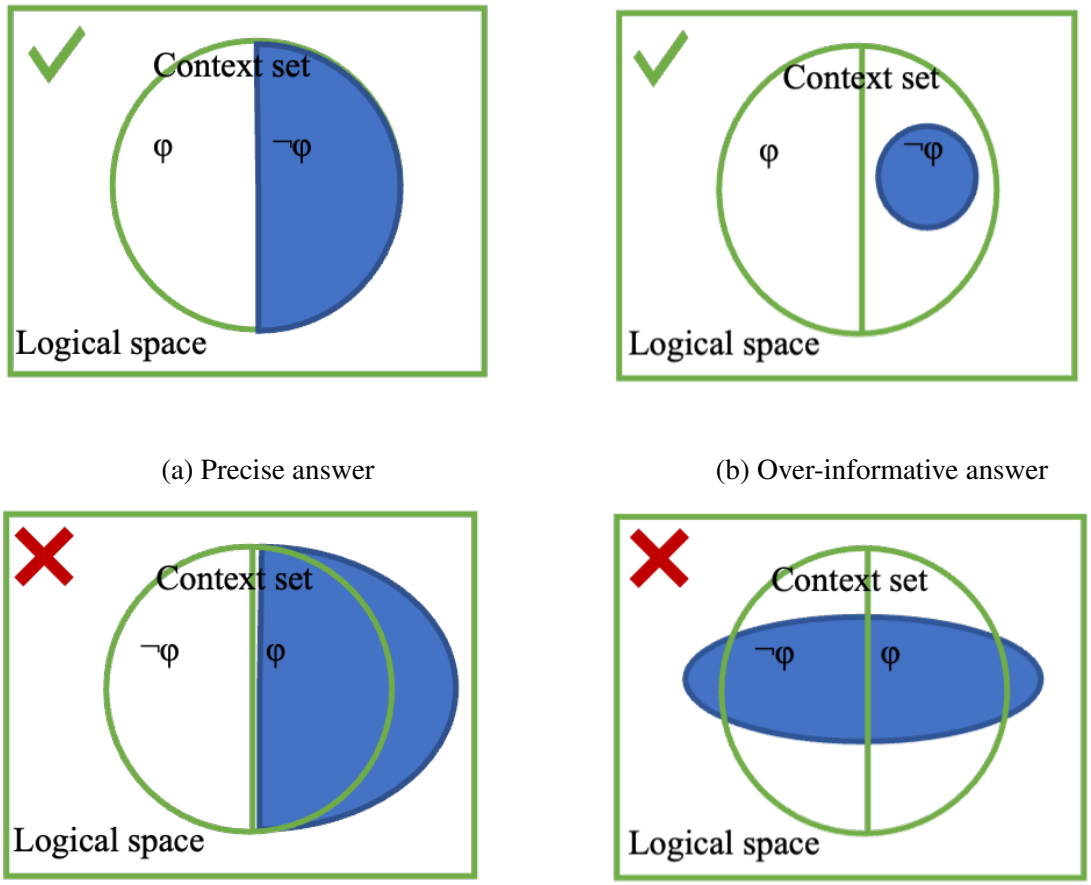
Those novel data contribute to an insight: the felicity of semantic opposition is directly correlated with whether each conjunct *settles* the polar question. This leads to the current proposal that the conjuncts of semantic opposition must settle the polar questions contained in the QUD. The rest of this section defines *question settlement*: subsection 4.1 formulates *question settlement* in the partition theory of questions, and claims that answers that settle the question may provide additional information that the question does not ask for. Then subsection 4.2 discusses Heim's 2015 observation that presupposed material cannot settle the question, which will be useful to the discussion later in section 5 .

4.1. Question settlement

Before I define question settlement, I first introduce the partition theory of questions, which it is formulated in. An important idea of Stalnaker (1978) is that in conversations, interlocutors build a common ground of propositions they publicly and collectively accept as true. This idea can be simplified to a context set, which is the set of worlds compatible with all the propositions in the common ground. Jäger (1996), Hulstijn (1997) and Groenendijk (1999) applied partition semantics (Groenendijk and Stokhof 1984) to questions, and developed the idea that questions partition this context set to help us determine in which cell of the partition our world is located.

For our purposes, we can assume that a polar question $\phi?$ partitions the context set into two cells ϕ and $\neg\phi$. Given this partitioned context set, an assertion proposes an update to it. Here are some logical possibilities of how an assertion may update it: it may select exactly one cell (Figure 2a; *precise answer*), a proper subset of a cell (Figure 2b; *over-informative answer*),

a proper superset of one of the cells, which may contain worlds that are not in the context set (Figure 2c), or parts of both cells (Figure 2d). I call precise answers and over-informative answers answers that *settle the question*.



(a) Precise answer

(b) Over-informative answer

(c) Non-settling answer

(d) Non-settling answer

Figure 2: Four ways to answer a polar question

I demonstrate these four types of answers with (14), and show that only settling answers are felicitous, and non-settling answers are quite odd.

(14) Q: Has John stopped smoking?
A1: He hasn't. *precise answer; Figure 2a*
A2: He hasn't despite not enjoying it. *over-informative answer; Figure 2b*
A3: ??He doesn't smoke. *non-settling answer; Figure 2c*
A4: #Sub28 took place in Bochum. *non-settling answer; Figure 2d*

The polar question ϕ? in (14Q) presupposes that John used to smoke, and thus assumes the context set to be the set of worlds in which John used to smoke. The polar question partitions this context set into ϕ, the set of worlds in which John has stopped smoking, and $\neg\phi$, the set of worlds in which John has not stopped smoking. (14A1) is a precise answer to this polar question because it selects $\neg\phi$. (14A2) is an over-informative answer because it selects a proper subset

of $\neg\phi$ (i.e. the set of worlds in which John has not stopped smoking and he does not enjoy smoking). Without special intonation and with just default prosody of a declarative sentence, (14A3) is an odd answer to the polar question. It does not settle the question because it selects the set of worlds in which John doesn't smoke, which not only includes $\neg\phi$, but also worlds that are not in the context set (i.e. worlds in which John never smoked before and still doesn't). In a context with no further detail, where whether SuB took place in Bochum has nothing to do with whether John has stopped smoking, (14A4) is a very odd answer to the polar question. The set of worlds selected by (14A4) intersects with both ϕ and $\neg\phi$, and thus do not settle the question.

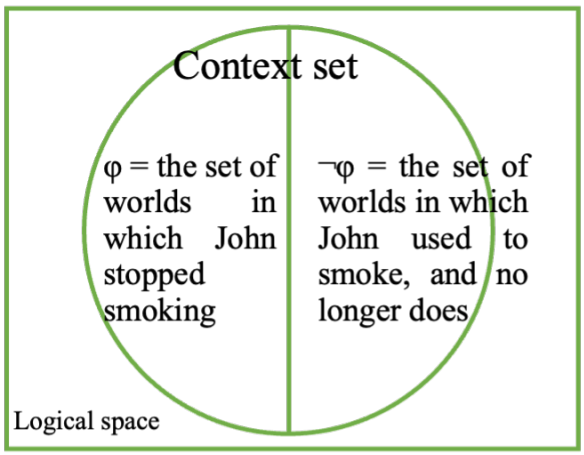


Figure 3: Partitions induced by (15Q)

I have introduced three types of answers in the partition theory of questions: precise answers, over-informative answers and non-settling answers. If we take precise answers to be members of the set denoted by the QUD, then Jasinskaja and Zeevat's (2008; 2009) set-membership approach requires the conjuncts of semantic opposition to be doubly distinct *precise answers* to the QUD. In section 5.1 I will show that this is too strict because the conjuncts can be over-informative answers to the QUD.

4.2. Presuppositions cannot settle a question

Heim (2015) observed that questions cannot be answered by an accommodated presupposition. Consider (15) for example. (15A1) is the precise answer, while (15A2) is over-informative. Strictly speaking, (15A3) is also over-informative because it selects a subset of positive cell, but it sounds odd as an answer.

(15) Q: Do you have children?
A1: Yes, I do. *precise answer; Figure 2a*
A2: I have a daughter. *over-informative answer; Figure 2b*
A3: #I have to pick up my daughter now.

The following example highlights this intuition with a minimal pair. (16A1) is an over-informative but good answer to (16Q) because it selects a subpart of the negative cell (i.e. worlds in

which the question asker cannot see the Labrador, and a girl from New York just adopted the dog). (16A2) is odd because it settles the question with a presupposition triggered by the cleft.

(16) Context: John is visiting a dog shelter because he is particularly interested in adopting a Labrador.
Q: Can I see the Labrador?
A1: A girl from New York just adopted the Lab.
A2: #It is a girl from New York who just adopted the Lab. (Elliott and Fox, 2020)

Having defined question settlement, which includes precise and over-informative answers that settle the question with at-issue content rather than presuppositions, the next section will show that only conjuncts that settle the QUD are acceptable in semantic opposition.

5. Empirical data: Conjuncts of semantic opposition must settle the QUD

5.1. Conjuncts of semantic opposition can be over-informative answers to the QUD

Recall that the set-membership approach requires the conjuncts of semantic opposition to be precise answers to the QUD. Toosarvandani (2014: fn 19) showed that this fails to allow semantic opposition with antonyms. This subsection provides another piece of evidence that the set-membership approach is too strict. Contrast (7a) with (9), repeated below, a felicitous semantic opposition sentence whose second conjunct is an over-informative answer to the QUD *Who bought a Ferrari?*

(9)Oleg bought a Ferrari, whereas Roma couldn't even find a car dealer.

The set-membership approach would predict (9) to be bad, contrary to fact. The first three steps are identical to those for (7a). Step 4 fails because the second conjunct is not the negative precise answer to the second polar question *Did Roma buy a Ferrari?* as Figure 4 demonstrates.

(17) *The set-membership approach to (9)*
Oleg bought a Ferrari, whereas Roma couldn't even find a car dealer.
Step 1. *Find a potential QUD*: Who bought a Ferrari?
Step 2. *Divide the QUD into two polar questions*: Did Oleg buy a Ferrari? Did Roma buy a Ferrari?
Step 3. *Check if the first conjunct is the positive precise answer to the first polar question*: ✓
Step 4. *Check if the second conjunct is the negative precise answer to the second polar question*: ✗!

As was explained in section 3.2, because the QUD for a semantic opposition sentence is implicit, it is not sufficient to go through just one QUD to show that the set-membership approach would predict (9) to be bad because there may be other QUDs that this approach would predict to be valid for (9). Thus, to show that this approach would predict (9) to be bad, I need to show that there is no QUD that could satisfy the set-membership requirement. This is indeed the case: because not even being able to find a car dealer generally entails not buying a Ferrari, we

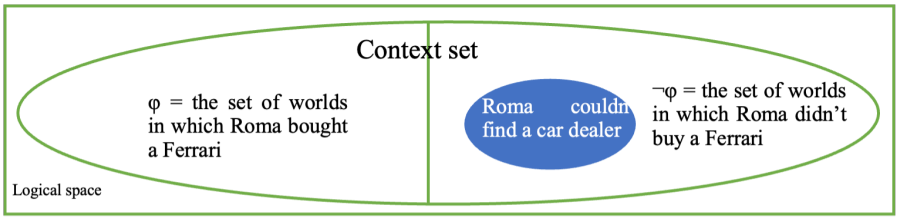


Figure 4: Partitions induced by *Did Roma buy a Ferrari?*

cannot find a QUD where the conjuncts of (9) are precise answers to its polar questions. For example, a potential QUD may be *Who could find a car dealer?* The second conjunct of (9) is the negative precise answer to the polar question *Could Roma find a car dealer?* but the first conjunct is not the positive precise answer to the polar question *Could Oleg find a car dealer?*

But (9) is felicitous, suggesting that the semantic opposition conjuncts don't need to be precise answers to the polar questions, but can be over-informative answers. The felicity of over-informative conjuncts of semantic opposition parallels the felicity of over-informative answers to questions:

(18) Q: Did Roma buy a Ferrari?
A: She couldn't even find a car dealer.

To control for the QUD, some examples in the literature provide a leading question to a semantic opposition sentence, with the implicit assumption that the leading question is the QUD addressed by the semantic opposition sentence. Following is such an example from Toosarvandani (2014: 45):

(19) Q: Who is tall? Is John tall? Is Bill tall?
A: John is tall, but Bill is not tall.

But even when provided with an overt leading question, that does not have to be the QUD addressed by the semantic opposition sentence. (20A) is felicitous, but if we assume that the QUD that its conjuncts should settle is (20Q), then it does not meet the current proposed requirement.[3]

(20) Q: Who is tall? Is John tall? Is Bill tall?
A: John is tall, whereas I don't know whether Bill is tall or not.

As the following derivation shows, the problem is the second conjunct, which does not settle the second polar question *Is Bill tall?* because the second conjunct is neither the negative precise answer nor over-informative answer to it.

(21) *The set-membership approach to (20A)*
John is tall, whereas I don't know whether Bill is tall or not.
Step 1. *Find a potential QUD*: Who is tall?
Step 2. *Divide the QUD into two polar questions*: Is John tall? Is Bill tall?
Step 3. *Check if the first conjunct settles the first polar question*: ✓
Step 4. *Check if the second conjunct settles the second polar question*: ✗!

[3]I am grateful to Bernhard Schwarz (p.c.) for pointing this out to me.

I argue that (20A) is fine because its conjuncts address a different QUD *Do you know who is tall?* The second conjunct settles the second polar question because it is the precise negative answer; the first conjunct is an over-informative answer to the first polar question, and thus also settles it.

(22) *The set-membership approach to (20A)*
John is tall, whereas I don't know whether Bill is tall or not.
Step 1. *Find a potential QUD*: Who do you know is tall?
Step 2. *Divide the QUD into two polar questions*: Do you know if John is tall? Do you know if Bill is tall?
Step 3. *Check if the first conjunct settles the first polar question*: ✓
Step 4. *Check if the second conjunct settles the second polar question*: ✓

Therefore, the QUD addressed by a semantic opposition sentence does not have to be explicitly provided. Even if a question may be explicitly provided, the answerer can still shift the QUD to a different one, and address that with the semantic opposition sentence instead. This requires linguists to go through every possible QUD for a given semantic opposition sentence, even in situations where a leading question has been provided.

5.2. Conjuncts of semantic opposition cannot answer the QUD with presuppositions

Having provided evidence that the set-membership approach is too strict, I will provide evidence that the entailment-of-set-membership approach is too strong. In semantic opposition, a conjunct's presupposition cannot include the other conjunct's asserted content. This can be illustrated with sentences where one of the conjuncts contains a presupposition trigger like a pronoun (23a), a cleft (23b), *after* (23c) and *stopped* (23d).

(23) a. #Oleg met a girl who bought a Ferrari, whereas she (=the girl Oleg met) didn't buy a Chevy.

b. #It is Oleg who bought a Ferrari, whereas Roma didn't buy one.

c. #Oleg went home after buying a Ferrari, whereas he didn't buy a Chevy.

d. #Oleg stopped smoking cigarettes, whereas he didn't smoke cigars before.

The infelicity of (23) cannot be due to the use of these presupposition triggers and the particular discourse relation between the conjuncts because if we leave out *whereas* or replace it with *and*, many of these sentences are fine:

(24) a. Oleg met a girl who bought a Ferrari, (and) she (=the girl Oleg met) didn't buy a Chevy.

b. It is Oleg who bought a Ferrari, Roma didn't buy one.

c. Oleg stopped smoking cigarettes; he didn't smoke cigars before.

This suggests that the infelicity of (23) is due to their incompatibility with semantic opposition. The entailment-of-set-membership approach cannot account for the infelicity of (23). Following is the stepwise analysis for (23a) as an example, with the potential QUD being *Which car x is such that Oleg met a girl who bought x?*

(25) *The entailment-of-set-membership approach to (24a)*
Oleg met a girl who bought a Ferrari, whereas she (=the girl Oleg met) didn't buy a Chevy.
Step 1. *Find a potential QUD*: Which car x is such that Oleg met a girl who bought x?
Step 2. *Divide the QUD into two polar questions*: Did Oleg meet a girl who bought a Ferrari? Did Oleg meet a girl who bought a Chevy?
Step 3. *Check if the first conjunct entails the positive answer to the first polar question*: ✓
Step 4. *Check if the second conjunct entails the negative answer to the second polar question*: ✓!

What is crucial is that by using a pronoun that refers to a definite DP, the second conjunct of (23a) presupposes that Oleg only met one girl, and asserts that that girl didn't buy a Chevy. The second conjunct thus entails that Oleg didn't meet any girl who bought a Chevy, which is the negative answer to the second polar question (Figure 5). The first conjunct is and trivially entails the positive answer to the first polar question. Thus, the conjuncts in (23a) satisfy the entailment-of-set-membership requirement, and are predicted to be okay, contrary to fact.

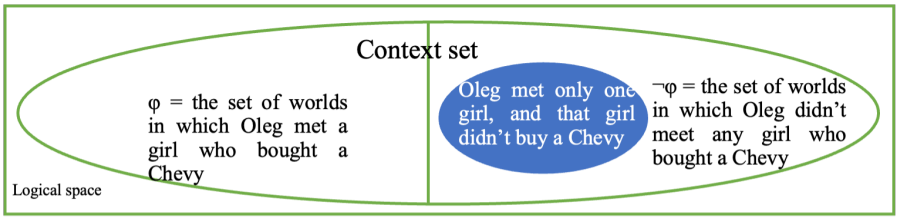


Figure 5: Partitions induced by *Did Oleg meet a girl who bought a Chevy?*

The current proposal based on question settlement manages to rule out (23a) correctly. Although the second conjunct in (23a) entails the negative cell of the polar question, it does not settle that polar question because it answers part of the question with a presupposition. This can be demonstrated by putting the question and answer pair into a dialog:

(26) Q: Did Oleg meet a girl who bought a Chevy?
A: #The girl he met didn't buy a Chevy.

Sentence (26A) is not a felicitous answer to (26Q) for the same reason that (15A3) and (16A2) are odd answers to their respective questions: (26A) tries to answer part of (26Q) with a presupposition (i.e. Oleg met only one girl), and presupposed material cannot settle the question.

It is worth mentioning that the infelicity of (23a) suggests that the polar questions addressed by each conjunct have to be *subquestions of the same QUD*. If (23a) did not involve *whereas*, as in (24a), the sentence is fine. This suggests that normally as the discourse proceeds, the presupposition triggered by the pronoun can be satisfied by the indefinite in the first conjunct. If we think of each conjunct in (24a) also as answering a polar question, then the polar question

answered by the first conjunct does not have a presupposition (e.g. *Did Oleg meet a girl who bought a Ferrari?*), but the polar question answered by the second conjunct does (e.g. *Did the girl Oleg met buy a Chevy?*). Therefore, in an *and*-sentence, the polar questions answered by each conjunct do not have to be parallel subquestions of the same QUD, and the second polar question may be "updated" depending on the content in the first conjunct: the second polar question may involve a presupposition that is introduced by the first conjunct.[4] But this is not the case for *whereas*-sentences: the second polar question cannot be "updated" this way, but must be a subquestion of the QUD, in parallel to the first polar question.

I have shown that the entailment-by-set-membership approach incorrectly predicts (23a) to be felicitous because the conjuncts entail the answers to the QUD *Which car x is such that Oleg met a girl who bought x?* but the current analysis rules out that QUD for (23a) because the second conjunct in (23a) cannot settle the question with a presupposition. But to rule out (23a) and predict it to be infelicitous, the current analysis not only needs to show that the conjuncts do not settle that particular QUD, but also that they don't settle *any* potential QUD. The other QUD that is promising and should be ruled out is *Which car did the girl that Oleg met buy?* As the following derivation shows, this QUD is ruled out because the first conjunct does not settle the first polar question.

(27) *My analysis of (23a)*
Oleg met a girl who bought a Ferrari, whereas she (=the girl Oleg met) didn't buy a Chevy.
Step 1. *Find a potential QUD*: Which car did the girl that Oleg met buy?
Step 2. *Divide the QUD into two polar questions*: Did the girl that Oleg met buy a Ferrari? Did the girl that Oleg met buy a Chevy?
Step 3. *Check if the first conjunct settles the first polar question*: ✗
Step 4. *Check if the second conjunct settles the second polar question*: ✓

We can highlight the failure of the first conjunct to settle the first polar question by putting the question and answer pair into a dialog:

(28) Q: Did the girl that Oleg met buy a Ferrari?
A: #Oleg met a girl who bought a Ferrari.

With the default prosody of a declarative sentence, (28A) is an odd answer to (28Q) because it selects a superset of the positive cell: worlds in the context set (i.e. worlds in which Oleg met only one girl and that girl bought a Ferrari) plus worlds outside the context set (i.e. worlds in which Oleg met more than one girls and at least one of them bought a Ferrari). This parallels (14A3) and corresponds to the configuration in Figure 2c, and thus fails to settle the question.

The answer (28A) may be improved with a rise-fall-rise intonation (Constant 2012):

(29) Q: Did the girl that Oleg met buy a Ferrari?
A: Oleg met a girl who bought a Ferrari.

[4]If we replace *and* in (24a) with counterexpectational *but* or *however*, the sentence is also fine, suggesting that the questions answered by the conjuncts of counterexpectational *but* do not have to be subquestions of the same QUD, in contrast to semantic opposition *but*. I think the fact that there is a greater degree of "parallelism" between the conjuncts of semantic opposition than between the conjuncts of counterexpectation is key to understanding the subtle differences in meaning between these different uses of *but*. I leave this question to future research.

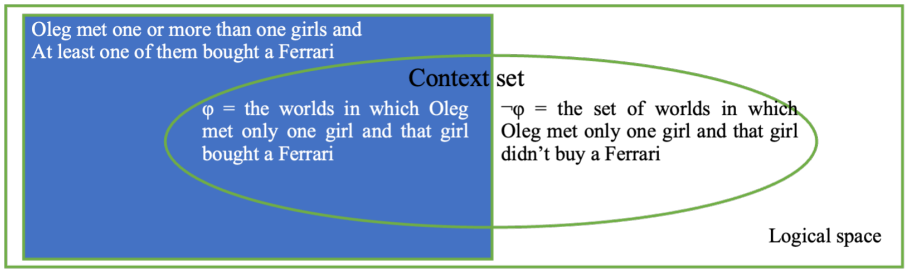


Figure 6: Partitions induced by *Which car did the girl that Oleg met buy?*

L*+H L- H%

The indefinite *a girl* creates an anti-presuppositional effect (e.g. Heim 1991; Marty 2017): by using the indefinite, the answerer implies that they cannot use a definite DP, suggesting that they do not share the asker's belief that Oleg only met one girl. Here is how an interaction of the indefinite and the rise-fall-rise intonation creates this anti-presuppositional effect: according to Constant (2012), a speaker's use of the rise-fall-rise intonation implies that the alternative propositions cannot be safely claimed. Assuming that the entire sentence in (29A) has focus, a salient alternative proposition is *The girl that Oleg met bought a Ferrari*. The answerer implies with the rise-fall-rise intonation that this alternative proposition cannot be safely claimed, presumably because they don't accept the use of the definite and in particular its presupposition that Oleg only met one girl.

6. Conclusion and implications

This paper has supported Toosarvandani's (2014) three-way distinction of the meanings of *but* (counterexpectation, semantic opposition and correction) with *whereas*, a lexical item dedicated for semantic opposition. Then I have shown that the felicity of semantic opposition is directly correlated with the felicity of its conjuncts as answers to the polar questions contained in the QUD. The semantic opposition conjuncts can be over-informative answers to the polar questions, suggesting that Jasinskaja and Zeevat's (2008, 2009) set-membership approach is too strict; the semantic opposition conjuncts have to settle the polar questions, and cannot do so with presuppositions, suggesting that Toosarvandani's (2014) entailment-of-set-membership approach is too relaxed.

