A 'situated' solution to prior's substitution problem[1]

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Abstract. In the complements of many DP/CP-neutral attitude verbs (e.g. remember, fear, see), CPs resist the truth-preserving substitution by a DP of the form 'the proposition $[_{CP}$]'. This substitution is often perceived as involving a shift in verb-reading from a reading in which the semantic value of the complement serves as the *content* of the attitude to a reading in which it serves as the *object* towards which the attitude is directed (see Moltmann's 2003 *objectivization effect*). This paper provides a uniform account of the above phenomena that uses the particular pragmatic properties of the situation that serves as the internal argument of the attitude report. The resulting account is inspired by Pietroski (2000) and Forbes' (2018) account of the objectivization effect and by Moltmann's (2003) 'unique determination'-strategy for the explanation of DP/CP substitution behavior. The account improves upon other accounts by explaining *both* the substitution behavior and the objectivization effect, and by explaining the validity (for some verbs) of the CP's substitution by DPs like 'the fact $[_{CP}$]' or 'the possibility $[_{CP}$]'.

Keywords: Intentional attitude reports, DP/CP complement-neutral verbs, CP nominalizations, substitution failure, objectivization effect, distributional differences between complements.

1. Introduction

1.1. DP/CP substitution behavior

In the complements of most DP/CP-neutral attitude verbs, CPs resist the truth-preserving substitution by a DP of the form 'the proposition $[_{CP}$]' (see a.o. Vendler, 1967; Prior, 1971; Parsons, 1993; King, 2002; Moltmann, 2003, 2013; Forbes, 2018). This holds for epistemic verbs[2] like remember, notice, discover, and regret (see (1)), for quasi-perceptual intentional and emotional verbs like imagine, hallucinate, fear, and suspect (see (2)), and for perception verbs like see, hear/overhear, feel, and sense (see (3)):

(1)   a. Pat remembers $[_{CP}$ that Bill bought a sports car].

  $\not\equiv$ b. Pat remembers $[_{DP}$ the proposition $[_{CP}$ that Bill bought a sports car]].

(2)   a. Pat fears $[_{CP}$ that Bill will try to hug her].

  $\not\equiv$ b. Pat fears $[_{DP}$ the proposition $[_{CP}$ that Bill will try to hug her]].

(3)   a. Pat sees $[_{CP}$ that Bill is waiting for her].

  $\not\equiv$ b. Pat sees $[_{DP}$ the proposition $[_{CP}$ that Bill is waiting for her]].

In the complements of these verbs, the substitution of a CP by a DP of the form 'the proposition $[_{CP}$]' yields a (semantically acceptable) sentence that has different – often less natural – truth-conditions than the original sentence. For example, while it is easy to imagine conditions under

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[2]For further examples of DP/CP substitution-resisting attitude verbs, the reader is referred to (Moltmann, 2003: 82–89) (see Moltmann, 2013: 126–132) and (Forbes, 2018).

which (1a) and (2a) are true, many of the conditions under which (1b) and (2b) are true are rather contrived (see Moltmann, 2003: 82; King, 2002: 344). Worse, while (3a) is true in many conceivable contexts, (3b) is (likely) not true in any contexts (i.e. it is necessarily false).

Some members of the above-described class of verbs allow the truth-preserving substitution of their CP complement by a DP of the form 'the fact [$_{CP}$]' or 'the possibility [$_{CP}$]' (see Parsons, 1993: 453–456; Moltmann, 2003: 83–85; Moffett, 2003: 81–84; Pryor, 2007: 228):

(4)   a.   Pat remembers [$_{CP}$ that Bill bought a sports car].
   ≡ b.   Pat remembers [$_{DP}$ the fact [$_{CP}$ that Bill bought a sports car]].

(5)   a.   Pat fears [$_{CP}$ that Bill will try to hug her].
   ≡ b.   Pat fears [$_{DP}$ (the realization of) the possibility [$_{CP}$ that Bill will try to hug her]].