Literature on question pragmatics has proposed many different definitions of how well an answer may address a question (e.g. relevance and good-answerhood by Groenendijk and Stokhof 1984; informativeness, licensing and pertinence by Groenendijk 1999). My study provides evidence for the linguistic and cognitive reality of *question settlement*, by showing that the (im)possibility of semantic opposition coordination depends on whether the conjuncts settle the relevant question.

Furthermore, judgments in question pragmatics have traditionally relied on intuitions about question-answer pairs. I have provided a diagnostic involving *whereas*- and *but*-coordination, declarative sentences that are nevertheless closely related to question-answering, adding to the growing literature that does so (e.g. AnderBois 2016).

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The local context of disjunction is not universal: A case study of Japanese[1]

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Abstract. Kurafuji (1998) observes that *bathroom anaphora* is felicitous in Japanese with an overt pronoun, but not with a covert 'pronoun.' This study reexamines this observation. I argue that the infelicity of the overt pronoun should be attributed to the absence of the local context for the second disjunct. I also demonstrate that the covert 'pronoun' is not a genuine instance of bathroom anaphora. The covert argument results from eliding an indefinite through *argument ellipsis*. The conclusion of this study implies that the local context of logical connectives is a locus of cross-linguistic/categorial variations.

Keywords: disjunction, bathroom anaphora, local contexts, Japanese

1. Introduction and summary

Bathroom anaphora, exemplified in (1), has been one of the central concerns of the dynamic analysis of anaphora resolution.[2]

(1) Either there is not a bathroom, or {**it / the bathroom**} is in a funny place.

The Japanese counterpart of the configuration is discussed by Kurafuji (1998). He observes that an overt pronoun *sore* '*it*' does not serve as bathroom anaphora.[3][4] The infelicity is replicated with a definite description *sono N* '*the N*.' The intended interpretation is obtained only with a null argument. (2) is a representative example.

[1]I would like to thank Stefan Kaufmann, Jon Gajewski, Magda Kaufmann, Giulio Muramatsu, Hajime Mori, Yu Hashimoto, and the three anonymous reviewers for SuB28 as well as the audience in UConn Meaning Group, Sendagaya Linguistics Circle. The usual disclaimers apply. This project is partially supported by UConn College of Arts and Sciences Research in Academic Themes grant, "Conditional Thought and Talk" (Mitch Green, Magdalena Kaufmann, Stefan Kaufmann), 2022–23.

[2]The observation is attributed to Barbara Partee.

[3]Disjunction is most typically expressed as 'ϕ *ka* ψ' in Japanese. The second disjunct can optionally be followed by another occurrence of *ka*, as in 'ϕ *ka* ψ *ka* .' Clausal disjunctions become more natural when they are embedded. When embedded, the second occurrence of *ka* is obligatory.

[4]This judgment is challenged by Elbourne (2005), who claims that the degradation with *sore* disappears when the nominative marker *ga* is replaced with a topic-marker *wa*. I have two remarks on this observation. Firstly, the improvement with *wa* is not robust and is at least subject to inter-speaker variations. Secondly, the improvement is absent, at least to my ear, if a pronoun is not a subject. (i) sounds infelicitous regardless of the pronoun's case-/topic-marker or position.

(i) #[$_\phi$ *Kono tatemono-ni-wa toire-ga nai*] ***ka***, [$_\psi$ *(sore-wa/-o) hitobito-ga (sore-wa/-o)*
This building-DAT-TOP bathroom-NOM NEG or, *it*-TOP/-ACC people-NOM *sore*-TOP/-ACC
hen'na tokoro-ni tsukutta] *(ka dochiraka da).*
funny place-DAT made (or either TOP)
'(It's either) there is no bathroom or people made it in a funny place.'

(2) [$_{\phi}$ *Kono tatemono-ni-wa toire-ga nai*] ***ka***,
This building-DAT-TOP bathroom-NOM NEG or,

[$_{\psi}$ { ***#sono toire**-ga* / ***#sore**-ga* / *e* } *hen'na tokoro-ni aru*]
the bathroom-NOM it-NOM funny place-DAT exists

(*ka dochiraka da*).
or either COP

'(It's either) there is no bathroom, or the bathroom is in a funny place.'

Kurafuji discusses two theories of pronouns/definite descriptions: *dynamic semantics* (Heim 1982; Groenendijk and Stokhof 1991; Kamp and Reyle 1993; Groenendijk et al. 1996; a.m.o.) and the *E-type anaysis* (Cooper 1979; Heim 1990; Elbourne 2001; a.m.o.). The two analyses are not incompatible, and he assumes that the theory subsumes both. A version of dynamic semantics discussed by Kurafuji does not offer an analysis of bathroom anaphora. Kurafuji claims that the overt anaphora must be resolved dynamically. The infelicity of the overt pronoun in (2) is attributed to the inability of dynamic semantics to resolve it.

For Kurafuji, the null argument in (2) is a covert *pronoun*. He argues that the reference of the (alleged) covert pronoun can be resolved in a non-dynamic fashion: the covert pronoun is (optionally) subject to the *E*-type analysis.[5] Since the *E*-type analysis accounts for bathroom anaphora, according to Kurafuji, the covert pronoun is felicitous in (2).

Kurafuji's account for the infelicity of the overt pronoun depends on two assumptions:

- Overt pronouns must be dynamically resolved.
- Dynamic semantics is unable to resolve bathroom anaphora.

This study challenges the second assumption. (I also discuss the first assumption in section 4.1 to confirm it. I keep assuming it in the rest of the paper.) Bathroom anaphora is dynamically resolved as long as the theory satisfies the following two conditions.

- 'ϕ *or* ψ' is interpreted as '$\phi \vee (\neg\phi \wedge \psi)$', where $\neg\phi$ is the *local context* of ψ.
- Double Negation Elimination (DNE) is valid.

Frameworks that satisfy them have indeed been proposed (Krahmer and Muskens 1995; Elliot 2022; Aloni 2023). Given such frameworks, Kurafuji's explanation of the infelicity in (2) needs revision. Two logical possibilities suggest themselves:

- A Japanese disjunction 'ϕ *ka* ψ' is *not* interpreted as '$\phi \vee (\neg\phi \wedge \psi)$': the local context is absent.
- Double Negation Elimination (DNE) is *not* valid.

I contend that the first option is on the right track. The validity of the argument implies that local contexts in logical connectives are subject to cross-linguistic variations.

[5]Kurafuji commits to the *mixed-approach* to anaphora resolution (Chierchia 1995): the theory of anaphora resolution subsumes *both* the dynamic analysis and the *E*-type analysis. Although I do not intend to dispute the mixed approach, the following discussion reveals that the observation in (2) does not support it.

Without the local context, the *E*-type analysis also fails to account for bathroom anaphora. The felicity of the null argument in (2) must be reconsidered. I demonstrate that (2) with a covert argument is not a genuine instance of bathroom anaphora. The null argument is not a covert pronoun, and it results from eliding an indefinite instead.

The rest of this paper is organized as follows. Section 2 lays out necessary theoretical backgrounds. The way bathroom anaphora is resolved in dynamic semantics is discussed. Section 3 is devoted to justifying the lack of the local context in the Japanese disjunction. Section 4 confirms the assumption made in Kurafuji (1998) and in section 3. The claim that the null argument in (2) is *not* a pronoun is justified here as well. Section 5 discusses a remaining issue.

2. Theoretical backgrounds

Bathroom anaphora (1) has been taken as a challenge for dynamic semantics. The challenge is due to the environment of the apparent antecedent of the anaphora, *a bathroom*. It stays (i) within the scope of negation and (ii) in a different disjunct from the anaphora. (i) or (ii) alone makes anaphoric relation impossible, as shown in (3).

(3) a. #George doesn't own a car. It's blue.
b. #Either Jones owns a bicycle, or it's broken.

(Simons 1996: 245–246)

To overcome this challenge, Kamp and Reyle (1993) argues that the anaphora in (1) is not directly anteceded by the indefinite in the first disjunct; rather, it finds its antecedent in the *local context* (Stalnaker 1999; Karttunen 1974; Heim 1982) of the second disjunct, that is, he negation of the first disjunct.[6] The proponents of this analysis formalize the idea that disjunction $\phi \vee \psi$ is interpreted as $\phi \vee (\neg\phi \wedge \psi)$, where $\neg\phi$ is the local context. The equality $\phi \vee \psi \equiv \phi \vee (\neg\phi \wedge \psi)$ is classically valid, and the postulation of it is independently supported by various linguistic phenomena, as discussed in section 3 and section 5. Augmented with the local context, (1) is interpreted as (4a). (4a) is reduced to (4b), *if double negation in the $\neg\phi$-clause is eliminated*. The anaphora *the bathroom* is anteceded by an indefinite *a bathroom* in the $\neg\phi$ clause.

(4) a. Either [$_{\phi}$ there is not a bathroom], or
[[$_{\neg\phi}$ *it is not the case that there is not a bathroom*] and
[$_{\psi}$ the bathroom is in a weird place]].
b. Either [$_{\phi}$ there is not a bathroom], or
[[$_{\neg\phi}$ *there is a bathroom*] and [$_{\psi}$ the bathroom is in a weird place]].

The resolution of bathroom anaphora presumes two prerequisites:

- 'ϕ *or* ψ' is interpreted as 'ϕ *or* ($\neg\phi$ *and* ψ)', where $\neg\phi$ is the *local context* of ψ.
- Double Negation Elimination (DNE) is valid.

[6] See Hofmann (2022) for a different line of analysis. For Hofmann, negation is *externally dynamic*, and disjunction is *internally and externally dynamic*, in Groenendijk and Stokhof's (1991) sense. Accessibility is regulated by discourse coherency. The pronoun in (1) can be directly anteceded by the indefinite in the first disjunct, as long as the discourse is coherent.

As illustrated below, the local context is incorporated into the dynamic theory in, for example, Groenendijk et al. (1996). Validating DNE is not a trivial task, but Krahmer and Muskens (1995) proposes a way to do so. I discuss how the technicalities satisfy the prerequisites below.

2.1. Local context in Groenendijk et al. (1996)

The primary notions in Groenendijk et al.'s (1996) *Update Semantics* are *possibilities* and *states*.[7]

- Possibilities and States
  - A possibility i is a pair $\langle f, w\rangle$, w is a possible world, and f is an assignment function, a partial function from variables to individuals.
  - A state c is a set of possibilities i.
  - $i' = \langle f', w'\rangle$ is an extension of $i = \langle f, w\rangle$ iff $f \subseteq f'$ and $w = w'$
  - For $i = \langle f, w\rangle$ and $i' = \langle f', w'\rangle$, $i[x/d] = i'$ iff i' is an extension of i, $\texttt{Domain}(f') = \texttt{Domain}(f) \cup \{x\}$, and $f'(x) = d$.

Sentences update a state into a new state. Minimally, the update is defined as follows. Below, for any ϕ and ψ, $(c[\phi])[\psi]$ (the successive updates of c by ϕ and then by ψ) is abbreviated as $c[\phi][\psi]$.

- Updates
  - $c[Px_1,...,x_n] \coloneqq \{\langle w, f\rangle \in c \mid \langle f(x_1),...,f(x_n)\rangle \in f(P)\}$
  - $c[\exists xPx] \coloneqq \bigcup_{d\in D}(c[x/d][Px])$,
    where $c[x/d] \coloneqq \{i[x/d] : i \in c\}$
  - $s[\neg\phi] = \{i \in c \mid$ there is no j such that j is an extension of i and $j \in c[\phi]\ \}$
  - $c[\phi \vee \psi] \coloneqq c[\phi] \cup c[\neg\phi][\psi]$

$c[\exists xPx]$ is the update by sentences with an indefinite. It first updates each $\langle f, w\rangle \in c$ into $\langle f', w\rangle$ so that f' has x in its domain and $f'(x) = d$, for some $d \in D$; then eliminates the possibilities such that the individual $f'(x)$ is not P in w'; do this update for every $d \in D$; finally, collects the result. The resultant state only contains possibilities $i'' = \langle f'', w''\rangle$ such that $f''(x)$ is P in w''.

The local context of the disjunction is specified in the definition. The framework meets the first prerequisite for resolving bathroom anaphora. The second disjunct updates only the $\neg\phi$-possibilities. Consider the update by bathroom sentence, which I suppose is represented as (5a), B for being a bathroom, and W for being in a weird place. By the definition of updates by disjunction, (5a) is reduced to (5b), where the local context is made explicit. *If DNE were valid*, (5b) would further be reduced to (5c). $c[\exists xBx] = c'$ contains possibilities $\langle f, w\rangle$ such that x is in the domain of f and $f(x)$ is a bathroom. c' is update by Wx. The variable in Wx is resolved in all the possibilities in c' and is assigned to a bathroom, as desired.

[7]The system proposed by Groenendijk et al. (1996) is slightly more complicated than laid out here, due to *referent system*. Since the discussion below will not be affected, I will ignore it below.

(5) a. $c[\neg\exists x Bx \vee Wx]$
b. $c[\neg\exists x Bx] \cup c[\neg\neg\exists x Bx][Wx]$
c. $c[\neg\exists x Bx] \cup c[\exists x Bx][Wx]$

However, DNE is not valid in the definitions above. (5b) is *not* reduced to (5c), and bathroom anaphora is not resolved. To see this, consider the following model in (6) and the updates in (7) within this model.

(6) $W = \{w_1, w_2, w_3\}$, Jonathan runs in w_1, Mary runs in w_2, and no one runs in w_3. and a vacuous assignment function f. The initial set of possibility $c = \{\langle f, w_1\rangle_{i_1}, \langle f, w_2\rangle_{i_2}, \langle f, w_3\rangle_{i_3}\}$.

(7) a. $c[\exists x.\texttt{run}(x)] = \{\langle f_j, w_1\rangle, \langle f_m, w_2\rangle\}$
b. $c[\neg\exists x.\texttt{run}(x)] = \{\langle f, w_3\rangle\}$
c. $c[\neg\neg\exists x.\texttt{run}(x)] = \{\langle f, w_1\rangle, \langle f, w_2\rangle\}$
(f_j is an extension of f that assigns `jonathan` to x)

$c[\exists x.\texttt{run}(x)]$ eliminates the possibilities $\langle f, w\rangle \in c$ s.t. no one runs in $w \in i$, namely i_3; and f is updated so that the extended function assigns to x someone who runs, `mary` or `john`.

$c[\neg\exists x.\texttt{run}(x)]$ collects the possibilities $i \in c$ s.t. i cannot 'survive' the update by $[\exists x.\texttt{run}(x)]$, namely, i_3.

$c[\neg\neg\exists x.\texttt{run}(x)]$ collects the possibilities $i \in c$ s.t. i cannot 'survive' the update by $[\neg\exists x.\texttt{run}(x)]$, namely, i_1 and i_2.

Notice that (7c) eliminates $\langle f, w\rangle$ s.t. no one runs in w. In this sense, the double negation is eliminated in the *information-content* level – $[\neg\neg\exists x\phi x]$ keeps the worlds where $\exists x\phi x$ is classically true. I say DNE is *information-valid*, or ***i-valid***. However, the double negation is *not* eliminated for anaphoric resolution. By the definition of negation, $c[\neg\neg\exists x\phi x]$ is always a subset of c, and f in $i \in c$ is not extended. Suppose that the resultant state of the update in (7c) is further updated by $[\texttt{tired}(x)]$, as in (8). The variable x is unresolved because $f(x)$ is undefined. I say DNE is not *discourse-valid*, or not ***d-valid***.

(8) $c[\neg\neg\exists x\texttt{run}(x)][\texttt{tired}(x)]$

Consider (5) again. Suppose that no possibility in c has x in its domain. Then, Wx is not resolved. This is because of the inequality $[\neg\neg\exists x Bx] \neq [\exists x Bx]$. The former does not extend an assignment function, and x is not added to the domains of possibilities. Since DNE is not *d-valid*, the bathroom anaphora is not resolved. Conversely, suppose that every possibility in c has x in its domain. Then, the variable in Wx is resolved (assigned to some individual). However, nothing guarantees the intended meaning: $f(x)$ may well be a non-bathroom individual. Although the variable is resolved, the sentence does not obtain the intended reading.

Thus, the framework of Groenendijk et al. (1996) only meets the first prerequisite for resolving bathroom anaphora: it specifies the local context of disjunction, but it does not *d*-validate DNE.

2.2. *d*-validating DNE in dynamic semantics

Krahmer and Muskens (1995), being aware of the technical issue caused by DNE, propose a

way to *d*-validate DNE (see Elliot 2022 and Aloni 2023 for the same line of analysis). The proposal is to make the system bilateral. Their proposal is based on *Discourse Representation Theory* (DRT; Kamp 1981; Kamp and Reyle 1993; a.m.o.), but the gist can be incorporated into Update Semantics. In the bilateral Update Semantics, each expression ϕ is associated with the positive update $[\phi]^+$ and the negative update $[\phi]^-$ (cf. van den Berg 1996). For any ϕ except for $\neg\phi$, the positive update $[\phi]^+$ is equivalent to the updates defined in the previous section. The negative update is defined as follows.

- $c[\phi]^- \coloneqq \{i \in s \mid$ there is no j such that j is an extension of i and $j \in c[\phi]\}$

Crucially, negation is redefined as a flip-flop operator that switches between positive and negative updates.

- $c[\neg\phi]^+ \coloneqq c[\phi]^-$
- $c[\neg\phi]^- \coloneqq c[\phi]^+$

The redefinition lets DNE be ***i*-/*d***-valid, for:

(9) $c[\neg\neg\phi]^+ = c[\neg\phi]^- = c[\phi]^+$

Suppose that a positive update by disjunction is defined as[8]

- $s[\phi \vee \psi]^+ \coloneqq s[\phi]^+ \cup s[\neg\phi]^+[\psi]^+$

Then the variable in (5) is resolved. The bathroom sentence is translated into (10a), which is reduced to (10b). The negation in the local context is eliminated, adding x to the domain of possibilities. For any c, possibilities in $c[\exists xBx]^+ (= c')$ has x in its domain, and for any $\langle f, w\rangle \in c'$, $f(x)$ is a bathroom. Then $c'[Wx]$ contains possibilities where the bathroom is in a weird place, which is the intended reading.

(10) a. $c[\neg\exists xBx]^+ \cup c[\neg\neg\exists xBx]^+[Wx]^+$
b. $c[\neg\exists xBx]^+ \cup c[\exists xBx]^+[Wx]^+$

The bilateral system proposed by Krahmer and Muskens (1995) meets the two prerequisites below for resolving bathroom anaphora. It, in turn, reveals that bathroom anaphora can be dynamically resolved.

- 'ϕ *or* ψ' is interpreted as 'ϕ *or* ($\neg\phi$ *and* ψ)', where $\neg\phi$ is the *local context* of ψ.
- Double Negation Elimination (DNE) is valid.

3. 'ϕ *ka* ψ' lacks the local context

Recall that the infelicity of the overt pronoun in (2), repeated below, is attributed by Kurafuji (1998) to the inability of dynamic semantics to resolve bathroom anaphora.

[8]Here, the local context $[\neg\phi]^+$ is *conjoined* with $[\psi]^+$. Krahmer and Muskens (1995) proposes that the local context forms a conditional with the second disjunct: *if* $\neg\phi$, *then* ψ. See the paper for their motivation. Since the current discussion is agnostic to the issue, I keep using the conjunctive definition.

(2) [$_{\phi}$ *Kono tatemono-ni-wa toire-ga nai*] ***ka,***
This building-DAT-TOP bathroom-NOM NEG or,

[$_{\psi}$ { ***#sono toire**-ga* / ***#sore**-ga* / *e* } *hen'na tokoro-ni aru*]
the bathroom-NOM it-NOM funny place-DAT exists

(*ka dochiraka da*).
or either COP

'(It's either) there is no bathroom, or the bathroom is in a funny place.'

The discussion in section 2 reveals that the alleged inability is not supported. The infelicity of the overt pronoun does not follow immediately from Kurafji's assumption (on which this study is also based) that the overt pronoun must be dynamically resolved. Instead, the infelicity follows if one of the two prerequisites are not met, namely, if:

- A Japanese disjunction 'ϕ *ka* ψ' is *not* interpreted as '$\phi \vee (\neg\phi \wedge \psi)$': the local context is absent.
- Double Negation Elimination (DNE) is *not* valid.

I argue that the first option is on the right track. I argue that the Japanese disjunction ϕ *ka* ψ lacks the local context for the second disjunct.

That the second option is not promising is evident from (11). There, *sore* as well as *sono N* is resolved across double negation.[9] Recall Kurafji's assumption that *sore* must be dynamically resolved. Then, the anaphora in (11) reveals that DNE is ***d***-valid in Japanese as well. Otherwise, (11) would be infelicitous.

(11)
a. [[*kono tatemono-ni-wa toire-ga nai*] *wakedewanai*].
This building-DAT-TOP bathroom-NOM NEG it.is.not.the.case

{ ***Sono toire**-ga* / ***sore**-ga* } *hen'na tokoro-ni aru (dake da).*
The bathroom-NOM it-NOM weird place-DAT exists just COP

'It is not the case that there is no bathroom in this building. It's just that the bathroom is in a weird place.'

b. [[*kono ronbun-ni-wa mondai-ga nai*] *wakedewanai*].
this paper-DAT-TOP problem-NOM NEG it.is.not.the.case

Demo hissya-wa { ***sono mondai**-o* / ***sore**-o* } *mushi-siteiru yooda.*
But the.author-TOP the problem-ACC it-ACC ignore-do seems

'It is not the case that this paper does not have a problem. But it seems that the author ignores the problem.'

Given the ***d***-validity of DNE, if the local context for the second disjunct is present in 'ϕ *ka* ψ,' it would be wrongly predicted that the bathroom anaphora should be felicitous with *sono N* and *sore*. Thus, I argue that the local context is absent in the second disjunct in the first place. Technically, the update of state c by 'ϕ *ka* ψ', $c[\phi \text{ ka } \psi]$, is defined as follows. The definition does not posit the local context.

[9] See also Karttunen (1976) for the observation that anaphora is resolved across double negation.

- $c[\phi \vee \psi] \coloneqq c[\phi] \cup c[\psi]$

The bathroom sentence with the *ka*-disjunction, represented as (12a), is reduced to (12b). The variable in Wx is not resolved as bathroom anaphora.

(12) a. $c[\neg\exists x Bx \; ka \; Wx]$
b. $c[\neg\exists x Bx] \cup c[Wx]$

The argument that 'ϕ *ka* ψ' lacks the local context is supported by independent observations. In English, the local context is motivated by various phenomena. These phenomena are not replicated in Japanese.[10] I discuss two of them in this section. The first one is *polarity-reversed sluicing* (Kroll 2019). Consider the sluicing in (13).

(13) (Students were given the option to do an extra credit problem, but were required to mark which problem they did next to their name on a spreadsheet. There is no mark next to John's name. The TA says:)

'*Either* [$_\phi$ *John didn't do an extra credit problem*]*, or* [$_\psi$ *he didn't mark which one* ~~***he did***~~].'

(Kroll 2019:2)

Apparently, the antecedent of the sluicing is the ϕ-clause, '*John didn't do...*'. However, the ϕ-clause has the opposite polarity to the elided clause, and major theories of ellipsis do not predict the sluicing to be licensed. In the theory that requires syntactic isomorphism between an elided clause and its antecedent (e.g., Rooth 1992), the sluicing in (13) is not licensed because the negative particle *n't* makes the ϕ-clause syntactically non-isomorphic with the elided clause. In the theory that requires some form of uni- or bi-directional entailment between an elided clause and its antecedent (e.g., Merchant 1999), (13) is not licensed because in no way a proposition χ entails or is entailed by its negative counterpart, $\neg\chi$.[11]

Kroll argues that a suitable antecedent for the ellipsis is provided by the local context of the

[10]The only exception I'm aware of is *presupposition filtering*. I discuss it in section 5.