This substitutivity also holds for verbs like hope and wish, which take a *prepositional* (rather than a direct) object complement (see (6)) and for verbs like destroy, frighten, and suck, which are neutral between taking a DP and a CP *subject* (see (7)):[3]

(6)   a.   Bill hoped/wished [$_{CP}$ that Pat would love him back].
   ≡ b.   Bill hoped/wished for [$_{DP}$ the possibility [$_{CP}$ that Pat would love him back]].
   ≢ c. $^{??}$Bill hoped/wished for [$_{DP}$ the proposition [$_{CP}$ that Pat would love him back]].

(7)   a.   [$_{CP}$ That the weather is not improving] sucks.
   ≡ b.   [$_{DP}$ The fact [$_{CP}$ that the weather is not improving]] sucks.
   ≢ c. $^{??}$[$_{DP}$ The proposition [$_{CP}$ that the weather is not improving]] sucks.

The objectivization effect. In attitude reports like (1) to (3), the truth-conditional difference between the (a)-sentence and the (b)-sentence is often attributed to a shift in the reading of the attitude verb (see Pietroski, 2000; Moltmann, 2003, 2013; Forbes, 2018). This shift changes the reading of the verb from a reading in which the semantic value of the complement serves as the *content* of the attitude (see (8a)) to a reading in which the semantic value of the complement serves as the *object* towards which the attitude is directed (see (8b)):

(8)   a.   Pat's remembering has as its *content* (the proposition/the fact) that Bill bought a sports car
   ≢ b.   Pat's remembering has as its *object* the proposition that Bill bought a sports car

In (Moltmann, 2003: 86–89) (cf. Moltmann, 2013: 131–132), this shift in reading is called *the objectivization effect*. In particular, since (8a) is not a possible reading of (1b), the inference from (1a) to (1b) is intuitively invalid. Analogous observations hold for the inference from (2a) to (2b) and from (3a) to (3b).

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[3]In the complements of intensional, episodic, and evaluative verbs (e.g. seek/look for, encounter, be boring), an analogous observation is made w.r.t. the substitution of bare adjective nominalizations (e.g. ordinariness) by their corresponding explicit property-denoting terms (here: the property of ordinariness) (see Moltmann, 2004: 19; Moltmann, 2013: 15–17; Zimmermann, 2006: 384–385):

(⋆)   a.   [$_{DP}$ Ordinariness] is boring.
   ≢ b.   [$_{DP}$ The property of [$_{DP}$ ordinariness]] is boring.

Note that the objectivization effect is typically not exemplified by pairs of sentences like (4) and (5). (The salient reading of (4b) is (8a)). However, this effect is exemplified by certain *alternative* readings of the matrix verbs in these sentences.[4] For (4b), this reading is made salient in a context in which the fact (*qua* abstract object) that Bill bought a sports car was a frequent topic of discussion in Pat's *Ontology 101* class. The relevant reading of (4b) is given in (9a):

(9)   a. Pat's remembering has as its *object* the fact that Bill bought a sports car

$\not\equiv$ b. Pat's remembering has as its *content* (the fact) that Bill bought a sports car

According to (Moltmann, 2013: 126–127), the objectivization effect is also not exemplified by the few attitude verbs (e.g. mental action verbs[5] like believe and prove) whose combination with a DP of the form 'the proposition $[_{CP}\ ]$' yields a sentence with natural, i.e. non-contrived, truth-conditions (see also King, 2002: 359–360; Forbes, 2018: 5). These verbs are typically CP-biased verbs that only select for some 'special' (i.e. abstract object-denoting) DP complements like CP nominalizations, the quantifier something, or proposition-names like Goldbach's conjecture.[6] The absence of the objectivization effect in attitude reports containing these verbs is exemplified by the observation that (10a) and (10b) both have (10b.i) as their only reading:

(10)   a. Pat believes $[_{CP}$ that the Earth is round].

$\equiv$ b. Pat believes $[_{DP}$ the proposition $[_{CP}$ that the Earth is round]].