[11] The only theory I am aware of that licenses the sluicing in (13) is Rudin's (2019) head-based syntactic identity theory. It states that sluicing is licensed as long as the *eventive core* of an elided clause is identical to that of its antecedent. The eventive core of a clause is the *v*P projection and the constituents below it. Suppose that the negative particle in the ϕ-clause in (13) is located above *v*P. Then the eventive core of the ϕ-clause and the elided clause are identical, *modulo* conversions of the trace (see Rudin 2019 for the exact formulation). The sluicing is licensed without mentioning the local context. The discussion in the main text persists, however. Notice that Rudin's (2019) theory overgenerates impossible sluicings discussed in Kroll (2019), for example, (i).

(i) (Students in a semantics class were given a set of extra credit problems, which they could choose to do up to half of. All students were required to put a mark on a spreadsheet next to each question, indicating whether they did or didn't do it. The professor and TA look at the spreadsheet and see that John has not put a mark next to all of the questions. The TA says to the professor:)
John marked which problems he did, but he didn't mark which problems* ~~*he didn't do***~~

(Kroll 2019: 26)

Being aware of the overgeneration problem, Rudin (2019: 3.1.) claims that some pragmatic principle regulates the interpretation of sluiced clauses. That is, there should be some principle that licenses the intended interpretation in (13) but not in (i). We can then hypothesize that the pragmatic principle mentions entailment by a local context. That is, the interpretation in (13) is possible *because* it is entailed by the local context, and the one in (i) is impossible because there is no such local context. As long as some pragmatic principle is required to regulate the interpretation of sluiced clauses, the felicity of (13) with the interpretation motivates the local context.

second disjunct, $\neg\phi$. Via DNE, the local context is [$_{\neg\phi}$ *John did do an extra credit problem*]. The local context entails the elided clause, *modulo* focus closure (Merchant 1999).

If the local context is not present in the Japanese 'ϕ *ka* ψ,' the polarity-reversed sluicing in (13) should not be replicated there. This prediction is borne out. Even under the same context as (13), the Japanese counterpart of polarity-reversed ellipsis in (14) is infelicitous.[12]

(14) # [$_{\phi}$ *John-wa tsuika kadai-o yara-**nak**-atta*] ***ka**,*
John-TOP extra assignment-ACC do-NEG-PAST or

[$_{\psi}$ *dore-o*$_1$ [~~*kare-ga*~~ *t*$_1$ ~~*ya-tta*~~] *ka kiroku-si-nak-atta*] *(ka da).*
which-ACC he-NOM do-PAST Q record-do-NEG-PAST (or COP)

Intended: 'Either John didn't do an extra credit problem, or he didn't mark which one ~~**he did**~~.'

Note that this is not due to a language-specific ban on polarity-reversed ellipses.[13] Kroll (2019) claims that (15) is another instance of polarity-reversed ellipsis. The Japanese counterpart in (16) is also felicitous, as observed in Sato (2022).

(15) I don't think that [California will comply], but I don't know why [~~**California will not comply**~~].

(16) *Boku-wa* [*kotosizyuuni koronaka-ga syuusokusuru-to*]
I-TOP by.the.end.of.this.year coronavirus.crisis-NOM is.over-COMP
*omottei-**nai**-si,*
think-NEG-and

naze [~~***kotosizyuuni koronaka-ga syuusokusi-nai***~~] *ka-mo*
why by.the.end.of.this.year coronavirus.crisis-NOM is.over-NEG Q-also
aruteido kentoogatsuiteiru.
to.some.extent can.guess

'I don't think that the coronavirus crisis will be over by the end of this year, and I can kind of guess why ~~it will not be over by then~~.'

(Sato 2022:342)

The other motivation for the local context we discuss here is the domain restriction of a modal in the second disjunct (Klinedinst and Rothschild 2012; Rothschild 2013). In (17), the use of epistemic *must* does not entail that the speaker is sure that John is in the kitchen. Instead, it is interpreted as '*if John is not in the basement, he must be in the kitchen*.' The quantificational domain of the modal is restricted by the local context $\neg\phi$. Otherwise, the use of *must* would be pragmatically odd: if the speaker were certain that John is in the kitchen, there would be no reason to mention the possibility of John being in the basement.

[12]Sluicing in Japanese is notoriously complex. The issue is if the elided material in (14) (and in alleged sluicings in general) has a full clausal structure as specified there, or derived as a *pseudo-sluicing* (roughly:*which problem ~~is it~~*). Nevertheless, the literature seems to agree that the case marker in the remnant wh-phrase guarantees that the construction is an instance of genuine sluicing. See, for example, Takahashi (1994).

[13]One may argue, for instance, the infelicity of (14) is due to the negation in Japanese being located lower than in English (cf. Han et al. 2004). If so, Rudin's (2019) theory discussed in footnote 11 predicts the infelicity of the sluicing in (14). However, it undergenerates the sluicing in (16).

(17) Either [$_{\phi}$ John is in the basement], or [$_{\psi}$ he must be in the kitchen].
(Rothschild 2013:65)

The absence of the local context in 'ϕ *ka* ψ' should render the Japanese counterpart of (17) to be infelicitous. This prediction is also borne out. A modal in the second disjunct is never restricted by a local context. (18a) and (18b) sound pretty odd. The only interpretation available is that the speaker is certain that Taro is in the kitchen, eliminating the necessity of mentioning the first disjunct.

(18) a. #[$_{\phi}$ *Taroo-wa chika-ni iru*] *ka*
Taro-TOP basement-DAT present or
[$_{\psi}$ *Taroo-wa kicchin-ni iru* ***nichigainai***] .
Taro-TOP kitchen-DAT present must
'Either Taro is in the basement, or it must be the case that Taro is in the kitchen.'

b. #[$_{\phi}$ *Taroo-wa chika-ni iru*] *or*
Taro-TOP basement-DAT present or
[$_{\psi}$ *Taroo-wa* {***machigainaku*** / ***kakujitsuni***} *kicchin-ni iru*] .
Taro-TOP surely certainly kitchen-DAT present
'Taro is in the basement, or Taro is surely/certainly in the kitchen.'

The same observation is obtained with a non-epistemic modal.[14] The circumstantial modal in (19) cannot be interpreted as '*if Taro is not in the basement, it is highly likely....*' Instead, it is interpreted as Taro is highly likely to be in the kitchen, whether or not he is in the basement.

(19) [$_{\phi}$ *Taroo-wa chika-ni iru*] *ka*
Taro-TOP basement-DAT present or
[$_{\psi}$ *Taroo-wa kicchin-ni iru* ***kanousei-ga takai***]
Taro-TOP kitchen-DAT present possibility high
'Taro is in the basement, or it is highly likely that Taro is in the kitchen.'

The fact that the polarity reversed sluicing in (13) and the domain restriction in (17) are not replicated provides independent supports for the absence of the local context in 'ϕ *ka* ψ.' If this proposal is on the right track, it reveals a new locus of semantic cross-linguistic variations: the presence or absence of the local context in disjunction. It further implies that there might be a variation in other logical connectives. The 'dynamic properties' of logical connectives, observed for disjunction in (1), (13), and (17), are almost exclusively discussed with English examples. Whether or not these examples are replicated in other languages and theoretical implications of their replicability are rarely discussed. The observation in Japanese above reveals the necessity of more investigations in other languages.

[14] I owe Teru Mizuno (p.c.) for this observation.

4. Further discussion on (2)

4.1. *Sore*/*sono N* as strong definites

So far, we have followed Kurafuji (1998) and assumed that the overt pronoun *sore* '*it*' and the definite description *sono N* '*the N*' must be dynamically resolved. This section is devoted to justifying this assumption. I demonstrate that *sono N* is a *strong definite* in Schwarz's (2009) dichotomy.

In Schwarz's (2009) dichotomy, *strong definties* are definite expressions that must be resolved dynamically. They are translated into a variable, and the variable must be mapped to some individual in the domain by an assignment function.[15] On the other hand, *weak definites* are definite descriptions that denote a unique individual that meets a certain description in a given situation. In other words, weak definites function as stated by the *E*-type analysis (Cooper 1979; Heim 1990; Elbourne 2001; a.m.o.). For example, given assignment function g and situation s, the weak definite the_{wk} *bathroom* is interpreted as (20a), while the strong definite $the_{sk,x}$ *bathroom* as (20b).

(20) a. $[\![the_{wk}\ bathroom]\!]^{g,s} \rightsquigarrow$ the unique bathroom in s
b. $[\![the_{st,x}\ bathroom]\!]^{g,s} \rightsquigarrow g(x)$

The two types of definites are diagnosed with the following predictions.

- Weak definites can be used as long as a given situation guarantees uniqueness. They can be used without being anteceded by an indefinite.
- Strong definites must be anteceded by an indefinite. As long as there is an antecedent, a strong definite does not require uniqueness.

In a dialect of German investigated by Schwarz (2009), a non-contracted sequence of a preposition and a definite article is interpreted as a strong definite. In contrast, a contracted form is interpreted as a weak definite. The contrast is shown below.

(21) a. *Der Empfang wurde* { *vom* / *#von dem* } *Bürgermeister eröffnet.*
The reception was by.the$_{wk}$ by the$_{st}$ mayor opened
'The reception was opened by the mayor.'
b. *In der Kabinettsitzung heute wird ein neuer Vorschlag* { ***vom*** *Kanzler* / ***#vom*** *Minister* } *erwartet.*
in the cabinet.meeting today is a new proposal by.the$_{wk}$ chancellor by.the$_{wk}$ minister expected
'In the cabinet meeting today, a new proposal by the chancellor/minister is expected'
(Schwarz 2009:40–41)

In (21a), the weak definite is felicitous and preferred. The utterance is made in a situation where there is a unique mayor. In (21b), the weak definite is felicitous with *Kanzler* '*chancellor*,' but not with *Minister* '*minister*,' because the world knowledge tells that there is a unique chancellor but not a unique minister.

[15]The technicality in the following discussion is simplified somewhat. In Schwarz (2009), strong definites are compositionally derived from the semantics of weak definites.

Strong definites are felicitous in (22), where it is anteceded by an indefinite. The weak definite is not felicitous there, because of the non-uniqueness of *politicians/books*.[16]

(22) a. *Hans hat einen Schriftsteller und einen Politiker interviewt. Er hat*
Hans has a writer and a politician interviewed He has

{ ***vom*** / ***von dem*** } ***Politiker*** *keine interessanten Antworten bekommen*
from.the$_{wk}$ from the$_{st}$ politician no interesting answers gotten.

'Hans interviewed a writer and a politician. He didn't get any interesting answers from the politician.'

b. *In der New Yorker Bibliothek gibt es ein Buck ü Topinambur.*
In the New York library exists EXPL a book about topinambur
Neulich war ich dort und habe { ***#im*** / ***in dem*** } ***Buch*** *nach einer*
Recently was I there and have in.the$_{wk}$ in the$_{st}$ book for an
Antwort auf die Frage gesucht, ob man Topinambur grillen kann.
answer to the question searched whether one topinambur grill can.

'In the New York public library, there is a book about topinambur. Recently, I was there and searched in the book for an answer to the question of whether one can grill topinambur.'

(Schwarz 2009: 30)

Schwarz's (2009) paradigm provides independent support for the assumption that the definite expression *sono N* must be resolved dynamically. (23a) shows that *sono N* is not licensed solely by uniqueness. A bare noun must be used instead (Japanese bare nouns have both indefinite and weak-definite interpretations, among others.) (23b) shows that it is felicitous as long as it is anteceded by an indefinite, even when the uniqueness is not guaranteed.

(23) a. ***(#Sono)*** ***soori****-ga* *kisya kaiken-o* *sita.*
the prime.minister-NOM press conference-ACC did.
'The prime minister did a press conference.'

b. *Kinoo tosyokan-de omosiroi hon-o mitsuketa.* ***#(sono)*** ***hon****-wa*
yesterday library-in interesting book-ACC found. The book-TOP
seiseibunpou-ni hanron siteita.
generative.grammar-DAT argue.against did.
'I found an interesting book in the library yesterday. The book argues against the generative grammar'

The observation suggests that *sono N* in Japanese is a strong definite. From the morphological similarity, I conjecture that the overt pronoun *sore*, which shares the anaphoric *so* part (cf. Hoji 1995) with *sono N*, is also classified as a strong definite. Then the assumption made by Kurafuji

[16]The reason why the weak definite is infelicitous here becomes less clear when the situation-based definition of conjunction is considered. Suppose that the sequence of sentences in (22) is interpreted as a conjoined sentence. Then the second 'conjunct' could be interpreted w.r.t. a minimal situation where the first 'conjunct' is true, which indeed contains a unique politician (see the discussion in section 4.2). It becomes even more puzzling because weak definites do have co-variation use. Schwarz (2009) does point out cases where weak definites seem to pick up a referent from the previously established context. I leave this issue open here.

(1998) and in the above sections is supported: *sono N* and *sore* are strong definites and must be resolved dynamically.

4.2. A null 'pronoun'?

Kurafuji (1998) assumes the null argument *e* in the bathroom interpretation in (2) is a covert 'pronoun'. He claims that the alleged pronoun can be interpreted as an *E*-type pronoun, in other words, as a weak definite. In this section, I first demonstrate that a weak definite obtains the intended reading in bathroom sentences only if the local context for the second disjunct is present.[17] The absence of the local context in the Japanese 'ϕ *ka* ψ' predicts that the covert 'pronoun,' assumed to be a weak definite, does not work as a bathroom anaphora either. Then, the felicity of the covert argument in (2) does not follow from the assumption that it is a weak definite. I argue instead that covert argument in (2) does not form a genuine instance of bathroom anaphora. The covert argument is an elided *indefinite* rather than a definite.

Weak definites denote a unique individual that meets a certain description in *s*. Suppose that the covert 'pronoun' in (2) is interpreted as (24), a weak definite with the description *bathroom*.[18]

(24) $[\![\textit{the}_{wk}\ \textit{bathroom}]\!]^{g,s} \rightsquigarrow$ the unique bathroom in *s*

The uniqueness must be evaluated w.r.t. a sufficiently *minimal situation*. In (25), for example, $\textit{the}_{wk}$ *bathroom* is interpreted in a minimal situation where the first conjunct is true.

(25) There is a bathroom in this building and the$_{wk}$ bathroom is in a weird place.

To implement the idea, the conjunction in (25) should be interpreted as (26). $s' \leq s$ holds if *s* is an extension of s': every proposition true in s' is true in *s*. The weak definite is interpreted in situation s', a minimal situation containing a bathroom. Since it is minimal, s' contains only one bathroom. The unique bathroom in that situation is denoted by the weak definite.

(26) $[\![(25)]\!]^{g,s}$ = *true* iff There is a bathroom in *s* and *in some minimal situation* s' *such that* $s' \leq s$ *and there is a bathroom in* s', the unique bathroom in s' is in a weird place.

Applying the idea to disjunction, the bathroom sentence in (27) with a weak definite should be interpreted as (28). Notice that the italicized part carries the same function as the local context we have assumed for English disjunction. The second disjunct ψ in $\phi \vee \psi$ is evaluated w.r.t. some minimal situation where ϕ is *false*. Via DNE, such a minimal situation s' is a situation that contains one bathroom. This bathroom is denoted by the weak definite.

(27) Either there is not a bathroom, or the$_{wk}$ bathroom is in a weird place.

(28) $[\![(27)]\!]^{g,s}$ = *true* iff There is a bathroom in *s* or *in some minimal situation* s' *such that* $s' \leq s$ *and* ***it is not the case that*** *there is not a bathroom in* s', the unique bathroom in s' is in a weird place.

[17] To the best of my knowledge, however, the literature of *E*-type analysis does not discuss much how *and* and *or* are interpreted in the framework. The following discussion is based on the definitions laid out in Mandelkern and Rothschild (2019), although they point out conceptual and empirical problems of the *E*-type analysis.

[18] The discussion is based on the assumption made by the *E*-type analysis that pronouns are decomposed into a definite article and a description (Cooper 1979; Elbourne 2001).

The notion of the local context is crucial in obtaining the intended bathroom-sentence interpretation, even if the definite is weak. If Kurafuji (1998) is right in assuming that the covert argument in (2) is a weak definite, the current proposal is at odds with the felicity of the covert argument there. The absence of the local context should predict the weak definite to be infelicitous.

To resolve this conflict, I argue that the null argument is interpreted as an elided indefinite, derived via *argument ellipsis* (Oku 1999; Kim 1999; a.o.). The sentence is interpreted as (29). The subject undergoes an ellipsis anteceded by the indefinite in the first disjunct.[19]

(29) Either there is not a bathroom, or ~~a bathroom~~ is in a weird place.

When and how argument ellipsis is licensed is a complicated matter (see Sakamoto 2019; Fujiwara 2022 for discussions). Nevertheless, it is evident from (30) that an indefinite licenses argument ellipsis across negation (30a) and disjunction (30b). In these examples, the null argument *e* is interpreted as *a book*.

(30) a. *Taroo-wa hon-o kawa-nak-atta. Hanako-wa e kat-ta.*
Taro-TOP book-ACC buy-NEG-PAST Hanako-TOP buy-PAST
'Taro didn't buy a book. Hanako bought *e*.'

b. [$_{\phi}$ *Taroo-ga hon-o kau*] *ka,* [$_{\psi}$ *Hanako-ga e kau*] *ka (dochiraka da).*
Taro-TOP book-ACC buy or Hanako-NOM buy or either COP
'(It is either) Taro buys a book or Hanako buys *e*.'

Then, the null argument in (2) can also result from argument ellipsis. An important consequence of this claim is that the null argument in the bathroom configuration can be interpreted as an indefinite. That this prediction is borne out is evident from (31). The second disjunct ψ is interpreted as '*he recently raises* ***a pet*** *carefully*.' This interpretation cannot be derived by interpreting the null argument as a weak definite *the pet*, even if the local context is present there. The local context of the second disjunct would be [$_{\neg\phi}$ *Taro has let a pet die*]. The alleged weak definite would denote the pet that Taro has let die. But then the second disjunct states that Taro carefully raises the pet he has let die, which is not an available interpretation of the second disjunct. Thus, in (31), the null argument must be interpreted as an elided indefinite.

(31) (Checking his history with pets, there is no trait that shows Taro let his pet die in the past five years. The speaker concludes:)
[$_{\phi}$ *Taro-wa petto-o korosita koto-ga ichidomo nai*] *ka,* [$_{\psi}$ *saikin-wa e*
Taro-TOP pet-ACC killed experience-NOM once NEG or recently-TOP
taisetsu-ni sodateteiru] *(or dochirakda da)*
carefully raise or either COP
'Either Taro never let a pet die, or he recently raises *e* carefully.'

Given the availability of argument ellipsis, the felicity of (2) with a covert argument does not

[19] Another possible analysis is that the uniqueness is a pragmatic presupposition. As discussed in section 5, presuppositions in the Japanese disjunction are filtered in the same way as observed in English. It seems that the local context effect is present only for presupposition filtering. If the uniqueness is also a presupposition, as assumed in the *E*-type analysis literature, the felicity of the covert argument in (2) is expected as long as the covert argument is a weak definite. Nevertheless, note that the examples discussed below in the main text still suggest that the covert argument *can* be an elided indefinite.

necessarily suggest that the bathroom configuration is possible in Japanese. Instead, I conclude that (2) with a covert argument does not form a bathroom sentence in the first place – the covert argument results from eliding an indefinite, anteceded by the indefinite in the first disjunct. The apparent bathroom interpretation of (2) does not form evidence against the current claim that the Japanese disjunction 'ϕ *ka* ψ' lacks the local context.

5. A remaining issue

In this section, I discuss another motivation for the local context in disjunction: presupposition filtering. Karttunen (1973) observes presupposition p in 'ϕ *or* ψ_p' is filtered if $\neg\phi$ entails ψ.

(32) a. Either baldness is not hereditary or **all of Jack's children** are bald.
$\rightsquigarrow$ Jack has children.

b. Either Jack has no children or **all of Jack's children** are bald.
$\not\rightsquigarrow$ Jack has children.

(Karttunen 1973: 180)

An intuition agreed on among the literature of the projection problem of presuppositions (Stalnaker 1999; Karttunen 1974; Heim 1982; Beaver 2001; a.m.o.) is that a presupposition projects unless it is entailed by its local context. The fact that the presupposition disappears in (32b) is another motivation for positing the local context $\neg\phi$ for disjunction $\phi \vee \psi$.

If the Japanese disjunction 'ϕ *ka* ψ' lacks the local context, it is expected that the presuppositions of the disjuncts projects unconditionally. This prediction is *not* borne out. The presupposition of a second disjunct is filtered by the same condition we observed in (32) for English. The presupposition of ψ does not project if it is entailed by $\neg\phi$. (33) presupposes Taro used to smoke, but (34) doesn't.[20]

(33) [$_\phi$ *Taroo-wa okane-ga nai*] ***ka***, [$_\psi$ *tabako-o suu-no-o* ***yame-ta***] *(ka*
Taro-TOP money-NOM NEG or smoke-ACC smoke-NMNL-ACC stop-PAST or
dochiraka da).
either COP
'Either Taro has no money, or he stopped smoking.'
$\rightsquigarrow$ He used to smoke.

[20]The filtering effect is also symmetric, as confirmed by an experimental investigation by Kalomoiros and Schwarz (2021) for English. (i) does not presuppose that Taro used to smoke.

(i) [$_q$ *tabako-o suu-no-o* ***yame-ta***] ***ka***, [$_p$ *Taroo-wa tabako-o sutta-koto-ga*
smoke-ACC smoke-NMNL-ACC stop-PAST or Taro-TOP smoke-ACC smoke-experience-NOM
nai] *(ka dochiraka da).*
NEG or either COP
'Either he stopped smoking, or he never used to smoke.'
$\not\rightsquigarrow$ He used to smoke.

(34) (The speaker observes that Taro does not smoke now. He concludes:)
[$_{\phi}$ *Taroo-wa* *tabako-o* *sutta-koto-ga* *nai*] ***ka***, [$_{\psi}$ *tabako-o*
Taro-TOP smoke-ACC smoke-experience-NOM NEG or smoke-ACC
suu-no-o ***yame-ta***] *(ka dochiraka da).*
smoke-NMNL-ACC stop-PAST or either COP
'Either he has never smoked, or he stopped smoking.'
$\not\rightsquigarrow$ He used to smoke.

The observation is at odds with the claim that the Japanese 'ϕ *ka* ψ' lacks the local context.[21] Although I have to leave an investigation on a possible resolution of the conflict for future work, here is a possible direction. Stalnaker (1999) pursues the idea that presupposition projection is a pragmatic phenomenon. Recently, Schlenker (2008, 2009) revives this idea and demonstrates that the local contexts can be derived via pragmatic reasoning. Suppose that pragmatic reasoning is available in every language (for its pragmatic nature). The Japanese paradigm above then suggests that the local context *derived via pragmatic reasoning* is enough to filter presuppositions but not to license bathroom anaphora, polarity-reversed sluicing, or the domain restriction of a modal. I conjecture licensing them requires the local context to be present *semantically*: in some languages like English, the local context derived via pragmatic reasoning is lexicalized, and it is involved in semantic computation, hence licensing bathroom anaphora, etc; in other languages like Japanese, the local context is not lexicalized, and it only shows up for a limited purpose, e.g., presupposition filtering.

The intuition is that presupposition projections are computed *separately* from anaphoric resolution, ellipsis resolution, or domain restriction. The idea might be best formalized in Karttunen and Peters (1979) *two-dimensional semantics*. That is, the local context exists both in the assertion and the presuppositional dimensions in English but only in the presuppositional dimension in Japanese. I leave the formalization of this idea for future work.