$\equiv$ i. Pat's belief has as its *content* (the proposition) that the Earth is round

$\not\equiv$ ii. Pat's belief has as its *object* the proposition that the Earth is round

1.2. Challenges and objectives

The substitution behavior of the complements of DP/CP-neutral attitude verbs and the objectivization effect have been the topic of much research in semantics and the philosophy of language. This is due to the difficulty of traditional Montague-style semantics to straightforwardly account for these phenomena. Following (Moltmann, 2003: 82) (see Prior, 1971), we hereafter refer to the inability of these semantics to explain the substitution-resistance of CPs with a DP of the form 'the proposition $[_{CP}\ ]$' as *the substitution problem*. This problem arises from (i) the traditional analysis of attitude reports as binary relations between individuals/cognitive agents and the semantic values of CPs (see Montague, 1973; cf. Dowty et al., 1981: Ch. 6; Fox and Lappin, 2005), (ii) the identification of the semantic contribution and compositional behavior of CP- and DP-taking occurrences of attitude verbs (see Zimmermann, 2006), and (iii) the identification of the semantic values of CPs with propositions (see Bach, 1997).

The challenge from the above phenomena is reinforced by the observation that none of the newer relational semantics for attitude reports simultaneously explains both the DP/CP-substitution behavior and the objectivization effect:[7] In particular, solutions to the substitution prob-

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[4]In this point, we deviate from (Moltmann, 2003: 86–89) (cf. Moltmann, 2013: 131–132), whose examples of the objectivization effect exclude cases like the ones discussed in the context of (9).

[5]Moltmann and Forbes also list the verbs deduce, infer, accept, assume, establish, and assert in this category. However, a simple Google search reveals that these verbs much more frequently combine with DPs of the form 'the fact $[_{CP}\ ]$' and/or 'the possibility $[_{CP}\ ]$'. Thus, on March 20, 2018, the string 'deduce the proposition' only yielded 129.000 hits, while the strings 'deduce the fact' and 'deduce the possibility' yielded 2.510.000 resp. 651.000 hits.

[6]As a result, we exclude mental action verbs from the class of DP/CP-neutral verbs.

lem that question the interpretation of CPs as propositions (see Vendler, 1967; Parsons, 1993; Pryor, 2007; Moltmann, 2003) typically cannot (straightforwardly) explain the objectivization effect. Inversely, explanations of this effect that deny the identity of the semantic values of CP- and DP-taking occurrences of attitude verbs (see Pietroski, 2000; King, 2002, 2007; Rosefeldt, 2008; Forbes, 2018) are still unable to solve the substitution problem.

This paper seeks to compensate for the above shortcomings. In particular, it provides a uniform account of DP/CP substitution behavior and the objectivization effect that uses the particular pragmatic properties of the situation or event that serves as the internal argument of the attitude report (for (1a): the properties of Pat's particular *remembered* event (Bill buying a sports car)). Our account is inspired by Forbes' (2018) and Elliott's (2016) accounts of the objectivization effect (cf. Pietroski, 2000) and by Moltmann's (2013) 'unique determination'-strategy for the solution of the substitution problem (cf. Moltmann, 2003: 83–84). Our account identifies Moltmann's instances of the objectivization effect as a special subcase of a more general phenomenon and advances several aspects of the situation semantics from (Liefke and Werning, 2018).

The paper is organized as follows: we start by outlining our strategy for the explanation of (1) to (10) (Sect. 2). The subsequent sections develop those parts of our account that are relevant for our explanation of DP/CP-substitution behavior (Sect. 3) and of the objectivization effect (Sect. 4). Section 5 anticipates and answers several objections to our account. The paper closes with a summary of our results and with pointers to future work.

2. Proposal, motivation, and background

To show the general strategy behind our account – and to identify the relation between the different parts of this account[8] –, we here give a brief sketch of the account:

(i) The proposed account explains the *substitution behavior* of the complements of DP/CP-neutral verbs (see (1)–(7), (10)) by pragmatic constraints on the contextual choice of the situation that serves as the internal argument of the attitude report. For the verb remember, these constraints include the restriction of the remember*ed* situation to a situation (or event) that is located in the world, $w_@$, that is associated with the situation of evaluation, @, and that precedes the time of @. DP/CP substitution behavior (here: (4)) is then explained through the compatibility of the verb's constraint-profile with the constraint-profile of the DP (for 'the fact [$_{CP}$]': if p is a fact, then p is true of a spatial part of $w_@$).