Finally, I mention a possible explanation on *why* the local context is absent in Japanese 'ϕ *ka* ψ.' So far, I have assumed that 'ϕ *ka* ψ' is semantically equivalent to 'ϕ *or* ψ' (modulo the local context). This is not necessarily the case, however. Shimoyama (2006) claims that the Japanese disjunction is derived by existentially quantifying over a set of propositions,[22] rather than the disjunction being a connective. Suppose then that Shimoyama (2006) is right, and the English disjunction is formulated in the classical way. Then although 'ϕ *ka* ψ' and 'ϕ *or* ψ are truth conditionally equivalent, the difference in how they are formed may be relevant to whether or not the local context exists.[23] The validity of this idea depends on how other languages that are argued to form disjunctions by quantifying alternatives – Hungarian, Sinhara, etc. – behave with respect to the phenomena investigated in this study.

[21] Note also that the presence of the presupposition filtering effect and the infelicity of bathroom anaphora together are at odds with the conjecture that presuppositions and anaphora exhibit parallel behaviors (Van der Sandt 1992; Krahmer 1998; Geurts 1999).

[22] See Szabolcsi (2015) for a proposal in the same spirit but in a different formalization. See also Aloni (2007) for an articulated logic of alternatives.

[23] Note, however, the difference disappears in *inquisitive semantics* (Ciardelli et al. 2018). Nevertheless, Erlewine (2017) claims that two disjunctive markers in Mandarin Chinese, *haishi* and *huòzhe*, coincide with the alternative and the boolean disjunctions, respectively, and they do show semantic differences.

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Topichood and temporal interpretation of DPs guide clause-internal, causal coherence[1]

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Abstract. Most studies of discourse coherence focus on relations like Result (cause-effect) and Explanation (effect-cause) that are established between two discourse units whose size is at least a single clause. Such relationships may, however, also be clause-internal. The current study explores clause-internal coherence triggered by resultative adjectives in examples like *The broken window got struck with a stone* $\rightsquigarrow$ 'the window was broken because of the stone.' Based on the results of two comprehension tasks, we propose that topichood, signaled by definiteness and subjecthood, permits and constrains plausible causal inferences clause-internally. This analysis suggests a tighter relationship between (morpho)syntax and coherence than is currently assumed.

Keywords: Coherence relations, QUDs, nominal temporality, topichood, definiteness, experimental pragmatics.

1. Introduction

Coherent discourse emerges from signaled or inferable relations among adjacent discourse units. These relations are known as *coherence relations* (Hobbs, 1979).[2] Most studies of coherence focus on inter-sentential relationships, as exemplified in (1a), where language users can infer an Explanation (effect-cause) relation between two sentences in both offline comprehension and online processing (e.g., Rohde, 2008; Grüter et al., 2018; Köhne and Demberg, 2013; Mak and Sanders, 2013). Some recent studies have also investigated coherence relations between relative clauses and their main clauses; for example, in (1b) readers can still obtain the causal inference that the employee was praised because he has made lots of money for the company.

(1) a. Diane praised the employee. He has made lots of money for the company.
b. Diane praised the employee who has made lots of money for the company. (Hoek et al., 2021b)

These studies indicate that linguistic elements traditionally considered too small to be discourse units, such as relative clauses, can also enter coherence relations (Hoek et al., 2021a, b). Indeed, coherence relations may be more widespread than previously recognized, as clause-internal coherence has also been observed (Anscombe, 1979; Hobbs, 1990; Webber, 1991; Cohen and Kehler, 2021; Sasaki and Altshuler, 2022, 2023). For example, comprehenders often infer that the individual in (2a) was hit by the car while jogging, an unfortunately common event,

[1]We would like to thank Kelsey Sasaki and the audiences at Sinn und Bedeutung 28 and XPrag 2023 for their questions and comments on this work. Any errors are ours.

[2]See also terms like 'rhetorical relations' and 'discourse relations' which are often used interchangeably with 'coherence relations.' For recent overviews of coherence relations, see, e.g., Kehler (2019), Jasinskaja and Karagjosova (2019), Altshuler and Truswell (2022: Ch.5), Hunter and Thompson (2022).

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but do not make a similar inference in (2b) as individuals are unlikely to be hit by cars while teaching. Similarly, clause-internal coherence can also be triggered by adjectives. For example, comprehenders may establish a Result (cause-effect) relation between *loud* and *annoyed* in (3), and an Explanation (effect-cause) relation between *drenched* and *water balloon* in (4).

(2) a. The jogger was hit by a car. (Hobbs, 2010)
b. The teacher was hit by a car.

(3) The loud student annoyed everyone. (Hoek et al., 2021a)

(4) A drenched child got hit by a big water balloon. (Sasaki and Altshuler, 2023)

However, clause-internal coherence is still understudied, and it is unclear at present what elements permit or constrain such inferences (Cohen and Kehler, 2021). The current study explores a particular context, resultative adjectives (e.g., *drenched*) in definite subjects, that permits clause-internal coherence. We adopt an experimental approach to secure native speaker judgments, and propose that topichood, signaled by definiteness and subjecthood, permits and constrains plausible causal inference.

The paper proceeds as follows. In §2, we motivate an experimental study that considers the availability and strength of clause-internal causal relations triggered by resultative adjectives when grammatical cues of Structure {Passive, Active} and Definiteness {Definiteness, Indefiniteness} are manipulated. In §3, we present comprehension tasks whose results suggest that resultative adjectives can induce causal inference within clauses, and this is strongest when they are embedded in definite subjects. We account for these results in §4, where we propose that the availability and strength of causal relations vary under different conditions due to the temporal (in)dependency of the determiner phrases (DPs) with the clauses in which they are embedded. We argue that clause-internal causal relations between DPs and their host clauses are supported when the DP is temporally independent from its host clause. We propose that definite subjects are often interpreted to be temporally independent because they are preferentially taken to be topics. We discuss the implications of this analysis in §5, where we also raise questions for further research.

2. Background

Coherence inferences may have single words as triggers; for example, it is well-known that 'too' is a cue of a Parallel relation (Asher and Lascarides, 1998) and that implicit causality verbs bias causal inference, perhaps because they give rise to a *Why*-type Question-Under-Discussion (QUD) (Kehler and Rohde, 2017). In the current study, we focus on resultative adjectives, which describes the result states of events – e.g. 'broken' describes the result state of a breaking event. We hypothesized that such adjectives have the potential to prompt a sub-QUD, 'what event caused this result state?'.[3] This invites inferences for causal explanations that establish coherence within the clause. We focus on contexts where there is a plausible relationship between a result state described by an adjective within a DP, and the event described by the main clause – e.g., one infers from (5a) that the window was broken because it was struck by a stone

[3]For an overview of QUDs and how QUDs they may be structured, see, e.g., Beaver et al. (2017), Hunter and Abrusán (2017).

(a)

(b)

Figure 1: Possible situations described by (5a) - (5d)

(see Fig. 1a). This is so even though (5a) is compatible with a non-causal reading (the window was already broken when it was struck by a stone; see Figure 1b). Interestingly, the availability of the causal inference seems to be correlated with syntactic structure and definiteness. In comparison to (5a), (5b)-(5d) appear to be constrained to, or at least bias towards, the non-causal reading.

(5) a. The broken window was struck by a stone from the sidewalk next to the building.
b. A broken window was struck by a stone from the sidewalk next to the building.
c. Bethany struck the broken window with a stone from the sidewalk next to the building.
d. Bethany struck a broken window with a stone from the sidewalk next to the building.

If we assume that comprehenders are less likely to establish clause-internal coherence relations than inter-sentential coherence relations (Cohen and Kehler, 2021), then it would not be surprising if the former were influenced by grammatical cues in a way that the latter are not. In our working example above, our hypothesis is that two factors constrain the temporal interpretation of the nominals: Structure {Passive, Active} and Definiteness {Definiteness, Indefiniteness}. This hypothesis, we think, is related to the independently motivated observation that the temporal location of a DP description need not be related to the temporal location of its clause (e.g., Enç, 1982, 1986; Musan, 1999; Tonhauser, 2002). For example, the time in which *widow* truthfully describes the subject referent in (6) is likely to be interpreted as being after the temporal location of the clausal event: a person becomes a widow only after their partner passes away (in this case, after the person kills her own husband[4]).

[4]If the pronoun is used deictically, e.g., the speaker points to a salient woman in the context who is not the individual referred to as *the widow*, then we could would infer that the individual described as *the widow* was also truthfully described as a widow at the time of the killing.

(6) The widow killed her husband. (adapted from Anscombe, 1979)

Moreover, we know that presuppositional DPs are distinguished from non-presuppositional DPs according to their determiners and syntactic positions. In particular, the description time of presuppositional DPs does not necessarily overlap with the time of the clausal event, while the description time of non-presuppositional DPs tends to overlap the time of the clausal event (Musan, 1999, 1995; Tonhauser, 2002, 2020). For example, *many fugitives* in (7a) can be a temporally independent presuppositional DP[5], as shown in (8a). (7a) can thus be interpreted as saying that many former fugitives are now in jail. In contrast, when it occurs in the existential *there*-construction, as in (7b), *many fugitives* can only be a non-presuppositional DP that tends to be interpreted at the time of the verbal predicate, as in (8b). Therefore, (7b) is infelicitous because it is impossible for the individuals to be described as fugitives and to be in jail at the same time (unless they escaped from some other jail).

(7) a. Many fugitives are in jail.
b. # There are now many fugitives in jail. (Musan, 1995)

(8) a. $\exists t_{DP}(Many_x(fugitive'(x,t_{DP}))) \wedge \exists t_{VP}(in(jail',x,t_{VP})) \wedge t_{DP} < t_{VP}$
b. $\exists t_{DP}(Many_x(fugitive'(x,t_{DP}))) \wedge \exists t_{VP}(in(jail',x,t_{VP})) \wedge t_{DP} = t_{VP}$

Returning to (5), we can further flesh out our hypothesis as follows: the manipulation of Structure {Passive, Active} and Definiteness {Definiteness, Indefiniteness} changes the presuppositional properties of the *broken window* DPs, which leads to their different temporal interpretations, only one of which is compatible with the causal event depicted in Figure 1a. This analysis, however, remains tentative until we have more solid evidence confirming that native speakers do, in fact, infer the aforementioned causal explanations clause-internally.[6] Therefore, we conducted a comprehension experiment to investigate whether resultative adjectives permit causal inferences within clauses, and if so, whether the causal inference is constrained by Structure {Passive, Active} and Definiteness {Definiteness, Indefiniteness}. We predicted that while resultative adjectives permit causal inferences within clauses, the availability and strength of causal inference are, in part, governed by the grammatical cues of Definiteness and Structure, with the Definite-Passive condition, as in (5a), biasing the strongest causal inference.

3. Experiment

We conducted two comprehension tasks, an initial study and a follow-up study, to confirm native speakers' intuition about clause-internal causal relations in different conditions. The designs of the two studies were very similar. In the initial study, we investigated whether resultative adjectives are more likely to enhance explanation coherence in the {Passive, Definite} condition than in other conditions. In the follow-up study, we specifically focused on a subcategory of resultative adjectives, namely deverbal resultative adjectives.

[5]In (7a), *many*, as a weak determiner, is a presuppositional determiner under its partitive reading and is a non-presuppositional determiner under its cardinal reading (Musan, 1995). We only discuss the partitive reading of *many* in (7a).

[6]The only experimental research that we are aware of that tests coherence inferences clause-internally comes from Sasaki and Altshuler (2022, 2023), who – in related experiments – consider the manipulation of Structure, but not Definiteness. See §3.1.4 for more discussion.

3.1. Initial study

3.1.1. Participants

48 participants (mean age 33.76, age range 20-67, 26 women) were recruited on Prolific. To ensure that only reliable participants would be eligible to take part in this task, we also required the potential participants to have a Prolific approval rate of at least 97%. All the participants reported being native speakers of English living in countries in which English was a primary language. All participants provided their written informed consent before participating in the experiment and received financial compensation (£3) for their time.

3.1.2. Design and stimuli

The experiment was written and hosted on PCIbex Farm (Schwarz and Zehr, 2021). We manipulated Structure {Passive, Active} and Definiteness {Definiteness, Indefiniteness} to create 40 target items analogous to (5) (see Appendix for sample stimuli). Each item contained a resultative adjective and an instrument of an event that could lead to such a result, followed by a comprehension question probing explanation coherence, such as 'Was the man drenched because of the water balloon?'. Participants were instructed to read each sentence and answer the comprehension question using a 7-point Likert scale, where 1 represented 'definitely yes' and 7 represented 'definitely no'. The sentence and question appeared together on the screen.

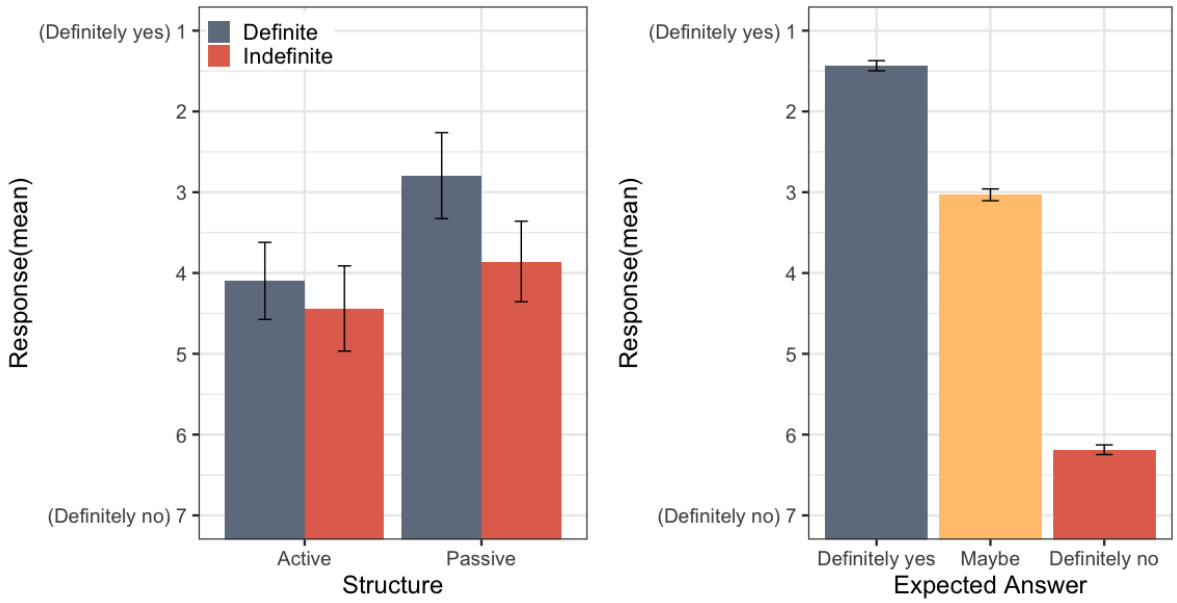
Target items were distributed across four lists based on a Latin Square design, with each item occurring only once per list, in one of the four conditions. They were interspersed with 40 filler items that were similar to the target items in terms of length and complexity. The filler items were designed to elicit responses across the entire scale, with 'definitely yes', 'definitely no', or 'maybe' as expected answers to their comprehension questions (see Appendix for sample fillers).

3.1.3. Data analysis and results

To ensure the quality of responses, we first cleaned the data based on reaction times (RTs). RTs falling below 1.5 standard deviations (SDs) below the mean of all participants' median RTs were considered extremely fast, while RTs exceeding 4 SDs above the mean of all participants' median RTs were considered extremely slow (Juzek, 2016)[7]. Four participants with extremely fast median RTs were identified as non-cooperative participants, so their data was excluded from further analyses.

The numbers of trials, as well as the means and standard errors (SEs) of the scales for each condition, are summarized in Table 1. Average ratings for causal coherence across all conditions were intermediate compared to those of fillers, while responses to the filler items indicated that participants utilized the full scale (see Figure 2b). The passive-definite condition received

[7]Extreme RTs suggested non-cooperative or abnormal language processing (Juzek, 2016). Extremely fast RTs might be the result of careless clicking, while extremely slow RTs could indicate distraction.



(a) (b)

Figure 2: Responses for experimental items (a) and filler items (b) in the initial study.

higher scores than in the other three conditions. We further analyzed the data with the cumulative link mixed model using the ordinal package (Christensen, 2022) in R (R core team, 2021). We sum-coded Structure and Definiteness as fixed effects, and included random intercepts and slopes for both subjects and items.

Condition		Numbers	Means	SDs	SEs
Active	Definite	440	4.07	2.13	0.102
Active	Indefinite	480	4.46	2.07	0.095
Passive	Definite	440	3.00	2.12	0.101
Passive	Indefinite	400	3.95	2.08	0.104

Table 1: An overview of responses for target items in the initial study

The model estimated ratings are shown in Figure 2a. Main effects of Structure (Est = -0.81, SE = 0.18, z = -4.41, $p < .001$) and Definiteness (Est = -0.72, SE = 0.13, z = -5.73, $p < .001$) were found, along with an interaction between them (Est = -0.71, SE = 0.24, z = -2.98, p = .003). Planned comparisons between definite and indefinite in two structures were calculated using the emmeans package (Lenth et al., 2018). These comparisons indicated that while Definiteness affected explanation coherence in both active and passive structures, the effect was larger in the passive conditions (Est = -1.14, SE = 0.20, z = -5.61, $p < .001$) than in the active conditions (Est = -0.40, SE = 0.15, z = -2.65, p = .008). This result is consistent with the prediction that causal inference would be strongest in the passive-definite condition.

3.1.4. Discussion

The results of this study suggest that (i) native speakers are able to infer the relation Explanation between a result state described by an adjective within a DP, and the event described by the main clause, and that (ii) such inferences are sensitive to grammatical cues of Structure and Definiteness. Comprehenders are most likely to establish the clause-internal Explanation when the the resultative adjective is contained in a definite subject DP, as in (5a).

Our findings are consistent with Sasaki and Altshuler (2022, 2023), who showed that attributive adjectives can trigger the same causal inferences within clauses. However, they investigated deverbal adjectives and non-deverbal adjectives separately, finding that while both of them can trigger clause-internal coherence, the coherence triggered by deverbal adjectives is more robust than that triggered by non-deverbal adjectives. The resultative adjectives we used in the stimuli including both deverbals (e.g., *broken*) and non-deverbals (e.g., *slippery*, see Appendix for sample items). Therefore, a further question for us is whether clause-internal causal inferences raised by deverbal resultative adjectives and guided by grammatical cues are more robust. We conducted another comprehension task focusing on deverbal resultative adjectives to address this question.

3.2. Follow-up study

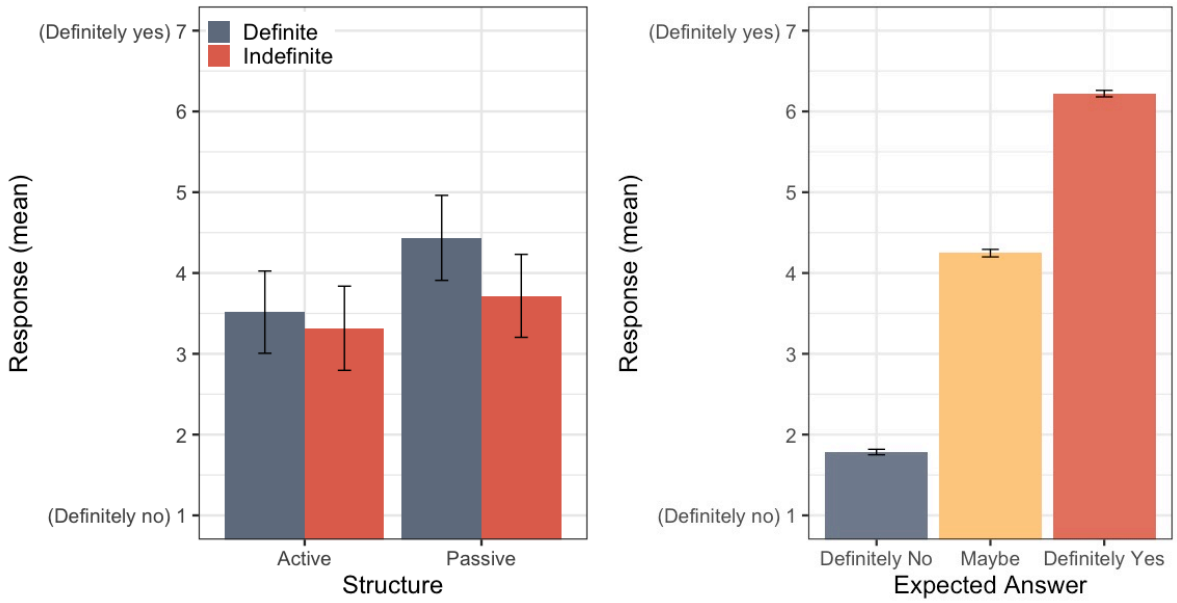
3.2.1. Participants

Monolingual English speakers recruited through Prolific participated in this study (mean age: 39.64, age range: 19-68, 30 women).[8] Participants from the initial study were prescreened, and as in the initial study, potential participants were required to have a Prolific rate of at least 97%. All participants provided written informed consent before participating in the experiment and received financial compensation (£4) for their time.

3.2.2. Design and stimuli

The design and stimuli used in this study were similar to the initial study. 40 experimental items and 80 filler items were intermixed. Each experimental trial consisted of a target sentence, as shown in (5), and a comprehension question. The most significant difference between this study and the initial study was that all resultative adjectives used in this study were deverbals, which have been reported to trigger more robust clause-internal causal inferences than non-deverbals (Sasaki and Altshuler, 2022, 2023). Additionally, the comprehension questions used in this study asked about the causal relationship between the adjective and the main clause event in a more direct way, such as 'Do you think the man was drenched because he was hit with the water balloon?' Participants were instructed to response to comprehension questions using a 7-point Likert scale, where 1 represented 'definitely no' and 7 represented 'definitely yes'.

[8]While we only required participants to be native English speakers in the initial study, we implemented stricter prescreening criteria in the follow-up study, requiring participants to be monolingual English speakers to avoid any potential influence from their second language(s).



(a) (b)

Figure 3: Responses for experimental items (a) and filler items (b) in the follow-up study.

3.2.3. Data analysis and results

We cleaned and analyzed the data using the same method as employed in the initial study. Data from one participant was removed due to extremely fast RTs, leaving data from 63 participants for further analysis.

Table 2 shows an overview of responses for target items. Similar to the initial study, average ratings for causal inferences across four conditions (see Figure 3a) were intermediate compared to those of fillers (see Figure 3b). Data were analyzed in a cumulative link mixed model, with Structure and Definiteness as sum-coded fixed factors and random intercepts and slopes for subjects and items. The model revealed main effects of Structure (Est = 0.58, SE=0.14, z = 4.23, $p < .001$) and Definiteness (Est = 0.40, SE = 0.10, z = 3.81, $p < .001$), and an interaction between them (Est = 0.44, SE = 0.21, z = 2.15, p = .03). Planned comparisons via emmeans (Lenth et al., 2018) confirmed that the effect of Definiteness was significant in the passive conditions (Est = 0.71, SE = 0.20, z = 3.54, $p < .001$), but not in active conditions (Est = 0.20, SE = 0.12, z = 1.64, p = .10).

Condition		Numbers	Means	SDs	SEs
Active	Definite	630	3.58	2.32	0.092
Active	Indefinite	630	4.48	2.28	0.091
Passive	Definite	630	4.40	2.30	0.091
Passive	Indefinite	630	3.80	2.27	0.091

Table 2: An overview of responses for target items in the follow-up study

3.2.4. Discussion

The results of the follow-up study are similar to those of the initial study. They indicate that causal inferences triggered by deverbal resultative adjectives, which give rise to more robust clause-internal Explanations than non-deverbal resultative adjectives (Sasaki and Altshuler, 2022, 2023), are still affected by Structure and Definiteness. Comprehenders are more likely to establish explanation relations between the result state of the deverbal adjective and the main clause event when the adjective is in a definite subject DP. Alongside the initial study, these results further suggest that clause-internal causal coherence raised by resultative adjectives is guided by the grammatical cues of Structure and Definiteness.

4. Analysis

We propose that differences in causal, clause-internal inferences — e.g., in (5a)-(5d), repeated below – arise from the possible temporal interpretations that can be established between the result state described by the adjective within a DP and the event described by the clause. We further propose that these interpretative possibilities are constrained by whether a DP is a topic, giving rise to distinct scopal relations between the DP and the event quantifier.

(5) a. The broken window was struck by a stone from the sidewalk next to the building.
b. A broken window was struck by a stone from the sidewalk next to the building.
c. Bethany struck the broken window with a stone from the sidewalk next to the building.
d. Bethany struck a broken window with a stone from the sidewalk next to the building.

While sentence topics are closely connected to subjects in English (Erteschik-Shir, 1997; Davison, 1984), felicitous topics must also be already familiar to speakers. This familiarity condition is linked to a DP's existence-presuppositional status; that is, a DP is presuppositional only if it is 'hearer-established' while non-presuppositional DPs are not established in the discourse model (Tonhauser, 2020; Musan, 1999). For example, when answering a question asking about the existence of dealers, as in (9a), the response in (9b), with the weak reading of *two*, is felicitous but the responses in (9c) and (9d), with the strong determiner *the* and strong quantifier *most*, respectively, are not. This is because strong DPs carry existence-presuppositions. Because their existence is presupposed, presuppositional DPs are established in the discourse, and are therefore more likely to be topics than non-presuppositional DPs.

(9) a. Are there any dealers in this town?
b. Two dealers have just been arrested. I guess that's evidence!
c. # The dealer has just been arrested. I guess that's evidence!
d. # Most dealers have just been arrested. I guess that's evidence! (Büring, 2012)

Topics have also been argued to be interpreted outside the scope of an event quantifier by Herburger (2000). Evidence for this argument comes from the inability of topics, as marked by sentence topic constructions and related constructions (e.g. Japanese *-wa*), to structure the quantification of a clause's event through focal mapping, where non-focused material in the

c-command domain of quantifier also contributes to the quantifier's restriction. Herburger also notes that scrambled phrases in German are also interpreted outside the scope of the clause's event quantifier.

We propose that, because neither indefinite subjects nor non-subject DPs are preferentially taken to be topics, native speakers preferentially interpret them within the scope of the clause's event quantifier. Taking (5) as an example, neither the indefinite subject in (5b) nor the non-subject DPs in (5c) and (5d) tend to be sentence topics, so readers are likely to interpret them in the scope of the clause's event quantifier, as shown in (10b). In these cases, the existence of the result state s (of being broken) falls within the scope of the event quantifier, $\exists e$, ranging over striking-with-a-stone events e, therefore the onset of the temporal interval of s precedes the temporal location of e. Given this temporal relationship between s and e, comprehenders can surmise that whatever event e_s caused the result state s, it too must be temporally located prior to e. Definite subjects, as exemplified in (5a), however, make good topics and, when taken as such, are interpreted outside of the scope of the event quantifier, as shown in (10b). Since the existence of the result state s is outside the event quantifier $\exists e$, there is no necessary relationship between the onset of the temporal interval of s and the temporal location of e. This permits comprehenders to infer that that the event e_s that caused the result state s is, in fact, the clausal event e itself, when plausible.[9]

(10) a. $\exists e[\text{strike-with-a-stone(e)} \;\&\; \exists x[\text{Theme(e,x)} \;\&\; \text{window(x)} \;\&\; \exists \text{s}[\text{broken(s)} \;\&\; \text{In(s,x)}]]] \models \text{e}_\text{s} \prec \text{e}$

b. $\exists x[\text{window}(x) \;\&\; \exists s[\text{broken}(s) \;\&\; \text{In}(s,x)] \;\&\; \exists e[\text{strike-with-a-stone}(e) \;\&\; \text{Theme}(e,x)]] \rightsquigarrow e_s = e$

We take this logic to be a special case of Tonhauser's generalization that non-presuppositional DPs display a stronger tendency than presuppositional ones to be temporally interpreted at the verbal predication time (Tonhauser, 2020). While Tonhauser proposed that the familiarity condition of presuppositional DPs contributes to their temporal independency, we further link her proposal of presuppositionality to sentence topicality, and propose that the information structure of DPs affects their relationship to the scope of event quantifiers, which then guides their temporal interpretation.

5. Discussion and conclusion

We have provided experimental evidence showing that native speakers are capable of making clause-internal inferences, and demonstrated furthermore that clause-internal coherence is constrained by Definiteness and Structure. We have tied these structural elements to the identification of sentence topics, and proposed that clause internal coherence is guided by the temporal interpretation of DPs which is influenced by their topichood. Temporal constraints on cause-result relationships means that coherence is best supported when embedded result states are temporally independent from main clause events. DPs that are construed as topics are temporally interpreted outside the scope of an event quantifier, decoupling the temporal interpretation of topic DPs from the temporal interpretation of their clauses. This permits native speakers to

[9]See Sasaki and Altshuler (2023) for a discussion of competing pragmatic principles which would guarantee the identification between e_s and e.

infer that the causing event of a result state described by an adjective in a topic DP to be the very same event denoted by the clause.

Coherence inferences within clauses has existed on the periphery of coherence research. Part of this is related to the fragility of clause-internal coherence. As demonstrated in this study, coherence relations depend on temporal relations, and temporal interpretation is tightly constrained within the clause, potentially leading to fewer clear cases of clause-internal coherence. In this work, we explicitly identify one source of clause-internal constraint and show that, first, temporal information is sensitive to grammatical cues, and second, when carefully controlled, coherence within clauses can naturally follow. This analysis suggests a tighter relationship between (morpho)syntax and coherence than is currently assumed.

We conclude by noting that if the topichood of DPs affects clause-internal, causal inferences, we expect similar effects to emerge when manipulating topics. For example, since presuppositional DPs tend to be topics, we expect resultative adjectives in other presuppositional subject DPs, such as in (11a) and (11b), to also allow comprehenders to obtain strong causal inferences, while non-presuppositional subject DPs, such as in (11c), should restrain such inferences. While our intuitions are in line with these predictions, we hope to confirm them with subsequent experiments.

(11) a. Most of the broken windows were struck by stones.
b. Every broken window was struck by a stone.
c. There were many broken windows struck by a stone.

Finally, we note that our analysis relies on an indirect relation between temporal interpretation and causal inferences. Future experiments may examine this relationship more directly by asking comprehension questions that probe temporal relations (e.g., *Was the window broken before it was hit by the stone?*)

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Appendix: Sample stimuli

Non-deverbal resultative adjectives

(12) a. The slippery floorboard got covered with some oil last Tuesday afternoon.
b. A slippery floorboard got covered with some oil last Tuesday afternoon.
c. Bill covered the slippery floorboard with some oil last Tuesday afternoon.
d. Bill covered a slippery floorboard with some oil last Tuesday afternoon.

(13) a. The clean mug was washed with detergent after breakfast this morning.
b. A clean mug was washed with detergent after breakfast this morning.
c. Briant washed the clean mug with detergent after breakfast this morning.
d. Briant washed a clean mug with detergent after breakfast this morning.

(14) a. The happy girl was presented the gift prepared for her on Christmas Eve.
b. A happy girl was presented the gift prepared for her on Christmas Eve.
c. Gwen presented the happy girl with the gift prepared for her on Christmas Eve.
d. Gwen presented a happy girl with the gift prepared for her on Christmas Eve.

(15) a. The upset student was shown with a failed grade one day before the summer vacation.
b. An upset student was shown with a failed grade one day before the summer vacation.
c. The teacher shown the upset student with a failed grade one day before the summer vacation.

d. The teacher shown an upset student with a failed grade one day before the summer vacation.

Deverbal resultative adjectives

(16) a. The injured dog got hit with a car on a busy street earlier this morning.
b. An injured dog got hit with a car on a busy street earlier this morning.
c. Peter hit the injured dog with a car on a busy street earlier this morning.
d. Peter hit an injured dog with a car on a busy street earlier this morning.

(17) a. The poisoned princess got assassinated with a cobra in the film which was popular last year.
b. A poisoned princess got assassinated with a cobra in the film which was popular last year.
c. The jealous queen assassinated the poisoned princess with a cobra in the film which was popular last year.
d. The jealous queen assassinated a poisoned princess with a cobra in the film which was popular last year.

(18) a. The damaged painting was cut with a razor blade during the heist in a museum.
b. A damaged painting was cut with a razor blade during the heist in a museum.
c. Tina cut the damaged painting with a razor blade during the heist in a museum.
d. Tina cut a damaged painting with a razor blade during the heist in a museum.

(19) a. The scented room was filled with fresh roses in the old castle for the wedding.
b. A scented room was filled with fresh roses in the old castle for the wedding.
c. Leonard filled the scented room with fresh roses in the old castle for the wedding.
d. Leonard filled a scented room with fresh roses in the old castle for the wedding.

Fillers

Expected to be *definitely yes*

(20) a. Tom is from Germany and likes beers. | Question: Is Tom from Europe?
b. All students took an exam last month and only three of them failed. | Question: Did any student fail in the exam?

Expected to be *maybe*

(21) a. The successful businessman has donated billions of dollars to the charity during the past ten years. | Question: Did the successful businessman donate lots of money to the charity last year?
b. Ray wanted to go swimming tomorrow with his brother. | Question: Does Ray like swimming?

Expected to be *definitely no*

(22) a. Although the project was supported by the local government, it was not welcomed by the residents. | Question: Was the project supported by the residents?
b. It was too noisy in the house, so the sleepy man couldn't fall asleep. | Question: Was the man sleepy because it was noisy in the house?

Semantics of Mandarin Demonstratives[1]

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Abstract. This paper presents novel data from Mandarin that can tease apart the two main analyses of demonstratives. Dayal and Jiang (2020) propose that demonstratives carry an anti-uniqueness presupposition, requiring there to be another entity meeting the NP description in the larger situation. The Hidden Argument Theory of demonstratives argue that demonstratives carry an additional restriction than a definite description. The Mandarin data I focus on involve demonstratives with restrictions that are so specific that anti-uniqueness cannot be met. By discussing this data, I show that an account of demonstratives based on situational anti-uniqueness is not sufficient. Then, I build an account of Mandarin demonstratives based on the main intuitions from the Hidden Argument Theory. Following Nowak (2021), I argue that the second restriction must be a syntactic constituent. In explaining the restricted distribution of demonstratives, I follow Blumberg (2020) and Ahn (2022) in arguing that there is a pragmatic competition. Finally, I extend Ahn's analysis and argue that proper names should be added to the inventory of expressions that can occupy the second argument position.

Keywords: demonstratives, definiteness, semantics.

1. Introduction

Over the past three decades, scholars have argued that demonstratives have two general uses: a. they provide direct reference to specific individuals or objects following Kaplan (1989), which is called the deictic use of demonstratives, and involve direct pointing with gestures as shown in (1); b. they can also employ non-deictic uses (King, 2001; Dayal and Jiang, 2020; Nowak, 2021; Blumberg, 2020; Ahn, 2022), including the anaphoric uses and descriptive uses. The anaphoric use is shown in (2) to denote the familiarity of a previous expression. Jenks (2018) particularly holds this view on Mandarin demonstratives. The descriptive use is shown in (3), where the demonstrative, restricted with descriptions, refers to a specific referent.

(1) (Pointing to a book) That is expensive.

(2) I met a linguist. That linguist looked happy. (Ahn, 2022: (13))

(3) That guy who is walking to open the door is my brother.

In this paper, I will focus on the non-deitic uses in Mandarin demonstratives, like (2) and (3). Regarding the form of demonstratives, I will only discuss those 'complex demonstrative constructions' or 'descriptive demonstratives' in Mandarin, like (4), rather than the 'bare demonstratives' like 'that linguist' in (2), or 'demonstrative pronouns' like 'that' in (1). In Mandarin, demonstratives are lexically represented by *zhe* ('this') and *na* ('that'). To form a complex demonstrative construction, 'zhe' or 'na' is combined with a nominal phrase, 'CL(classifier)-NP' in Mandarin. The Mandarin gloss *'na ge-CL ren'* means 'that person' in English. The main Mandarin data discussed in this paper are shown in (4), where (4)a) is a non-deictic use of

[1]I would like to thank my committee members Dr. Dorothy Ahn, Dr. Simon Charlow and Dr. Michael Glanzberg for the exceptional advising and guidance through this work. All errors are mine.

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a demonstrative with a relative clause, to denote that the speaker's brother is the one who walks to open the door; in (4)b), a proper name followed by a demonstrative refers to the proper name itself.

(4) a. [zou guoqu kai men de **na ge ren**] jiu shi wo de gege
walk to open door DE that-CL-person then is I de brother
The person who walks to open the door is my brother.
b. [Zhangsan **na ge ren**] shuan le wo de xin
Zhangsan that-CL-person tie I DE heart
Zhangsan ties my heart.

I present my proposal in two parts – the first part compares the two main theories with the undergeneration problems of Dayal and Jiang (2020) and shows that the Hidden Argument Theory works better for Mandarin empirical data, and the second part discusses the possible undergeneration issues implementing Ahn (2022) and gives a modification proposal. For non-deictic uses of demonstratives, we find two families of theories in the literature: a. on the first view, to explain the markedness of the demonstrative compared to the definite descriptions, the demonstrative is lexically restricted with an anti-uniqueness presupposition (Dayal and Jiang, 2020); b. the second view is the Hidden Argument Theory (HAT) (King, 2001; Elbourne, 2005; Blumberg, 2020; Nowak, 2021; Ahn, 2022: a.o.), on which, the demonstrative takes two arguments instead of just one, and the second argument which is hidden (silent) restricts the demonstrative.

2. Empirical data from corpus

In this section I will introduce empirical data on Mandarin demonstratives of non-deictic uses. I use CnCorpus (`http://corpus.zhonghuayuwen.org/`) and BCC corpus (BLCU Corpus Center: `http://bcc.blcu.edu.cn/`) to collect data on demonstratives. I searched *'na ge ren'* ('that person') in the corpus and filtered the irrelevant or complicated data. The results of this search include demonstratives with relative clauses (RC) and proper names. Section 2.1 provides Mandarin demonstratives with relative clauses. Section 2.2 shows data of Mandarin demonstratives with proper names.

2.1. Non-deictic uses: Demonstratives with restrictive RC/modifier

(5) a. [zou guoqu kai men de **na ge ren**] jiu shi wo de gege
walk to open door DE that-CL-person then is I de brother
The person who walks to open the door is my brother.
b. [ta xin shang de **na ge ren**] wei ta chi le bu shao ku
she heart up DE that-CL-person for her ear PAR not little bitter
That person who she loves takes lots of pains for her.
c. rang [ni jia xiang song jidan de **na ge ren**] shuo ba
let you home village deliver egg DE that-CL-person say PAR
Let that person who delivers eggs in your hometown talk!

2.2. Non-deictic uses: Demonstratives identity to the preceding proper names

(6) a. [Zhangsan **na ge ren**] shuan le wo de xin
Zhangsan that-CL-person tie I DE heart
Zhangsan ties my heart.
b. wo bu renshi [Lisi **na ge ren**].
I not know Lisi that-CL-person.
I don't know Lisi.

3. The first theory: Dayal and Jiang (2020) and their undergeneration problems

As mentioned before, there are two general types of theories on the non-deictic uses of demonstratives: one holds the view that the demonstrative takes sole argument – it is the demonstrative itself that is restricted by a presupposition; the other argues that the demonstrative takes two arguments – it is the second hidden argument that conveys more information and semantically restricts the demonstrative. The first type of theory focuses more on the lexical restrictions on demonstratives, such as Dayal and Jiang (2020). They propose an account based on Robinson (2005), by adding an anti-uniqueness presupposition to the demonstrative itself. Since Dayal and Jiang (2020) is the only theory which provides the full analysis on Mandarin demonstratives, I will begin with the discussions and evaluations of their theory.

3.1. Dayal and Jiang (2020): situation-based anti-uniqueness presupposition

Dayal and Jiang first challenge Jenks (2018)'s view of Mandarin demonstratives on which they are strong definites while bare nouns in Mandarin are weak definite. By providing empirical data to show that a. Mandarin demonstratives cannot always be used when familiarity exists; b. bare nouns can also be used as unique definites under the minimal context, they argue that the Mandarin demonstrative should be treated as an ordinary demonstrative. They give a unified analysis on Mandarin demonstratives based on Robinson (2005), aligned with demonstratives cross-linguistically.

Dayal and Jiang (2020)'s formal semantic analysis of demonstratives is given in (7). For any demonstrative, it has an anti-uniqueness presupposition which requires a larger situation s', such that more than one entity satisfies the common noun property P in the larger situations s'. If the anti-uniqueness presupposition is satisfied, then it picks out the unique entity in the minimal situation s that satisfies two properties: the common noun property P and the intended referent property, which is represented by the free variable y.

(7) $[\![Dem]\!] = \lambda s \lambda P : \exists s' s \leqslant s' |P_{s'}| > 1 . \iota x [P_s(x) \wedge x = y]$

3.2. Dayal and Jiang (2020)'s undergeneration problems in Mandarin demonstratives

In this subsection I will illustrate Dayal and Jiang (2020)'s demonstrative proposal on the non-deictic Mandarin demonstrative uses with relative clauses, and proper names. Dayal and Jiang

(2020)'s anti-uniqueness presupposition requires a larger situation with more than one entity holding the noun properties. For the non-deictic uses of demonstrative when there is only one entity with the property in the minimal situation and no other entities holding the same property in the larger situations, it will predict that the demonstratives cannot be felicitously used, which disobey the empirical fact. I will use (5a) as the main example to discuss in this subsection, which is shown as (8) below.

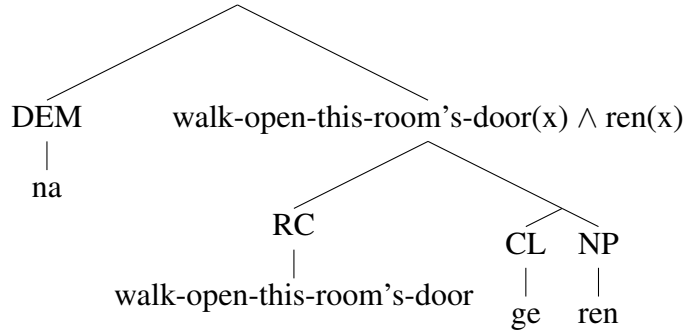
(8) zou guoqu kai men de **na ge ren** jiu shi wo de gege.
walk to open door DE that-CL-person then is I de brother
The person who walks to open the door is my brother.

The issue arises when a relative clause is so specific that it cannot hold of any other entity in the larger situation. For the example (8), suppose there are some individuals in the room (the number of the individuals in the room does not matter). With the descriptive sentence (8) uttered, the relative clause picks out one unique entity that walks up to open the specific door in the discourse context, where there cannot be anyone else in the larger situations walking up to open that specific room's door in the minimal context. There could be individuals in the larger situations holding the property of 'walking to open door', but not exactly the same door as the one in the minimal context, 'walking to open this room's door'.

There are two possibilities of treating the relative clauses under Dayal and Jiang (2020)'s approach. One is to say, the relative clause helps to pick out the entity thus should be treated inside the demonstrative construction, following the interpretation of (8) given above. The other is to treat the relative clause as a supplement to the demonstrative construction, where the relative clause does not provide any lexical restrictions to the demonstrative itself. With the discussion of the natural interpretation of (8) above, I first illustrate the analysis of (8) under Dayal and Jiang (2020)'s approach to treat the relative clause as being inside the noun properties, shown in (9). Since Dayal and Jiang do not provide a syntactic structure of demonstrative with relative clauses, I follow Lin et al. (2003), Del Gobbo (2003) and Nowak (2021)'s discussion of the syntax structure of Mandarin demonstratives with relative clauses, which will be discussed more below in Section 4. They argue that there are two possible structures: relative clause initial structure or the demonstrative initial one. I adopt the demonstrative initial construction for the illustrations in (9), which directly captures the fact that the relative clause is treated as part of the noun property combining with the bare noun first.

(9) a. **[walk-to-open-this-room's-door DE that Cl person]**

b. ιx.[walk-open-this-room's-door(x) $\wedge$ ren(x)]



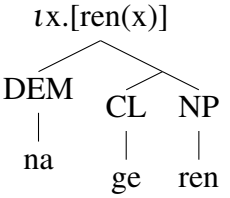
c. (1) $[\![dem]\!] = \lambda P.\lambda s.\exists s' s \leq s' |P_{s'}| > 1.\iota x[P_s(x) \wedge x = y]$; *(D&J's proposal)*
(2) P = walk-to-open-this-room-door DE CL person;

(3) $[\![$*walk-to-open-this-room-door DE that Cl person*$]\!]$
$= \lambda s.\exists s' s \leq s' | walk-open-this-room-door-person_{s'}| > 1.\iota x[walk-open-this-room-door-person_s(x) \wedge x = y]$

Following the proposal of Dayal and Jiang (2020) in (9)c.1), the anti-uniqueness presupposition requires that there should be other individuals satisfying the property of walking to open the specific room's door, while in the minimal context of (8), there is only one individual opening this specific door. Thus under the analysis of (9)c.3), (8) should not be acceptable, contrary to fact. In order to avoid Dayal and Jiang (2020)'s anti-presupposition problem, one possible alternative analysis could be to treat the relative clauses as supplementary and non-restrictive. Since non-restrictive relative clauses are often analyzed to be interpreted outside the DP, we can maintain that only the noun is a restriction property to iota, and of course there will be other people in the larger situation, thus meeting the presupposition. The semantic analysis is illustrated below in (10).

(10) a. walk-to-open-door DE **[that Cl person]**

b.



c. (1) $[\![that]\!] = \lambda P.\lambda s.\exists s' s \leq s' | P_{s'}| > 1.\iota x[P_s(x) \wedge x = y]$; *(D&J's proposal)*
(2) P = person;
(3) $[\![that\ Cl\ person]\!] = \lambda s.\exists s' s \leq s' | person_{s'}| > 1.\iota x[person_s(x) \wedge x = y]$

Given this analysis, only the bare noun 'person' could satisfy the property P, with no lexical meanings contributed by the general classifier 'ge'. The construction 'that-CL-person' denotes a singular individual in the minimal situation, with the presupposition met. However, this interpretation is infelicitous as the demonstrative now is simply denoting an individual. With the external relative clause being a separate sentence following the single individual, the relative clause is behaving like a supplement and cannot help to restrict the demonstrative to denote the unique individual. Moreover, the intended referent property, the free variable y also lies inside the iota expressions and is not connected with the external relative clause, and therefore cannot help to restrict the denotation of the demonstrative. Again, suppose that in the minimal context there are some people in the room and the speaker A and the hearer B are outside the room talking to each other. With the relative clause supplementary to the demonstrative use 'that person', the receiver B cannot tell which person is the speaker's brother in the room. To show the supplementary treatment, the original demonstrative construction with relative sentence could be rephrased to be two separate sentences, where the relative sentence is now following the demonstrative-BN (bare noun) to be supplementary: *'That person is my brother. (A pause). He is walking to open the door.'* Here the demonstrative use is not quite felicitous as people cannot tell which one is the speaker's brother, even though later they will get the supplements of more descriptions. With the demonstrative-BN and the supplementary clause separately, the denotation of the demonstrative part still faces problems, since the supplementary clause can only help later on descriptions but not help when the demonstrative selects references. This reference failure of the demonstrative with relative clause shows that even though treating RC outside the bare noun property meets Dayal and Jiang (2020)'s anti-uniqueness presupposi-

tion, it is still not acceptable to treat RC as a non-restrictive supplement outside the bare noun property of the demonstrative to successfully denote the correct entity.