(ii) To explain *the objectivization effect* (see (8), (9)), we assume that nominalized CPs are interpreted as the *objects* of attitude verbs when their constraint-profile is not compatible with the constraint-profile of the verb (e.g. in (1b)), or – if their constraint-profile *is* compatible with the constraint-profile of the verb (see (4b)) – when their embedding verb receives an alternative (i.e. object-)reading (i.e. (9a)). Otherwise, they are interpreted as the *contents* of the attitudes described by these verbs.

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[7]Zimmermann (2006) can be taken to suggest an alternative account of DP/CP substitution behavior and the objectivization effect that explains these phenomena w.r.t. a difference in LF-structure (and, attendantly, in compositional interpretation). Zimmermann's account distinguishes ($\star$b) from ($\star$a) (see fn. 3) by analyzing ($\star$a) as an instance of subsumption (i.e. $[\![DP]\!] \sqsubseteq [\![VP]\!]$: 'all ordinary things are boring things') and analyzing ($\star$b) as an instance of predication (i.e. $[\![VP]\!]([\![DP]\!])$: 'a certain abstract object is boring'). We leave the transfer of Zimmermann's account to cases like (1) to (3) as the topic for another paper.

[8]These relations give rise to the uniformity of the proposed account.

The remainder of this section introduces the proposed semantics for DP/CP-neutral attitude verbs (in Sect. 2.1) and presents the relevant background of this semantics (in Sect. 2.2).

2.1. 'Situating' attitude complements

To get our proposed semantics off the ground, we use a situation-semantic modification of the traditional interpretation of attitude verbs. Traditionally, attitude verbs (here: believe) are interpreted as relations to propositions, where propositions are represented by sets of possible worlds (type st;[9] see (11)). The traditional interpretation assumes that the cognitive agent stands in the described relation to a particular proposition p if p is true in all of his/her attitudinally relevant alternatives (see (12), where $\text{Dox}_{x,i}$ is the set of x's doxastic alternatives in i, i.e. the set of worlds that are compatible with everything that x believes in i; cf. Hintikka, 1969):

(11) $[\![\text{believe}]\!]^i = \lambda p^{st} \lambda x^e [believe_i(x,p)]$

(12) $\equiv \lambda p^{st} \lambda x^e [\forall j^s . \text{Dox}_{x,i}(j) \to p(j)]$

Hintikka's semantics has today become the standard semantics for propositional attitude reports. However, for the interpretation of many of the verbs from Section 1.1 (incl. remember, notice, and see), this semantics faces a serious shortcoming: in contrast to the complements of believe-type verbs, the complements of the above verbs are typically used to describe a single *particular* situation (or event) – even if the propositional content of the complement is true at other situations/worlds in the set of the agent's relevant alternatives. Hintikka semantics fails to identify this situation. This is especially problematic since, for many of the above verbs, the mentioned situation cannot be identified with (or inferred from) i. For example, the event of Bill buying a sports car that is described by the complement of (1a) presumably did not happen in i, but in a (specific remember*ed*) situation that temporally precedes i.

To capture the above observation,[10] we interpret DP/CP-neutral verbs like remember along the lines of (13). This interpretation treats remember as a relation to a set of situations in which p is true, which approximate the information of the temporal world-slice (or *index*), $\langle w_\sigma, t_\sigma \rangle$, that is associated with the agent's remembered situation/event at i, σ. In (13), σ is a variable over internal situation-arguments. $\langle w_\sigma, t_\sigma \rangle$ (with w_σ a world and t_σ a point in time in w_σ's history)

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[9]We hereafter give types in superscript.

[10]Because of the informational completeness of Kratzer-style situations (which are *total* world-parts), the relevant occurrences of remember cannot be interpreted as relations to Kratzer-style situations. Such an interpretation (see (†)) would fail to capture the difference between attitude reports with gerundive complements (e.g. (†a)) – which allow for a 'situation'-reading (see Stephenson, 2010) – and reports with finite clausal complements (e.g. (†b)) – which typically do *not* allow for this reading.