So far, we have seen how Dayal and Jiang (2020)'s proposal cannot extend to account for the data of Mandarin demonstratives with a relative clause being specific in the minimal context like (10). Similarly, the demonstrative data with proper names will also be an undergeneration problem to Dayal and Jiang (2020). In a given context where the individual's proper name is unique, there cannot be other individuals holding the same proper name in the larger situations, as there is only one individual holding his/her name property in the minimal situation.

To summarize this section, Dayal & Jiang's analysis of Mandarin complex demonstratives have undergeneration problems in their anti-uniqueness presupposition for the non-deictic uses of Mandarin demonstratives with relative clauses and proper names. When the relative clause or proper name is too restrictive, there can only be one entity having the property in the minimal situation, which cannot satisfy the anti-uniqueness requirement in the larger situations. The alternative way to treat RC as a non-restrictive supplement still fails to contain enough information to capture the correct denotation of the complex demonstrative construction, and therefore is still a problem.

4. The alternative theory: Hidden Argument Theory

Hidden Argument Theory is first proposed by King (2001) and Elbourne (2005). King (2001) argues that the demonstrative 'that' should take two arguments to make a generalized quantifier. Elbourne (2005) also treats 'that' with two arguments, but the demonstrative will return the unique entity that satisfies both properties rather than a generalized quantifier. Their proposal is given in (11), where the second argument G(x) corresponds to the identificational property. This second argument G is covert, while the first argument F is overt to the material.

(11) that F = the x: [F(x) & G(x)]

4.1. Apply Nowak (2021) on Mandarin data in section 2

Hidden Argument Theory can better capture the data in section 2 for Mandarin demonstrative constructions with relative clauses and proper names. As discussed above, the demonstrative takes two arguments under HAT: the first argument is overt as the predicates, while the second argument can be covert as the identificational property, or be overt represented as the relative clause or the modifier. With the overt restrictive second argument, the demonstrative carries more information and can provide the position to the relative clause or proper names, rather than being lexical restrictive itself like Dayal and Jiang (2020). For Dayal and Jiang (2020), with the restriction property added by the relative clause or the proper name, the anti-uniqueness presupposition of the demonstrative cannot always be satisfied. However, with the second hidden argument added as a syntactic constituent, the hidden argument can directly capture the semantic restriction on the demonstrative, which I will use the data from section 2 to show that the relative clause and the proper name will be illustrated in the second argument. Following Nowak's presupposition account, this second argument should semantically restrict the first

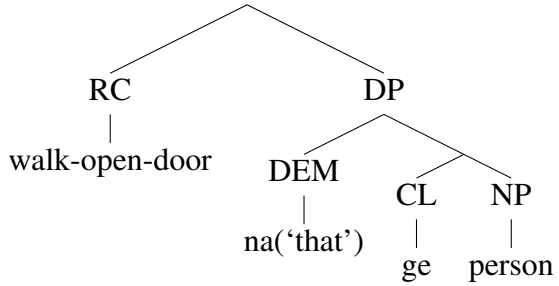
argument. I will first show the illustrations of the non-deictic cases of demonstratives with RC, with the examples (5a) and (5c) from section 2. Following that, for the non-deictic cases of 'proper name-demonstrative' construction, I give the analysis with an example of (6a). The syntax structure given below follows Nowak (2021)'s analysis, to treat the relative clause or modifiers higher as a separate second property and the demonstrative combines with the NP first.

4.1.1. Descriptive cases with relative clauses

(12) a. **[walk-to-open-door DE that Cl person]**

b. ⟦*walk-to-open-door DE that Cl person*⟧ =
λx. the intersection of x : person(x) = 1 and x : walk-open-door(x) = 1 is a proper subset of x : person (x) = 1. ιx : walk-open-door(x) & person(x) = 1

c. ιx.[walk-open-door(x) $\wedge$ person(x)]



This is acceptable non-deictic data for demonstratives. In this structure, 'that' finds both of the arguments it requires in the syntax; 'ren' saturates one argument place, and 'walk-open-door,Äô saturates the second. To compute the extension of the string, we start by checking to see that it satisfies our restriction presupposition. Since there are guys who do not walk to open the door, the expression 'walk to open the door' is a restrictor on 'person', according to our definition, which means the derivation can proceed. Then we apply the whole representation:

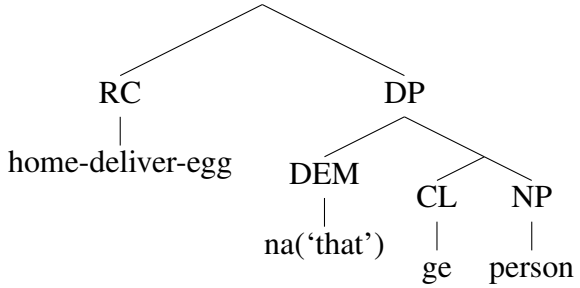
(13) the x: [person(x) & walk-open-door(x)]

Similarly, the analysis of example (5c) is shown as below in (14).

(14) a. let you home village deliver egg DE that CL person talk

b. the x: [person(x)&home-deliver-egg(x)]

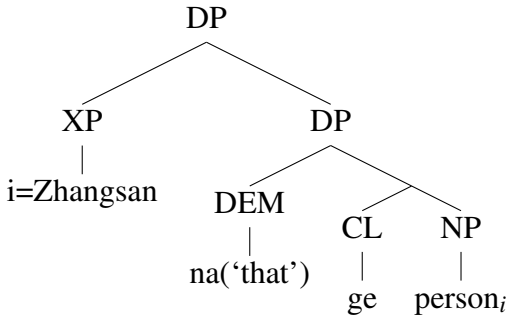
c. ιx.[home-deliver-egg(x) $\wedge$ person(x)]



4.1.2. Demonstratives identity to the proper name

In the non-deictic complex demonstrative examples like (6a), the preceding proper name is an identity function which denotes the unique definite saturating the second argument. So the property of being the proper name like 'Zhangsan' is a restrictor of being a 'person'. The restriction condition is met. With the assignment function which maps the index *'i'* to Zhangsan, the analysis is given in (15).

(15) a. Zhangsan that Cl person ties my heart
b. the x: [person(x)=identical-to-Zhangsan(x)]
c.



5. Comparing Dayal and Jiang (2020) and Nowak (2021)

Comparing Dayal and Jiang (2020) with Nowak (2021)'s modified Hidden Argument Theory, I conclude that both Dayal and Jiang (2020) and Nowak (2021) fundamentally argue the demonstrative is a semantic operation which restricts a larger set to a subset with the anti-uniqueness presupposition, by either adding the presupposition to the lexical demonstrative itself that there are always more than one noun properties *p* in the larger situations, or by adding the presupposition into the relationship between the two arguments such that the second overt argument of the demonstrative should restrict the first covert argument. These two theories for demonstratives both directly introduce the non-redundancy condition as a presupposition to the interpretations of demonstratives. They share the similarities that both are presupposition accounts.

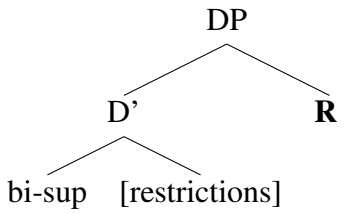
Specifically, Dayal and Jiang (2020)'s proposal requires two properties for the entity *x*, the common noun property *P* and the intended referent *y*, which seems similar to the two arguments requirement of Hidden Argument Theory. The intended referent variable *y* of Dayal and Jiang (2020)'s proposal, can be compared with the second hidden argument of Nowak (2021). King (2001), Elbourne (2005), and Nowak (2021) all give the clear definitions on the second hidden argument, such that it is the identificational property and can be covert or overt as a modifier or a relative clause. Nowak (2021) also defines the restriction relation between the second hidden argument and the first argument. Dayal and Jiang (2020) does not focus on the intended referent *y* in the examples, which they discuss more on the bare demonstrative examples like *'that boy'*. The intended referent is defined as a free variable, and there are no other restrictions on *y* given in their formal interpretation of the demonstrative. For the application in the complex demonstratives, with the requirement of 'x=y', the semantic type of *y* should also be the definite type of *x*, thus *y* cannot be represented overtly as a predicate like the relative clause or the modifier compared with the definition of the second hidden argument of Nowak

(2021). The two 'second' properties are different by definition: for Dayal and Jiang (2020), the intended referent is a free variable of a entity without representations; while for Nowak (2021), the hidden second argument is a predicate property and can be overtly represented as modifiers or relative clauses. The advantage of the Hidden Argument Theory is that, with the second argument of the demonstrative presented, Hidden Argument Theory can capture different uses of demonstrative constructions with the second argument overt being relative clauses or other restrictive modifiers, or covert being contextual saturation. D&J's demonstrative proposal cannot capture the non-deictic uses when the other parts of the demonstrative constructions being too restrictive.

6. Apply Ahn (2022)'s Indirect Direct Account and its limitations

Ahn (2022) proposes a mixed account based on the indirect approach 'Hidden Argument Theory' following Nowak (2021)'s framework which treats the demonstrative as a definite expression with an additional argument, and adds the direct reference property to the additional argument.

(16)



(17) $[\![bi\text{-}sup]\!] = \lambda P.\lambda R.\iota x : \forall y[P(y) \wedge R(y) \leftrightarrow y \sqsubseteq x]$

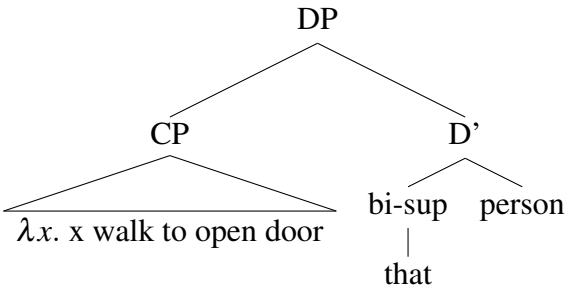
According to Ahn (2022), the 'bi-sup' is the binary maximality operator, which extends from the 'supremum' operator taking the restrictions and returning the entity which satisfies all the restrictions. The bi-sup operator also takes the additional restriction, which is marked as the bold 'R' representing restrictions, same as Nowak (2021)'s second hidden argument G(x), which stands higher outside the D' headed by the demonstrative. Instead of following the traditional view that deixis returns the individual via the assignment function, Ahn suggests that the deictic pointing gesture is a predicate like the modifiers 'tall' which predicates over the individual. This pointing gesture as well as the anaphoric index and a relative clause can become the 'R' properties.

I will show that Ahn (2022)'s proposal can account for the data of Mandarin demonstratives with relative clauses, but not with proper names, since the second argument can only be index, RC, and the pointing gesture. I first illustrate the descriptive cases with relative clauses in (18), with the example of (5a).

(18) a. **[walk-to-open-door DE that Cl person]**

b. $[\![$*walk-to-open-door DE that Cl person*$]\!]$=
bi-sup$(\lambda x.person(x))(\lambda x.WOD(x))$'The maximal entity that walk to open door')

c.

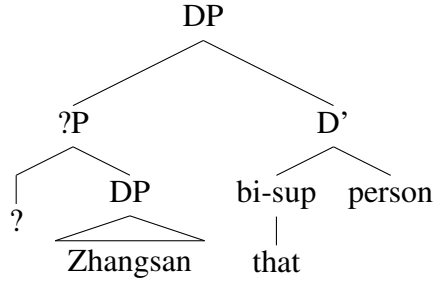


Ahn's proposal can capture the relative clause case of Mandarin demonstrative as expected. The relative clause fits perfectly in the position of R to the demonstrative construction. According to the previous discussions on the syntax of Mandarin relative clauses following Lin et al. (2003), Del Gobbo (2003) and Nowak (2021), the second argument can be located preceding the first argument, as shown in (18c), which follows the correct word order of Mandarin demonstrative with relative clause case. For the demonstratives with proper name, the illustration is given below in (19).

(19) a. **[Zhangsan that Cl person]**

b. $[\![Zhangsan_i\ that\ Cl\ person]\!]$=
bi-sup$(\lambda x.person(x))(\lambda x.i(x))$'The maximal entity that takes the index i')

c.



However, Ahn's R set cannot satisfy the property of proper names in the demonstrative constructions. The proper name *'Zhangsan'* in (5) can **not** be treated as an RC, **nor** the anaphoric index, **nor** the gestures. I adopt Jenks (2018)'s view on the properties of restrictions on demonstratives, such that the directly referential use of **proper names** is parallel to the anaphoric index, which seems cannot be accounted for by Ahn's R set. Mandarin example in (3) indicates that proper names should be added to the R set. Following Jenks (2018), proper names, pronouns, and the index should all be treated as the domain restrictions of the anaphoric definite ι^x – the Mandarin demonstrative. This hypothesis is also supported by some specific uses of English demonstratives. As shown in (20), the demonstrative with the proper name is felicitous to be used with some emotive effects, although the proper name is unique in the minimal situation.

(20) **English data** [$_{PN}$ That John] walks to open the door.

(21) My modified version of **R**: **R** = {index, RC, pointing gestures, **proper names**}

(22) a. $[_{DP}[\mathbf{R}:\mathsf{Zhangsan}][_{D'}[\text{bi-sup } na][[_{CL}ge][_{NP}ren(`person')]]]]$

b. $[\![Zhangsan\ that\ Cl\ person]\!]$
= bi-sup$(\lambda x.\ \mathsf{person}(x))(\lambda x.\ \mathsf{Zhangsan}(x))$
$= \iota x : \forall y[\mathsf{person}(y) \wedge \mathsf{Zhangsan}(y) \leftrightarrow y \sqsubseteq x]$
'The maximal entity that takes the proper name *Zhangsan* as a person'

7. Conclusion

In this paper, I discussed the previous views on demonstratives with comparisons by providing empirical data of non-deictic uses of Mandarin demonstratives, including demonstratives with relative clauses and proper names. Dayal and Jiang (2020)'s situation-based anti-uniqueness presupposition account undergenerates cases where the RC or the proper name is too specific such that there is only one unique entity in all the possible worlds; for those cases I showed that Hidden Argument Theory is better suited by implementing Nowak (2021) and the pragmatic account Ahn (2022). Then, with the illustrations of the data from section 2, I showed that Ahn's proposal works out for Mandarin demonstratives with RC, where RC belongs to the set of R properties, but not with proper names. Following Jenks (2018), I then proposed to add the proper name into the lexical category of the second argument R set.

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Discourse consistency and dynamic modals in commitment space semantics[1]

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Abstract. This paper examines puzzles surrounding epistemic contradiction as well as cases known as "standoff." To resolve these puzzles, I incorporate Veltman's (1996) test conception of epistemic modals into Krifka's (2021) commitment space semantics. The resulting framework is a two-pronged update semantics in which an epistemic possibility claim $\Diamond p$ carries the discourse effect of delimiting future developments of the discourse to those states where p remains as an open possibility.

Keywords: discourse consistency, update semantics, commitment space semantics, epistemic modals, epistemic contradiction, standoffs.

1. Introduction

Puzzles surrounding epistemic contradiction have long been a focal point in semantic analyses of epistemic modals. In its simplest form, epistemic contradiction concerns sentences of the form $\Diamond p \wedge \neg p$ and $\Diamond \neg p \wedge p$ as well as their reversed orders, as exemplified by (1).

(1) a. #It might be raining and it is not raining. $\Diamond p \wedge \neg p$
b. #It is raining and it might not be raining. $p \wedge \Diamond \neg p$

As Yalcin (2007) argues, unlike the Moorean sentence "*p, but I don't know p*," the oddness of epistemic contradiction does not disappear when embedded, as the contrast in (2) demonstrates.

(2) a. Suppose it is raining and I don't know that it is raining.
b. #Suppose it is raining and it might not be raining.

Hence, it appears a simple contextualist account where "*might p*" just means "*p* is compatible with what the speaker knows," supplemented with a pragmatic story that requires knowledge for assertion, is inadequate to explain epistemic contradiction. A semantic analysis seems needed.

The pursuit of an explanation for epistemic contradiction has sparked a slew of analyses of epistemic modals, and one testing ground for these different theories is in their treatment of epistemic contradiction of other varieties. This paper aims to contribute to the literature in this respect. In particular, I will focus on cases known as *standoff* (Bennett, 2003; Goldstein, 2022) as well as their variants. To illustrate a typical case of standoff, consider the following example adapted from Bennett (2003). Suppose there are two levers which together control a water gate: when Lever 1 but not 2 is down, Top Gate is open and water flows left; when Lever 2 but not 1 is down, top Gate is open and water flows right; when Lever 1 and 2 are both down, Top Gate remains closed. Suppose Ann and Bob each can only see the position of one lever: Ann sees that Lever 1 is down, and Bob sees that Lever 2 is down. They then each pass a note to Carl:

(3) Ann's note: Top Gate might be open, and if it is open then the water is flowing left.
Bob's note: Top Gate might be open, and if it is open then the water is flowing right.

[1]I would like to thank the semantics and pragmatics group at Heinrich Heine University, attendants of the Nihil seminar at ILLC, and audience at SuB28 for helpful comments and discussion.

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These two notes do not strike us as necessarily contradictory. In fact, after having received both notes, Carl should be able to infer that Top Gate is closed. By contrast, if the two conditionals are uttered by a single speaker as in (4), then they do sound like a blatant contradiction.

(4) Ann: #Top Gate might be open, and if it is open then the water is flowing left, and if it is open then the water is flowing right.

To explain this contrast, I will invoke a notion of commitment and provide an analysis of epistemic modals in *commitment space semantics*. In addition, the proposed framework can also capture a large variety of epistemic contradictions that have been discussed in the literature. In §2, I will review various epistemic contradictions this paper sets out to capture. I will evaluate these data against a Veltman (1996) style update semantics, mainly for two reasons. First, as we shall see, a more sophisticated update semantics can in fact capture all the data; however, it has difficulty explaining the contrast between (3) and (4). Second, it helps set up the stage for my own implementation of dynamic modals in commitment space semantics in §3. Then in §4, I will refine this analysis by offering a two-pronged update framework which separates the traditional updates on an information state from updating with a sentence's discourse effect on a commitment space. In §5, I will discuss some ways to extend the framework to address a wider range of issues. §6 concludes.

2. Desiderata: epistemic contradiction and standoff

2.1. Update semantics and variants of epistemic contradiction

In update semantics and dynamic semantics more generally, the semantic contribution of a sentence is given by its update potential, construed as a function from input contexts or information states to output contexts. Following Veltman, I use $c[\varphi]$ to represent the output from updating the context c, usually modeled as a set of worlds, with φ. In update semantics, epistemic modals receive a test interpretation under which an update with $[\Diamond\varphi]$ tests whether its input context is compatible with φ:

(5) $c[\Diamond\varphi] = \{w \in c \mid c[\varphi] \neq \varnothing\}$

If c is compatible with φ, then the test is successful and the update returns its input state c without any change; if c is incompatible with φ so that $c[\varphi] = \varnothing$, then the update returns the empty set, thereby signaling discourse anomaly. There are two commonly employed notions of discourse consistency in update semantics (see, e.g., Groenendijk et al., 1996):

(6) **Consistence:** φ is consistent iff $\exists c : c[\varphi] \neq \varnothing$.
Coherence: φ is coherent iff $\exists c : c \neq \varnothing$ & $c[\varphi] = c$.

Consistence states that the update with φ does not necessarily lead to the absurd information state represented by the empty set, while coherence, which entails consistence, states that there is a non-absurd state, a fixed point, which already incorporates the information conveyed by φ so that the update with φ is idle. To put it another way, given a notion of support:

(7) **Support:** an information state/context c supports φ (notation $c \vDash \varphi$) iff $c[\varphi] = c$.

for φ to be coherent, it means there must be some non-trivial body of information which supports φ. This notion of coherence plays a crucial role in explaining the contradictoriness of epistemic contradiction. Consider the update with $[\Diamond p \wedge \neg p]$ as in (1a). This is predicted to be consistent under both a static interpretation of conjunction (i.e., $c[\varphi \wedge \psi] := c[\varphi] \cap c[\psi]$) as well as a dynamic one (i.e., $c[\varphi \wedge \psi] := s[\varphi][\psi]$). The update with $[\Diamond p \wedge \neg p]$ on any c that contains both some p-world and some $\neg p$-world will yield a non-empty set as its output. Hence, the first notion of consistency falls short. By contrast, (1a) fails to be coherent regardless of whether a static or a dynamic conjunction is used, because no context that supports $\Diamond p$ can simultaneously supports $\neg p$.

However, prior literature has noted the existence of intuitively contradictory sentences that are nevertheless coherent (Mandelkern, 2020a; Holliday and Mandelkern, 2022; Yalcin, 2015; Aloni, 2001). Consider a *Wittgenstein disjunction* of the form $(\Diamond p \wedge \neg p) \vee (\Diamond \neg p \wedge p)$:

(8) #It might be raining and it is not raining, or it might not be raining and it is raining.

Assume Veltman's update clause for disjunction with $c[\varphi \vee \psi] := c[\varphi] \cup c[\psi]$; any information state that contains both some p-world and some $\neg p$-world will be a fixed point for the update with $[(\Diamond p \wedge \neg p) \vee (\Diamond \neg p \wedge p)]$. The update with the first disjunct removes from c all p-worlds, while the update with the second disjunct removes all $\neg p$-worlds; taking their union then returns the original set c. Hence, contrary to our intuition, (8) is predicted to be coherent.

If we instead opt for a dynamic interpretation of disjunction à la Heim (1983) with $c[\varphi \vee \psi] := c[\varphi] \cup c[\neg\varphi][\psi]$, we can in fact correctly predict $(\Diamond p \wedge \neg p) \vee (\Diamond \neg p \wedge p)$ to be incoherent. Since updating c with the negation of the first disjunct $[\neg(\Diamond p \wedge \neg p)]$ eliminates every $\neg p$-world from c, upon which updating with the second disjunct $[\Diamond \neg p \wedge p]$ necessarily returns the empty set, the update with the whole disjunction can never reach a non-empty fixed point.

Despite its initial success, a Heimian disjunction leads to an additional problem—some classical validities no longer hold. As Mandelkern (2020a) noticed, the law of excluded middle (LEM) fails with a Heimian disjunction. Take $\neg(\Diamond p \wedge \neg p) \vee \neg\neg(\Diamond p \wedge \neg p)$ as an example. Since updating with the negation of the first disjunct $[\neg\neg(\Diamond p \wedge \neg p)]$, which amounts to updating with $[\Diamond p \wedge \neg p]$, eliminates all p-worlds, the subsequent update with the second disjunct $[\neg\neg(\Diamond p \wedge \neg p)]$ will yield the empty set. As a result, updating with the whole disjunction just becomes updating with the first disjunct $[\neg(\Diamond p \wedge \neg p)]$, which will not always be idle. Thus, $\neg(\Diamond p \wedge \neg p) \vee \neg\neg(\Diamond p \wedge \neg p)$ fails to be valid under a dynamic interpretation of disjunction.

Relatedly, another type of cases where intuitively contradictory sentences are nonetheless deemed coherent concerns disjunctions of the form $(\Diamond p \wedge \Diamond q \wedge \neg p) \vee (\Diamond p \wedge \Diamond q \wedge \neg q)$, as shown in (9):

(9) #Either Paul might be at the party and so might Quinn but Paul isn't at the party, or Paul might be at the party and so might Quinn but Quinn isn't at the party.

Let $c = \{p\bar{q}, \bar{p}q\}$ be our input context, with $p\bar{q}$ being a world where p is true but q is false and $\bar{p}q$ being a world where the opposite holds. Then under a static interpretation of disjunction, the first update $c[(\Diamond p \wedge \Diamond q \wedge \neg p)]$ returns $\{\bar{p}q\}$; the second update $c[(\Diamond p \wedge \Diamond q \wedge \neg q)]$ returns $\{p\bar{q}\}$; the update with the whole disjunction thus returns its input context, so the sentence is incorrectly predicted to be coherent. Although adopting a dynamic disjunction helps once again, given the aforementioned problem, one may hope for a better solution.

Additionally whereas (9) sounds infelicitous, the following sentence which is of the form $(\Diamond p \wedge \Diamond q) \wedge \neg(p \wedge q)$ sounds completely natural:

(10) Paul might be at the party and so might Quinn, but it is not the case they are both at the party.

However, in classical logic (9) and (10) are logically equivalent because of DeMorgan's laws and the law of distributivity.[2] To account for this apparent contrast, Holliday and Mandelkern (2022) provide a possibility semantics based on ortholattices according to which the law of distributivity in (11) fails when φ, ψ, or χ contains any epistemic modal:

(11) $\varphi \wedge (\psi \vee \chi) \vDash (\varphi \wedge \psi) \vee (\varphi \wedge \chi)$

While Holliday and Mandelkern's orthologic can in fact capture all the data presented so far, one may worry whether a ban on distributivity with embedded modals is an overkill. For one thing, the inference from (12a) to (12b) does feel rather uncontroversial.

(12) a. Paul might be at the party, and either Quinn or Rey is at the party.
b. Either Paul might be at the party and Quinn is at the party, or Paul might be at the party and Rey is at the party.

Lastly, coherence also fails to capture the oddness of embedded epistemic contradictions as shown in (13), and appealing to a dynamic disjunction is of no help here:

(13) #It might be the case that Paul might be at the party but he isn't. $\Diamond(\Diamond p \wedge \neg p)$

Since the update with the embedded $[\Diamond p \wedge \neg p]$ on any state that contains some p and some $\neg p$-worlds will not be empty, the test imposed by the matrix $\Diamond$ is satisfied. Consequently, the update with $[\Diamond(\Diamond p \wedge \neg p)]$ will simply return its input state.

2.2. Fixed-point updates and standoff

To address these inadequacies of the standard update semantics, Klinedinst and Rothschild (2014) proposed an ingenious fix which essentially imposes a coherence check locally by requiring every update to always be repeated until it reaches a fixed point. They define a fixed-point update $c[\varphi]^* := c[\varphi]...[\varphi]$ where the output c' from repeatedly updating c with $[\varphi]$ must always reach a fixed point such that $c'[\varphi] = c'$. Normal updates $[\cdot]$ are recursively defined in terms of fixed-point updates $[\cdot]^*$ as follows:

(14) $c[p] = c[p]^*$, where p is atomic
$c[\neg\varphi] = c - c[\varphi]^*$
$c[\varphi \wedge \psi] = c[\varphi]^* \cap c[\psi]^*$

[2]It is interesting to note that the following sentence, which is of the form $(\Diamond p \wedge \Diamond q) \wedge (\neg p \vee \neg q)$, sounds slightly degraded compared to (10):
(i) Paul might be at the party and so might Quinn, but either Paul isn't at the party or Quinn isn't at the party.
While a detailed exploration of this issue will have to wait for another time, it may be suggested that in (i) the disjunction $\neg p \vee \neg q$ receives an inquisitive interpretation which then interacts with the modals and results in markedness. With an inquisitive disjunction, the DeMorgan's inference from $\neg(p \wedge q)$ to $\neg p \vee \neg q$ is indeed blocked (see, e.g., Ciardelli et al., 2018).

$c[\varphi \vee \psi] = c[\varphi]^* \cup c[\psi]^*$
$c[\Diamond \varphi] = \{w \in c \mid c[\varphi]^* \neq \varnothing\}$

The update semantics augmented by fixed-point updates successfully captures all the data discussed so far. The simple epistemic contradiction is predicted to be inconsistent as the update $c[\Diamond p \wedge \neg p]^*$ which becomes $c[\Diamond p \wedge \neg p]...[\Diamond p \wedge \neg p]$ will always yield the empty set. The Wittgenstein disjunction $(\Diamond p \wedge \neg p) \vee (\Diamond \neg p \wedge p)$ is inconsistent as well given that with fixed-point updates both $c[\Diamond p \wedge \neg p]^*$ and $c[\Diamond \neg p \wedge p]^*$ become empty. Likewise for $\Diamond(\Diamond p \wedge \neg p)$, since $c[\Diamond p \wedge \neg p]^* = \varnothing$, the update $c[\Diamond(\Diamond p \wedge \neg p)]^*$ will also return the empty set.

However, I believe the fixed-point update is too strong as a general notion of updates. Consider again a case of standoff as in (3), repeated below. There does seem to be consistent way to update with the information contained in the two notes obtained from the two speakers.

(15) Ann's note: Top Gate might be open, and if it is open then the water is flowing left.
Bob's note: Top Gate might be open, and if it is open then the water is flowing right.

Granted, one may conclude that one of the notes must contain false information because the hearer may take one of the speakers to be more trustworthy than the other, but it is also fully reasonable for someone who takes both speakers to be equally trustworthy to draw the conclusion that Top Gate is in fact closed. Nevertheless, with fixed-point updates, the update with Bob's note must be repeated until it reaches a fixed point. Consequently, even if we can predict the inference that Top Gate is closed after the first update with Bob's note, the subsequent updates with "Top Gate might be open" will necessarily lead to the absurd state.

On the other hand, as (4)—repeated below as (16)—illustrates, the standoff conditionals are indeed contradictory when they are uttered by a single speaker.

(16) Ann: #Top Gate might be open, and if it is open then the water is flowing left, and if it is open then the water is flowing right.

Likewise, if the two conditionals are produced by two different speakers but in a single conversation as in (17), the discourse is also perceived to be odd.

(17) Ann: Top Gate might be open, and if it is open then the water is flowing left.
Bob: #Yes, and if it is open then the water is flowing right.

To take stock, we want a notion of updates that is able to predict inconsistency for various epistemic contradictions from §2.1, but is also flexible enough to capture the contrast between a standard case of standoff in (15) and its infelicitous cousins in (16) and (17). To accomplish these two tasks, I will utilize a notion of commitment. I will make a first pass at cashing out this view in the next section and further spell out and refine the analysis in §4 and §5.

3. Invoking commitment

With respect to the aforementioned two tasks, the benefit of invoking commitment is apparent in the case of capturing the contrast between the standoff in (15) and its infelicitous cousins in (16) and (17). In (16), by asserting this sentence, the speaker becomes committed to (i) "Top Gate might be open," (ii) "if Top Gate is open then the water is flowing left," and (iii) "if Top Gate

is open then water is flowing right." However, given a suitable analysis of conditionals which enables the inference from (ii) and (iii) to "Top Gate is not open," these three commitments jointly constitute an instance of epistemic contradiction. Similarly in (17), since Bob affirms Ann's assertion, it commits himself to both "Top Gate might be open," and "if Top Gate is open then the water is flowing left." But because Bob's own assertion also commits himself to "if Top Gate is open then the water is flowing right," again it means that Bob's commitments are jointly incompatible. By contrast, in (15), since Bob is ignorant of what Ann knows, he is not committed to "if Top Gate is open then the water is flowing left." Hence, the same contradictoriness does not arise.

What is less obvious perhaps is how to define epistemic modals in a semantics that incorporates a notion of commitment so that epistemic contradictions can be properly accounted for. The analysis I will put forth is couched in Krifka's Commitment Space Semantics (CSS). In CSS, updates are performed on *commitment spaces* (notated by uppercase C). A commitment space is a set of *commitment states* (notated by lowercase c), modeled as sets of possible worlds.[3] A commitment state is like a Stalnakerian context set but it also embodies information about each participant's discourse commitment.

A commitment space C then contains the commitment state at the current stage of discourse—called the *root* $\sqrt{C}$—which functions similar to Stalnaker's (1999) common ground, along with all possible continuations of the common ground. These notions are formally defined as follows (cf. Krifka 2021: 68):

(18) a. A commitment space C is a set of non-empty commitment states.
b. A commitment state c' is a continuation of c (notated $c' \sqsubset c$) iff $c' \subset c$ and $c' \neq \varnothing$.[4]
c. $\sqrt{C}$, the root of C, is defined as $\{c \in C \mid \neg\exists c' \in C[c \sqsubset c']\}$.

The root of a commitment space thus consists of all maximal elements of C, the commitment states that are the least specific. In this paper, I will focus on cases where the root $\sqrt{C}$ contains only one member, so to simplify, whenever $\sqrt{C}$ is a singleton that contains only one commitment state, I will also call this commitment state the root of C and use $\sqrt{C}$ to represent it.

Given that in CSS assertions express discourse commitments, an update on a commitment space C with an assertion of φ always first involves an update of the form $[s \vdash \varphi]$, which reads "s is committed to φ" with s usually being the speaker. For the time being, let us set aside the detail of this update to which I will return in §5. If other discourse participants do not object to the asserted content of φ, then φ becomes part of the common ground and C will be updated with $[\varphi]$. This update is defined as follows where "$\sqsubseteq$" is the improper version of "$\sqsubset$":

(19) $C[\varphi] := \{c \in C \mid c \sqsubseteq \sqrt{C[\varphi]}\}$

Essentially, this update will first update the current common ground (i.e., the root) by removing all worlds incompatible with φ and then lift the result to commitment space by collecting all possible continuations of the updated common ground. What distinguishes CSS is its ability to define *meta speech act* operators directly at the level of commitment spaces. These operators

[3]Here, I follow Krifka (2021) in construing commitment states as sets of worlds. In Krifka (2015), commitment states are modeled as sets of propositions instead.

[4]Note that this is slightly different from how "continuation" is defined in Krifka 2021. This change is made to facilitate my exposition of the two-pronged update framework later in §4.

are capable of changing a commitment space without altering its root by pruning certain commitment states from its input, thereby delimiting possible future developments of the discourse. Most notably is what Cohen and Krifka (2014) call *denegations* as shown in (20):

(20) a. I don't promise to come.
b. I don't claim that Paul is at the party.

(21) a. I promise not to come.
b. I claim that Paul isn't at the party.

Different from the sentences in (21) where negation applies to the propositional content of the speech act, the denegations in (20) are characterized as refusals to perform certain speech acts. In CSS, the denegation "$\sim$" is defined as follows:

(22) Denegation: $C[\sim\varphi] := C - C[\varphi]$

Figure 1 illustrates the difference between updating a commitment space with a denegation $\sim p$ and with a propositional negation $\neg p$. The update $C[\sim p]$ retains the root $\surd C$ of its input commitment space and only constrains future legal continuations by removing all states where p is settled true. By contrast, the update $C[\neg p]$ alters the root of its input commitment space.

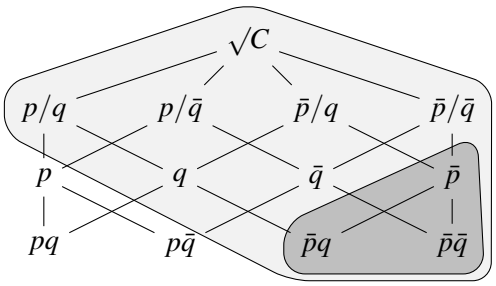


Figure 1: Updating C, which includes all the commitment states as shown above, with $\sim p$ (represented by the light grey area) and with $\neg p$ (represented by the dark grey area), respectively. In the figure, for example, p represents a state where p is settled true and q is unsettled, $p\bar{q}$ a state where p is settled true and q is settled false, and p/q a state where only the classical disjunction $p \vee q$ is settled true; with only two atomic propositions p and q, the root $\surd C$ above represents the minimal commitment state where nothing has been settled.

Moving on to the epistemic modal, I will also construe "$\Diamond$" as a meta speech act operator, at least for now. More specifically, $\Diamond\varphi$ will be viewed as the denegation of $\neg\varphi$:

(23) $C[\Diamond\varphi] := C[\sim\neg\varphi]$

An update with $[\Diamond p]$ for example constrains the commitment space by eliminating all commitment states where $\neg p$ is settled true, i.e., states that do not contain any p-worlds. Intuitively, an utterance of "*might p*" commits the speaker to keeping p as an open possibility, or at least until the *might*-claim is retracted.[5]

[5]The is perhaps reminiscent of the link between "$\Diamond$" and the *weak rejection* operator "$\ominus$" as proposed by Incurvati and Schlöder (2019, 2022). On their view, a strong assertion of $\Diamond p$ is inferentially equivalent to a weak assertion of p, which is in turn equivalent to a weak rejection of $\neg p$, i.e., $\ominus\neg p$. Since "$\ominus$" is an illucutionary force operator, a similar worry about embedded modals which I will discuss later also applies to their analysis. In fact, embedded epistemic contradictions are not immediately captured on their account and need to be derived via additional

Before elucidating how this analysis accounts for various epistemic contradictions, I will follow Cohen and Krifka (2014) and define speech act conjunction and disjunction as follows:

(24) a. Speech act conjunction: $C[\varphi \wedge \psi] := C[\varphi] \cap C[\psi]$
b. Speech act disjunction: $C[\varphi \vee \psi] := C[\varphi] \cup C[\psi]$

Lastly, we define consistency, the previous notion of support, validity, as well as *update-to-test* consequence (Veltman, 1996) at the level of commitment spaces:

(25) a. φ is consistent iff $\exists C : C[\varphi] \neq \varnothing$
b. C supports φ ($C \vDash \varphi$) iff $C[\varphi] = C$
c. φ is valid iff $\forall C : C \vDash \varphi$
d. $\varphi_1, \varphi_2, ..., \varphi_n$ entails ψ iff $\forall C : C[\varphi_1][\varphi_2]...[\varphi_n] \vDash \psi$

Let us now first consider how an update on a commitment space with the simple epistemic contradiction $\Diamond p \wedge \neg p$ looks like. Given that the update $C[\Diamond p]$ is defined as $C - C[\neg p]$, its intersection with the update $C[\neg p]$ will always be empty, as Figure 2 depicts. Hence, updates with $[\Diamond p \wedge \neg p]$ and $[\Diamond \neg p \wedge p]$ as well as their reversed orders are all predicted to be inconsistent.

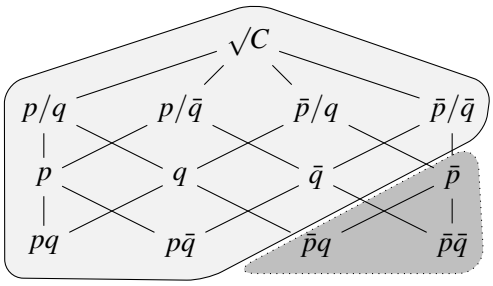


Figure 2: Epistemic contradiction $C[\Diamond p \wedge \neg p]$. The update $C[\Diamond p]$ is represented by the light grey area, and the update $C[\neg p]$ is represented by the dark grey area.

Analogously, for Wittgenstein disjunctions, since both $C[\Diamond p \wedge \neg p]$ and $C[\Diamond \neg p \wedge p]$ return the empty set. Updating with the disjunction $(\Diamond p \wedge \neg p) \vee (\Diamond \neg p \wedge p)$ which takes the union of the two sets will also be empty. Inconsistency is also predicted for disjunctions of the form $(\Diamond p \wedge \Diamond q \wedge \neg p) \vee (\Diamond p \wedge \Diamond q \wedge \neg q)$ for the same reason.

As for whether LEM is still preserved in the face of sentences like $\neg(\Diamond p \wedge \neg p) \vee \neg\neg(\Diamond p \wedge \neg p)$, we need to first modify this sentence a bit. Given that "$\Diamond$" is treated as a meta speech act operator for the moment, it follows that a propositional negation "$\neg$" cannot outscope it because otherwise the update $c[\neg(\Diamond p \wedge \neg p)]$ on a commitment state cannot be executed. Hence, the sentence needs to be reinterpreted as $\sim(\Diamond p \wedge \neg p) \vee \sim\sim(\Diamond p \wedge \neg p)$. For this sentence, LEM is indeed preserved, since updating any commitment space with it will always be idle.

This reinterpretation strategy fails to work, however, when we consider embedded epistemic contradictions such as $\Diamond(\Diamond p \wedge \neg p)$. By taking both occurrences of "$\Diamond$" to be "$\sim\neg$," again we have a case where "$\neg$" outscopes "$\sim$," and the sentence cannot be interpreted. On the other hand, if we treat the embedded "$\Diamond$" not as a meta speech act operator but simply as a Veltman test modality, then although the update can be executed, it will not give the correct result.

pragmatic means (see Incurvati and Schlöder, 2022).

The update $C[\Diamond(\Diamond p \wedge \neg p)]$ will become $C - \{c \in C \mid c \sqsubseteq \surd C[\neg(\Diamond p \wedge \neg p)]\}$. Since the update $\surd C[\neg(\Diamond p \wedge \neg p)]$ will not always return the root $\surd C$ as the update $\surd C[\Diamond p \wedge \neg p]$ will not always be empty, the update $C[\Diamond(\Diamond p \wedge \neg p)]$ also will not always be empty, which means $\Diamond(\Diamond p \wedge \neg p)$ is still predicted to be consistent.

I will address the challenge posed by embedded modals in the next section, but before moving on, let me highlight some additional features of the current analysis. One feature of this meta speech act analysis of epistemic modals is that some updates could end up eliminating all possible ways to settle an atomic sentence. For example, consider the update with the conjunction $\Diamond p \wedge \Diamond \neg p$. Since $\Diamond p$ requires all future developments to be compatible with p while $\Diamond \neg p$ requires all future developments to be compatible with $\neg p$, together they rule out all possible ways for p to be settled, yielding the commitment space as depicted in Figure 3.

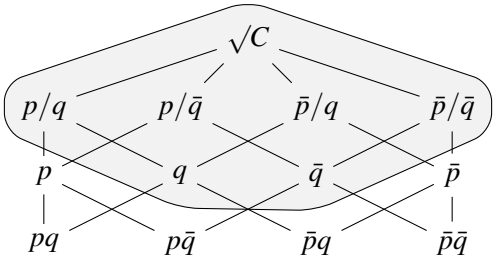


Figure 3: $C[\Diamond p \wedge \Diamond \neg p]$

To argue in favor of this result, let us compare the discourse effect of asserting $\Diamond p \wedge \Diamond \neg p$ and that of asserting one of its conjuncts. Consider the contrast between (26) on one hand, and (27) and (28) on the other.

(26) a. John might still be in France, and he might not.
b. #Yes, he is still in France/he is now in Germany.
c. No/Well actually, he is still in France/he is now in Germany.

(27) a. John might still be in France.
b. Yes, he is still in France.

(28) a. John might no longer be in France.
b. Yes, he is now in Germany.

In (26), after the update with $[\Diamond p \wedge \Diamond \neg p]$, the discourse cannot be further developed to settle John's whereabouts in either direction. To either affirm or reject p, the commitment carried by $\Diamond p \wedge \Diamond \neg p$ must be resisted or first retracted as in (26c). By contrast, in (27) the discourse can be further developed in the direction of affirming p, and in (28) in the direction of affirming $\neg p$. The current view predicts this since after updating on a commitment space with $[\Diamond p \wedge \Diamond \neg p]$, updating with either $[p]$ or $[\neg p]$ will become inconsistent.

Relatedly, recall (10), repeated below as (29), which is of the form $(\Diamond p \wedge \Diamond q) \wedge \neg(p \wedge q)$. Different from $(\Diamond p \wedge \Diamond q \wedge \neg p) \vee (\Diamond p \wedge \Diamond q \wedge \neg q)$, this sentence is intuitively unmarked.

(29) Paul might be at the party and so might Quinn, but it is not the case they are both at the party.

As Figure 4 shows, although (29) is in fact consistent, by delimiting future continuations so that Paul's being at the party and Quinn's being at the party must remain as open possibilities, we end up with a commitment space where the presence of Paul and Quinn at the party cannot be settled without the discourse participants first retracting $\Diamond p \wedge \Diamond q$. Similar to the update with $[\Diamond p \wedge \Diamond \neg p]$ in Figure 3, this update leads to a commitment space where both the issues of whether p and of whether q cannot be settled in the negative way unless one of the *might*-claims gets first retracted. Compare the following two conversations:

(30) a. Paul might be at the party and so might Quinn, but it's not the case that they are both at the party.
b. #That's right. In fact, Paul/Quinn isn't at the party.

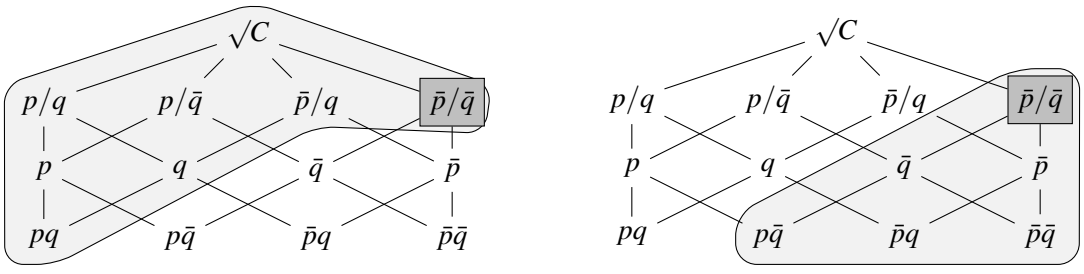
(31) a. It's not the case that both Paul and Quinn are at the party.
b. That's right. In fact, Paul/Quinn isn't at the party.

(30b) feels odd for the very same reason that renders (26b) odd. In contrast to (31a), the addition of the might claims in (30a) rules out the possibility of smoothly developing the discourse by affirming either Paul's or Quinn's absence at the party.

Another feature of the current analysis is in its treatment of necessity modals as well as negated possibility modals. In standard update semantics, since $\Box\varphi$ continues to be defined as $\neg\Diamond\neg\varphi$, the update with $[\Box\varphi]$ amounts to the following update:

(32) $c[\Box\varphi] = \{w \in c \mid c[\varphi] = c\}$

This result is counter-intuitive, because it follows that in a context where the truth of φ has yet to be settled, an utterance of "*must* φ" will always be regarded as inconsistent, given that $c[\Box\varphi]$ will always be empty unless c already supports φ. In CSS, this problem can be avoided. The negation of a possibility modal will be represented as $\sim\Diamond\varphi$, which is equivalent to $\neg\varphi$, and the necessity modal $\Box\varphi$ can be reinterpreted as $\sim\Diamond\neg\varphi$, which is equivalent to φ—given that both "$\sim$" and "$\neg$" satisfy double negation elimination. As a result, updates on commitment spaces with $[\neg\Diamond\varphi]$ and $[\Box\varphi]$ are tantamount to updates with $[\neg\varphi]$ and $[\varphi]$. That being said, this is not the only way to construe necessity modals in CSS, and I will entertain a slightly weaker interpretation of necessity modals in §6.1.



(a) $C[\Diamond p \wedge \Diamond q]$ (b) $C[\neg(p \wedge q)]$

Figure 4: $C[(\Diamond p \wedge \Diamond q) \wedge \neg(p \wedge q)]$. The final output, represented by the dark grey area, is the intersection of the outputs from the updates with the two conjuncts.

4. Refinement: a two-pronged update approach

The proposal laid out in §3 has difficulty dealing with embedded modals. As we have seen, it fails to predict the oddness of sentences like $\Diamond(\Diamond p \wedge \neg p)$. Also, treating epistemic modals as meta speech act operators across the broad does not seem to mesh with their distribution data. For instance, epistemic "*might*" can be freely embedded in downward entailing environments, which as Cohen and Krifka (2014) argue is uncharacteristic of meta speech acts (see also Krifka, 2023). Moreover, given that in standard CSS, the objects of one's commitment are propositional, we face difficulty formulating the very claim "$s \vdash \Diamond p$"—that is, s is committed to *might* p. We may relax the requirement for propositionality by allowing objects of one's commitment to be some dynamic content such as update potentials (cf. Kamp, 1990), but give that epistemic modals influence commitment spaces, it seems we still need to complicate the picture by saying objects of one's commitment are now functions over commitment spaces.

In what follows, I will argue that we can in fact retain a simple update semantics for dynamic modals and construe the objects of one's commitments, at most, as functions over commitment/information states. The meta speech act effects carried by epistemic modals will be derived as a result of some default conversational principle governing discourse developments. This results in a two-pronged update framework which imparts similar meta speech act effects to epistemic modals without directly treating them as meta speech act operators.