(†) $\exists \sigma^s \exists y^e [remember'_i(pat, \sigma) \wedge (buy_\sigma(bill, y) \wedge car_\sigma(y))]$

    a. $= [\![\text{Pat remembers } [_{\text{GC}} \text{Bill buying a sports car}]]\!]^i$
         (Pat remembers the specific event in which Bill bought a sports car)

    b. $\neq [\![\text{Pat remembers } [_{\text{CP}} \text{that Bill bought a sports car}]]\!]^i$
         $\equiv [\![\text{Pat remembers } [_{\text{DP}} \text{the fact } [_{\text{CP}} \text{that Bill bought a sports car}]]]\!]^i$

Since they allow for the informational depletion of situations to entities that only code the information content of propositions, Liefke and Werning's (2018) *contextually specified situations* enable the interpretation of the relevant occurrences of remember as relations to situations. For the details of this interpretation, the reader is referred to (Liefke and Werning, 2018: 676–678). The development of this interpretation is left as a project for future work.

is the index of which σ is a (spatial/informational) part (see Sect. 2.2). To capture the role of indices in the interpretation of attitude complements, we hereafter call $\langle w_\sigma, t_\sigma \rangle$ the *(referential) anchor* of these complements (see Liefke and Werning, 2018: 659) and describe sets of situations of the form of the semantic attitude complement in (13) as *anchored attitude complements*.

(13) $[\![\text{remember}]\!]^i = \lambda p \lambda x [\text{remember}_i(x, \lambda j \exists \sigma . \, j \leq \langle w_\sigma, t_\sigma \rangle \wedge p(j))]$

(13) follows the semantics of believe-type verbs from (11) in interpreting attitude verbs as *relations* to the semantic value of their complement. It differs from this interpretation in replacing sets of worlds by sets of *situations* as the semantic values of attitude complements and by restricting these sets to situations that approximate the information of the anchor of the internal situation σ. As a result of this restriction, sets of situations 'encode' information about the world and time of σ. The latter will be relevant for the explanation of DP/CP substitution behavior and (in combination with further assumptions) of Moltmann's objectivization effect.

Note that, in the interpretation of remember from (13), the existential quantifier $\exists \sigma$ scopes *below* (the logical translation of) the attitude verb. This scoping relation reflects the observation that cognitive agents often do not hold attitudes of the form of (1a) *de re* of specific situations or events: reports like (1a) are still true in contexts in which the cognitive agent only remembers the propositional content of the attitude complement (i.e. he/she remembers that there is a past situation/event of which this proposition is true), but is not – or no longer – able to identify the particular situation/event that is described by this complement.

The above interpretation of remember is inspired by the traditional (Barwise/Perry-style) situation-semantic analysis of attitude reports (see Barwise and Etchemendy, 1987; Cooper, 2005; Ginzburg, 2011; cf. Austin, 1970) and by Kratzer's situation-semantic analysis of factive attitude verbs (see Kratzer, 2002, 2006). Barwise and Perry's analysis interprets attitude complements as true Austinian propositions,[11] i.e. as structured objects of the form $\langle s, \sigma \rangle$, where s is a situation, σ is a situation type, and s is correctly classified by σ. Kratzer's analysis interprets factive attitude complements as facts exemplifying the proposition, p, that is expressed by the complement, i.e. as minimal situations (= situations without proper parts) in which p is true.

Sets of situations of the form $\lambda j \exists \sigma [j \leq \langle w_\sigma, t_\sigma \rangle \wedge p(j)]$ (see (13)) code almost the same information as true Austinian propositions or Kratzer-style facts. In particular, in such sets, the role of the referential anchor (which *situates* the complement relative to a particular index) is played by the index that is associated with the situation s (in Austinian propositions) respectively by the index that is associated with the fact that exemplifies p (in Kratzerian facts). The role of the restrictor, p, is played by situation types and by the exemplified proposition, respectively.

Sets of situations of the form $\lambda j \exists \sigma [j \leq \langle w_\sigma, t_\sigma \rangle \wedge p(j)]$ improve upon Kratzer-style facts by enabling the representation of 'unanchored' situations, which is relevant for the interpretation of creation and depiction reports (e.g. (14)). In our semantics, such situations can be represented by sets of isomorphic, i.e. qualitatively identical, situations (see Kratzer, 2002: 667; cf. Fine, 1977: 136). For example, in (14), the depicted (imaginary) situation in which there is a unicorn need not be anchored in a specific world, location, or time: it is well possible for Paul to paint a unicorn without intending to depict *a particular* situation (in some particular possible world,

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[11] I thank Robin Cooper and an anonymous reviewer for *Cognitive Structures 2018* for helpful discussions about anchoring and Austinian propositions.

at a specific point in time) that is inhabited by a unicorn.