The default conversational principle that I was speaking of is the following:

(33) **Persistence of commitment**:
   a. if $c \vDash \varphi$ then $c[\psi] \vDash \varphi$, or equivalently
   b. if $c \vDash \varphi$ and $c' \sqsubset c$, then $c' \vDash \varphi$

Persistence states that if a commitment state already supports φ, then after updating it with any new information the output should still support φ, or equivalently, in CSS, it means that if c supports φ then it should continue to support it in all possible continuations of the discourse. When φ is a modal-free formula, persistence is always satisfied. By contrast, *test* modalities fail to satisfy persistence: a commitment state that supports $\Diamond p$ will no longer support it after an update with $\neg p$. This is in fact a desirable result for Veltman because processing a sequence like (34) does not cause any problems (Veltman, 1996: 223).

(34) Somebody is knocking at the door... Maybe it's John... It's Mary.

Here, I want to make a distinction between persistence with respect to acquiring and processing information and persistence of discourse commitment. While (34) may indicate that information processing does not have to be persistent, I argue that when it comes to making discourse commitment, persistence should still hold. If a speaker is already committed to something, then she should continue to uphold her commitment unless the commitment is retracted in light of new information. This should apply to modal commitment as well. Persistence of modal commitment highlights the forward-looking aspect in our daily usage of epistemic modals (cf. Mandelkern, 2020b). In uttering "$\Diamond p$," not only does the speaker express that p is compatible with what she knows or with the common ground information, but she also draws attention to p as an open possibility, and by doing so—that is, by proposing to treat p as an open possibility until new information becomes available—the speaker manages to orient future discourse in a

given direction. To see this, let us convert (34) into a conversation.

(35) Ann: Somebody is knocking at the door.
Bob: Maybe it's John.
Ann: (*opens the door*) No, it's Mary./#Yes, it's Mary.

As (35) shows, the common ground cannot be updated with "it's Mary" straightaway without the commitment carried by "maybe it's John" having been first retracted.

At the same time, it is worth noting that persistence of commitment does not always result in the aforementioned meta speech effects of epistemic modals. For instance, prior work has pointed out a distinction between subjective and objective epistemic modalities as demonstrated by the following pair (Krifka, 2023: 131; see also Nilsen, 2004):

(36) a. It is possible that Le Pen will win, even though she certainly won't.
b. #Le Pen will possibly win, even though she certainly won't.

The objective modality in (36a) only claims that Le Pen's winning is possible according to some source of information, and the speaker does not have to be committed to this very possibility. Hence, persistence of commitment will only require in subsequent discourse that "Le Pen's winning is possible according to some source of information" still holds; it does not require Le Pen's winning to remain as an open possibility. Moreover, there are also special cases where persistence of commitment, as a default conversational principle, is overridden. In particular, this is what happens in a typical case of standoff as in (3), which I will return to in §5.

Now, given that we want the meta speech act effect of modals triggered by persistence to be a detachable enrichment, I will offer a two-pronged update framework. Updating a commitment state c with φ is accompanied by two separate updates: first, there is the usual update on a commitment state as per Veltman's semantics which takes in a commitment state and returns a commitment state—call this the *root update* $c[\varphi]$; second, there is the update with any discourse effects carried by φ on a commitment space which takes in a commitment state but returns a commitment space—call this the *discourse effect update* $c[\varphi]^+$—defined recursively as follows:

(37) **Discourse effect updates – DE updates**:
$c[p]^+ := \{c' \mid c' \sqsubseteq c[p]\}$
$c[\varphi \wedge \psi]^+ := c[\varphi]^+ \cap c[\psi]^+$
$c[\varphi \vee \psi]^+ := c[\varphi]^+ \cup c[\psi]^+$
$c[\neg\varphi]^+ := c^{\sqsubseteq} - c[\varphi]^+$, where $c^{\sqsubseteq} = \{c' \mid c' \sqsubseteq c\}$
$c[\Diamond\varphi]^+ := \{c' \sqsubseteq c \mid c'[\varphi]^+ \neq \varnothing\}$

For an atomic sentence p, its DE update outputs the set that contains all continuations of $c[p]$, i.e., all non-empty subsets of $c[p]$. If $c[p]$ itself is empty, $c[p]^+$ is also empty. Conjunction and disjunction are self-explanatory. The DE update of a negation yields a similar effect as that of updating with a denegation: $c[\neg\varphi]^+$ subtracts from all continuations of c those that are continuations of $c[\varphi]$. For $c[\Diamond\varphi]^+$, it collects only those continuations c' such that the discourse effect carried by φ can also be satisfied at c', viz., $c'[\varphi]^+ \neq \varnothing$. $\Box\varphi$ is defined as $\neg\Diamond\neg\varphi$ as usual.

To see these definitions at work, let us first consider the update $c[\Diamond p \wedge \neg p]^+$. It yields the set $\{c' \sqsubseteq c \mid c'[p]^+ \neq \varnothing\} \cap (c^{\sqsubseteq} - c[p]^+)$, which is $\{c' \sqsubseteq c \mid c'[p] \neq \varnothing\} \cap \{c' \sqsubseteq c \mid c'[p] = \varnothing\}$, which is empty. Hence, the discourse effect carried by $\Diamond p \wedge \neg p$ is inconsistent. Analogous results

also hold for Wittgenstein disjunctions. Unlike treating "$\Diamond$" as a meta speech act operator outright, we can now also handle embedded epistemic contradictions. Consider the update $c[\Diamond(\Diamond p \wedge \neg p)]^+$. It yields the set $\{c' \sqsubseteq c \mid c'[\Diamond p \wedge \neg p]^+ \neq \varnothing\}$. As we just saw, updating any state with $[\Diamond p \wedge \neg p]^+$ produces the empty set, the set $\{c' \sqsubseteq c \mid c'[\Diamond p \wedge \neg p]^+ \neq \varnothing\}$ will be empty as well, which thereby makes the meta speech act effect carried by $\Diamond(\Diamond p \wedge \neg p)$ inconsistent.

At the level of commitment spaces, the update on a commitment space $C[\varphi]$ will be jointly decided by its root update $\surd C[\varphi]$ together with its DE update $\surd C[\varphi]^+$. They work in tandem to constrain the shape of the output commitment space. I assume the following two constraints in calculating the final output from a commitment space update:

(38) Let C' be the output of an update on a commitment space $C[\varphi]$, then
  a. root restriction: if $\surd C[\varphi] \neq \varnothing$ and $\surd C[\varphi]^+ \neq \varnothing$, then $\surd C' = \surd C[\varphi]$;
  b. DE restriction: $C' \subseteq \surd C[\varphi]^+ \cup \{\surd C[\varphi]\}$.

The root restriction states that whenever possible, the root of the output commitment space should be given by the root update; the DE restriction states that every commitment state in the final output must either come from the DE update $\surd c[\varphi]^+$ or be identical to the new root $\surd c[\varphi]$.[6] From these two constraints, we derive the following update clauses.

(39) **Updates on commitment spaces:** $C[\varphi] =$
  a. $\varnothing$, if $\surd C[\varphi]^+ = \varnothing$;
  b. $\{c \in \surd C[\varphi]^+ \mid c \sqsubseteq \surd C[\varphi]\}$, if $\surd C[\varphi] \in \surd C[\varphi]^+$;
  c. $\surd C[\varphi]^+ \cup \{\surd C[\varphi]\} - \{\varnothing\}$, if $\surd C[\varphi] \notin \surd C[\varphi]^+$ but $\surd C[\varphi]^+ \neq \varnothing$.

The first clause encompasses cases like epistemic contradictions where the DE update returns the empty set. Thus, the whole update is empty, and the sentence is deemed inconsistent.

The second clause covers two types of cases. First, the outcome of the root update $\surd C[\varphi]$ can be identical to the root of the commitment space generated by $\surd C[\varphi]^+$. This is the case, for instance, when φ is atomic. In such cases, since $\surd C[\varphi]^+$ is already rooted in $\surd C[\varphi]$, the update $C[\varphi]$ simply returns the whole commitment space generated by $\surd C[\varphi]^+$. On the other hand, it can also happen that $\surd C[\varphi]^+$ contains the commitment state $\surd C[\varphi]$ but not as its root. In particular, given the update clauses in (37), negation is treated like delegation when calculating the discourse effect it produces. As a result, the DE update $\surd C[\neg p]^+$, which amounts to the update with a denegation $C[\sim p]$ as shown in Figure 1, will have $\surd C$ as its root instead of the output from the root update $\surd C[\neg p]$. To satisfy the root restriction in (38), the new commitment space will be formed by collecting all states from $\surd C[\neg p]^+$ that are rooted in $\surd C[\neg p]$.

As for the last clause, there are also two types of cases falling under it. Firstly, given how disjunction is defined for the DE update, calculating the discourse effect associated with a disjunction will often return a commitment space that contains multiple roots. For instance, let $\surd C$ be the minimal state as shown in Figure 1; then the update $\surd C[p \vee q]^+$ will yield a commitment space that contains two roots, namely $\surd C[p]$ and $\surd C[q]$, represented by the two state p and q in Figure 1. The output of the root update $\surd C[p \vee q]$, represented by the state p/q in Figure 1, is not contained in $c[p \vee q]^+$. To amend this so as to satisfy the root restriction, we will add the new root $c[p \vee q]$ to the commitment space generated by $c[p \vee q]^+$.

[6] I have been assuming that the root of a commitment space will always be a single commitment state. That said, the framework can be easily generalized to accommodate roots that contain multiple commitment states.

Secondly, we have cases where the root update returns the empty set, in particular cases involving updating on a commitment state where p has yet to be settled true with the necessity claim $\Box p$. There are two possible outcomes: if p has already been settled false at $\surd C$, then the DE update $\surd C[\Box p]^+$, i.e., $\surd C[\neg\Diamond\neg p]^+$, will be empty; consequently, the update on the commitment space C will also be empty as per clause (39a). However, if p remains undetermined at $\surd C$, then the update $\surd C[\Box p]^+$ will restrict future developments of the discourse to states where p is settled true.[7] It follows that the commitment space update $C[\Box p]$ will, in effect, be tantamount to the update $C[p]$. The refined system thus inherits the desirable feature of the previous analysis concerning updating with necessity modals.

5. Standoff conditionals in discourse

In this section, I will elucidate how the update system delineated above works in a multi-agent scenario and explain how standoffs in a private information gathering setting as in (15) differ from those in a single speaker or a public discourse setting as in (16) and (17). As mentioned before, in CSS, updating with an assertion always involves first updating with a commitment clause $s \vdash \varphi$, which reads "*s is committed to* φ." Formally, $s \vdash \varphi$ will be treated as an atomic sentence and will have the same root and DE updates as other atomic sentences:

(40) a. Root update: $c[s \vdash \varphi] = \{w \in c \mid V(s \vdash \varphi, w) = 1\}$[8]
b. DE update: $c[s \vdash \varphi]^+ := \{c' \mid c' \sqsubseteq c[s \vdash \varphi]\}$

Given that updating with a claim about a commitment is different from updating with the content of the said commitment, to explain how an update with $[s \vdash \varphi]$ is transformed into an update with $[\varphi]$—in other words, how the content of a commitment becomes grounded in a commitment state—Krifka (2023) proposed the following closure condition (slightly modified):

(41) Commitment Closure of c: If s is a participant in the conversation that is trustworthy, and $s \vdash \varphi$ holds at every w in c (i.e., c supports $s \vdash \varphi$), and the other participants in conversation do not object, then updating c with $[\varphi]$.

In order to distinguish a public discourse setting where discourse participants are mutually visible to one another from a private information gathering scenario, I will make one more modification by relativizing commitment states to discourse groups, encoded via subscripts. For example, in a case like (15) where Carl receives separate notes from Ann and Bob, we can designate the relevant commitment space with C_{Carl}, for Ann and Bob are not part of the discourse. By contrast, in a public setting like (17), we can designate the relevant commitment space with $C_{\mathfrak{A}}$ with Ann and Bob being members of the discourse group $\mathfrak{A}$.

One last thing we need is a working semantics for indicative conditionals. I will assume a dynamic strict analysis of conditionals (see, e.g., Willer, 2017): an indicative conditional $\varphi \rightarrow \psi$ presupposes $\Diamond\varphi$ and asserts the strict material conditional $\Box(\neg\varphi \vee \psi)$. To simplify, we can set aside the presuppositional aspect of $\Diamond\varphi$ and take $\varphi \rightarrow \psi$ to bring about the following update:

[7] Formally, $\surd C[\neg\Diamond\neg p]^+ = \surd C^{\sqsubseteq} - \{c' \sqsubseteq \surd C \mid c'[\neg p]^+ \neq \varnothing\} = \{c' \sqsubseteq \surd C \mid c'[p]^+ = c'^{\sqsubseteq}\} = \{c' \sqsubseteq \surd C \mid c'[p] = c'\}$

[8] For Krifka (2014, 2023), updating with a commitment is more complex as it involves a performative aspect which changes the current world-time index where the discourse takes place.

(42) $C[\varphi \rightarrow \psi] := C[\Diamond\varphi][\Box(\neg\varphi \vee \psi)]$

We can now represent the three scenarios in (15-17) as inducing the following updates:

(43) a. Ann's note: Top Gate might be open, and if it is open the water is flowing left.
Bob's note: Top Gate might be open, and if it is open the water is flowing right.
b. $C_{Carl}[Ann \vdash \Diamond O][Ann \vdash \Box(\neg O \vee L)][Bob \vdash \Diamond O][Bob \vdash \Box(\neg O \vee \neg L)]$

(44) a. Ann: #Top Gate might be open, and if it is open the water is flowing left, and if it is open the water is flowing right.
b. $C_{Ann}[Ann \vdash \Diamond O][Ann \vdash \Box(\neg O \vee L)][Ann \vdash \Diamond O][Ann \vdash \Box(\neg O \vee \neg L)]$.

(45) a. Ann: Top Gate might be open, and if it is open then the water is flowing left.
Bob: #Yes, and if it is open then the water is flowing right.
b. $C_{\mathfrak{A}}[Ann \vdash \Diamond O][Ann \vdash \Box(\neg O \vee L)][Bob \vdash \Diamond O][Bob \vdash \Box(\neg O \vee \neg L)]$

Consider (44) first where the standoff conditionals are produced by a single speaker. Since Ann is committed to both conditionals and nothing suggests that she has retracted any part of the assertion, applying commitment closure will update C_{Ann} with $[\Diamond O][\Box(\neg O \vee L)][\Diamond O][\Box(\neg O \vee \neg L)]$. It is easy to verify that under the definition given in (39), this update will return the empty set: on one hand, the DE update with $[\Diamond O]^+$ will remove from C all commitment states where O is settled false; on the other hand, the updates with $[\Box(\neg O \vee L)]$ and $[\Box(\neg O \vee \neg L)]$ together place the opposite requirement that O is settled true in all future continuations of the discourse.

Likewise in (45), since Bob, who is a member of the discourse group $\mathfrak{A}$, does not object to Ann's assertion, commitment closure will give rise to the update $C_{\mathfrak{A}}[\Diamond O][\Box(\neg O \vee L)][\Diamond O][\Box(\neg O \vee \neg L)]$, which will again return the empty set. Hence, we correctly predict infelicity in both (44) and (45).

Now, the key difference between (43) and (45) is that in (43), Ann and Bob are not part of the discourse group when we zone in on Carl's private information. This means Carl may opt for a reinterpretation of the standoff conditionals, because the default interpretation, with the meta speech act effect carried by $\Diamond O$ at full force, results in inconsistency.[9] Since Ann and Bob are not active participants of the discourse and thus cannot react to the other person's discourse moves, commitment closure does not have to ground every aspect of a sentence. In particular, as I have previously suggested, the triggering of the meta speech act effect associated with the DE update $[\Diamond O]^+$ is most natural when the speaker is part of the discourse, because by delimiting future continuations of the discourse in this way the speaker can facilitate communication by directing attention to certain possibilities. Thus, when the speaker is not part of the relevant discourse group, there is less reason to carry out the update $[\Diamond O]^+$. Moreover, in the present case, the minimum change required to render the update with the two conditionals consistent is to block the DE update $[\Diamond O]^+$. Consequently, a charitable hearer in this case can weaken the default update after applying commitment closure as follows:

(46) a. $C_{Carl}[\Diamond O]^0[\Box(\neg O \vee L)][\Diamond O]^0[\Box(\neg O \vee \neg L)]$, where
b. $C[\varphi]^0 := \{c \in C \mid c \sqsubseteq \surd C[\varphi]\}$

[9] Again, this is not to say that the hearer will always choose to reinterpret. It is possible that after having received both notes, Carl decides that one of the speakers must be wrong.

That is, the update $C[\varphi]^0$ simply collects all possible developments of the root update $\surd C[\varphi]$ without considering any further restrictions on the commitment space that φ may carry. The update in (46) produces the desired result that the output commitment space now supports $\neg O$.

On the other hand, weakening in general is not possible in a public setting like (45). After hearing Ann's assertion, Bob should be able to draw the inference himself that Top Gate is not open. As a cooperative interlocutor, Bob should immediately declare this instead of taking up Ann's commitment and placing the burden of drawing this inference on his hearers. That being said, in a conversation where one of the participants has reason to not be fully cooperative, standoff conditionals can become admissible when consecutively uttered by two different speakers:

(47) Teacher: Can you tell me what you know?
Student: I know that if Top Gate is open, then the water is flowing left.
Teacher: From what I can see, if Top Gate is open then the water is flowing right, so based on what each of us knows, what can you infer?

6. Extensions and further applications

Before concluding, I will briefly highlight some ways to extend the proposed update framework so as to apply to a wider range of issues surrounding epistemic modals.

6.1. Weak necessity modal

Given the definitions in (37) and (39), the necessity modal currently employed is strong in the sense that $\Box\varphi$ entails φ, viz., $C[\Box\varphi] \vDash \varphi$ for all C. In the literature, the question of whether epistemic *must* is a strong modality is still an issue of contention (von Fintel and Gillies, 2021; Lassiter, 2016; Goodhue, 2017). Although I do not intend to engage with this debate here, I will suggest a way to extend the current framework to allow for a weaker necessity modal. Consider an example from Kibble (1994: 8).

(48) a. John has a guitar. It's a Fender Stratocaster.
b. John must have a guitar. #It's a Fender Stratocaster.

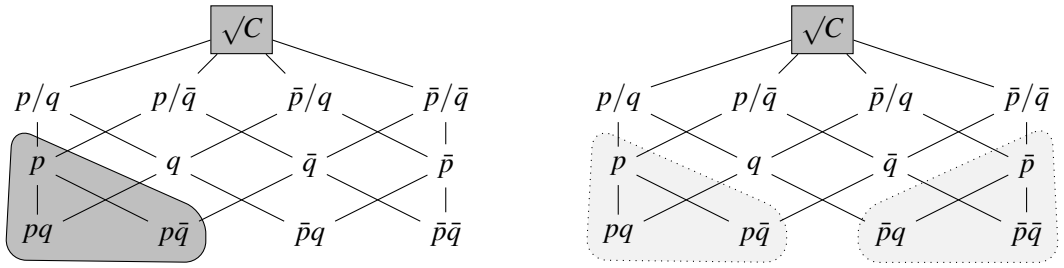
Suppose that *must* is in fact weak. Then we may suspect the reason why (48b) is infelicitous is that "John must have a guitar" does not make it common ground that John has a guitar; since no discourse referent is introduced into the common ground, the anaphora lacks an antecedent. To cash out this intuition in CSS, we can introduce a weak necessity modal "$\boxdot$" and define its two-pronged updates on a commitment state as follows:

(49) a. Root update: $c[\boxdot\varphi] := c$
b. DE update: $c[\boxdot\varphi]^+ := c[\varphi]^+$

As Figure 5a shows, the update $C[\boxdot p]$ does not alter the root commitment state but merely restricts future continuations by retaining only those states where p is settled true.[10] As a

[10]Having the root unchanged is an oversimplification. A more sophisticated root update can, for example, collect only those worlds w in c where p is true at all of the most prototypical worlds at w (see, e.g., Kratzer, 1991).

result, $\boxdot p$ no longer entails p, since an update with the latter will also shift the root state.



(a) $C[\boxdot p]$ (b) $C[\boxdot p \wedge \boxdot \neg p] = \{\sqrt{C}\}$

Figure 5: Weak necessity modal

One troublesome consequence arise from this interpretation of $\boxdot$ is that sentences of the form $\Box p \wedge \Box \neg p$ as well as $\Box p \wedge \neg \Diamond p$ are no longer inconsistent as updating with these sentences do not always result in the empty set as shown in Figure 4b. To explain the oddness of such sentences, we can resort to a stronger notion of consistency:

(50) **Strong Consistency:** φ is strongly consistent iff $\exists C : C[\varphi] \neq \varnothing \;\&\; C[\varphi] \neq \{\sqrt{C}\}$

For φ to be strongly consistent, it should be possible that an update with φ yields a commitment state which can be further developed. Since the update with $[\boxdot p \wedge \boxdot \neg p]$ necessarily results in a singleton set that contains only the current root, it is not strongly consistent. The two conjuncts impose incompatible restrictions on future continuations of the discourse so that there is no way for the current root to be further refined.

6.2. Free choice inference

Epistemic possibility modals give rise to so-called 'free-choice' inference:

(51) a. Paul might be at the party, or Quinn might be at the party. $\Diamond p \vee \Diamond q$
b. It is possible that either Paul or Quinn is at the party. $\Diamond(p \vee q)$
c. $\Rightarrow$ Paul might be at the party and Quinn might be at the party. $\Diamond p \wedge \Diamond q$

Both (51a) and (51b) give rise to the inference in (51c). The present account, however, fails to vindicate free choice. For example, a world where p is settled true and q false will survive the update with $[\Diamond p \vee \Diamond q]$ but will not survive the subsequent update with $[\Diamond p \wedge \Diamond q]$; hence, an update with $[\Diamond p \vee \Diamond q]$ will not always lead to a commitment space that supports $\Diamond p \wedge \Diamond q$.

There are various ways to extend the current framework to capture free choice. Most conveniently, we can modify the root update by adopting an update system capable of deriving free choice as an entailment at the level of commitment/information states (e.g., Goldstein, 2019; Aloni, 2022) or some more elaborate notions of information states (e.g., Ciardelli et al., 2009; Zhang, 2023). Then when calculating the meta speech effect carried by $\Diamond p \vee \Diamond q$, we also calculate those carried by its logical consequences, which in turn ensures that the output commitment space from this update will be delimited by $[\Diamond p \wedge \Diamond q]^+$.[11] Alternative, a more radical solution

[11] It is worth noting that this solution is incompatible with deriving free choice as a conversational implicature due

would be to modify the DE update so as to make it the case that $c[\Diamond p \vee \Diamond q]^+ = c[\Diamond p \wedge \Diamond q]^+$. I will leave further exploration of this issue to future work.

7. Conclusion

In this paper, I combined a commitment space semantics with a test semantics for epistemic modals. The resulting framework is a two-pronged update system wherein epistemic modals carry the discourse effects of delimiting future developments of the discourse: an update with $\Diamond p$ constrains future continuations to those where p remains as an open possibility. These discourse effects can be conceived of as resulting from a default conversational principle which requires discourse commitment to be persistent. This novel analysis captures a large variety of epistemic contradictions as well as discourse consistency in various standoff scenarios.

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to concerns about overgeneration. For example, it is plausible that $\Diamond p$ conversationally implicates $\Diamond \neg p$. However, if when calculating the meta speech act effect carried by $\Diamond p$ we also calculate the effect carried by its implicature and require the commitment space to be restricted by $[\Diamond \neg p]^+$, then we will incorrectly predict sentences like "*Paul might be at the party. In fact, he is at the party*" to be inconsistent.

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