(14)   Paul paints [$_{DP}$a unicorn].

Sets of situations of the above form improve upon true Austinian propositions by facilitating an account of equivalences of the form displayed in (4): Since Austinian propositions are objects of a different semantic type (viz. $(s \times s)t$) from Russellian propositions (type st), they do not straightforwardly enter into entailment relations with the latter. However, such relations are suggested by the cited data (see also (5)–(7) and (10)).

2.2. Situations, contextual specification, and event-dependence

Our previous discussion has made prominent reference to situations. To enable a more realistic modelling of internal situation-arguments,[12] we adopt an informationally partial version of Kratzer-style situations (see Kratzer, 2002, 2006). Situations of this kind are (typically incomplete) collections of information about a specific index $\langle w, t \rangle$ (see Liefke and Werning, 2018: 657–659), i.e. they are *informational approximations* of (particular spatial locations in) indices.

The informational incompleteness of situations induces a partial ordering, $\leq$, on the set of situations: a situation σ_2 *includes* a situation σ_1, i.e. $\sigma_1 \leq \sigma_2$, if σ_2 contains all information of the form 'a Fs in w at t' that is contained in σ_1, where a and F are an individual and a property or activity, respectively. This condition requires that the index, $\langle w_{\sigma_2}, t_{\sigma_2} \rangle$, about which σ_2 contains information has the same world-coordinate as the index, $\langle w_{\sigma_1}, t_{\sigma_1} \rangle$, about which σ_1 contains information (s.t. $w_{\sigma_2} = w_{\sigma_1}$), that the time-coordinate, t_{σ_2}, of $\langle w_{\sigma_2}, t_{\sigma_2} \rangle$ includes the time-coordinate, t_{σ_1}, of $\langle w_{\sigma_1}, t_{\sigma_1} \rangle$ (s.t. t_{σ_2} starts before or simultaneously with t_{σ_1} and ends after or simultaneously with t_{σ_1}), and that the location, l_{σ_2}, of $\langle w_{\sigma_2}, t_{\sigma_2} \rangle$ includes the location, l_{σ_1}, of $\langle w_{\sigma_1}, t_{\sigma_1} \rangle$ (s.t. l_{σ_2} maintains or expands the perimeters of l_{σ_1}). Below, we take '$\sigma \leq w$' to assert the inclusion of σ in (the sum of all temporal parts of) the world w.

We say that σ_2 *properly includes* σ_1, i.e. $\sigma_1 < \sigma_2$, if σ_2 contains *more* information of the form 'a Fs in w at t' than is contained in σ_1. We call any situation which includes a situation an *extension* of the included situation, and identify the maximal (consistent) extension of a situation with the (possible) world containing the world-part about which the situation contains information. A situation which is extended by another situation is called a *part* of its extending situation, or an *informational approximation* of its extending situation.

We have suggested above that the witness for $\exists \sigma$ in (13) depends on the external situation i. In particular, the contents of different remember*ing* events are anchored in the index-associates of different remember*ed* events. To capture this dependence, we assume that the situation that serves as the internal argument of an attitude report is identified by a contextually given choice function, f (see (15)). This function selects a specific situation from the set of situations S. The function f depends on the external ('remember*ing*') situation i and is constrained by the particular state or event that is described by the attitude verb (for remember: by the restriction to situations j that are located at the world-coordinate, w_i, of the index, $\langle w_i, t_i \rangle$, that is associated

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[12]For example, we typically do not remember *all* facts that are true in the relevant situation or event, but only the perceptually or contextually/informationally salient ones (see fn. 10).

with i (i.e. $j \leq w_i$) and that end before (the latest time-point of) the time-coordinate, t_i, of this index (i.e. $j \prec i$) (cf. Stephenson, 2010: 153).

To represent these dependencies, we add a context parameter, C, to the choice function f (see Heusinger, 1997: 74 ff.). This parameter identifies the event described by the attitude verb (for (1a): $\iota e^v [remember'_@ (e) \wedge \text{AGENT}_@(e) = z]$, where @ is a variable for the external situation (above: i) and where z is a free individual-variable that refers to the attitude holder (above: x)). In (15), '$f_C(S)$' then denotes the particular situation that x remembers in i. The resulting interpretation of remember, which will be adopted in the rest of this paper, is given in (15):

(15) $[\![remember]\!]^i \; = \; \lambda p \lambda x [remember_i (x, \lambda j \exists f. \, j \leq \langle w_{f_C(S)}, t_{f_C(S)} \rangle \wedge p(j))]$

With the presented background on anchoring, contextual specification, and event-dependence in place, we are now in a position to explain DP/CP substitution behavior.

3. Part I: anchors and the substitution problem

We have suggested above that its dependence on a particular remember*ing*-event constrains the choice function f to situations that are located in $w_@$ and that end before $t_@$. In virtue of these constrains, the interpretation of remember from (15) is equivalent to (16):

(16) $\lambda p \lambda x [remember_i (x, \lambda j \exists f. \, (j \leq \langle w_{f_C(S)}, t_{f_C(S)} \rangle \wedge (\boldsymbol{j \leq w_i \wedge j \prec i})) \wedge p(j))]$

3.1. Substitution with 'the fact [cp]'

To explain the semantic acceptability of (4b) and its equivalence to the remember-report in (4a), we further consider the situational constraints that are introduced by the interpretation of the DP shell the fact (in (17)). In particular, to capture the common-sense exclusion of counterfactual facts (see Handfield, 2005), we demand that facts be restricted to the actual world (i.e. $j \leq w_@$):

(17) $[\![the \; fact]\!] \; = \; \lambda p \lambda j \, [\boldsymbol{j \leq w_@} \wedge p(j)]$

The 'naturalness' of the truth-conditions of content-readings of (4b) (see (8a)) can then be explained by the observation that the 'constraint-profile' of DPs of the form 'the fact $[_{\text{CP}} \;]$' (i.e. $\lambda j [j \leq w_@]$, see (17)) is compatible with the constraint-profile of the verb remember (i.e. $\lambda j [j \leq w_@ \wedge j \prec @]$, see (16)). Specifically, since any pair of situations, $\langle i, j \rangle$, that is such that $j \leq w_i \wedge j \prec i$ is a pair of situations that is such that $j \leq w_i$, the constraint profile of the DP *is already contained in* the constraints on the remember-specific choice function f. This observation explains the intuitive equivalence of (stylized variants[13] of) (4a) and (4b) (see (18)):

(18) $[\![Pat \; remembers \; [_{\text{DP}} the \; fact \; [_{\text{CP}} that \; p]]]\!]^i$
  $= \; remember_i (pat, \lambda j \exists f. \, j \leq \langle w_{f_C(S)}, t_{f_C(S)} \rangle \wedge (\boldsymbol{j \leq w_i \wedge p(j)}))$
  $\equiv \; remember_i (pat, \lambda j \exists f. \, (j \leq \langle w_{f_C(S)}, t_{f_C(S)} \rangle \wedge (\boldsymbol{j \leq w_i \wedge j \prec i})) \wedge (\boldsymbol{j \leq w_i \wedge p(j)}))$
  $\equiv \; remember_i (pat, \lambda j \exists f. \, (j \leq \langle w_{f_C(S)}, t_{f_C(S)} \rangle \wedge (\boldsymbol{j \leq w_i \wedge j \prec i})) \wedge p(j))$
  $\equiv \; remember_i (pat, \lambda j \exists f. \, j \leq \langle w_{f_C(S)}, t_{f_C(S)} \rangle \wedge p(j))$
  $= \; [\![Pat \; remembers \; [_{\text{CP}} that \; p]]\!]^i$

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[13] These variants replace the CP that Bill bought a sports car by the CP that p.

3.2. Substitution with 'the possibility [cp]'

Our previous considerations have been restricted to the substitution of clausal remember-complements by DPs of the form 'the fact $[_{CP}$]'. Analogous to these considerations, the substitutivity of the clausal complements of fear with DPs of the form '(the realization of) the possibility $[_{CP}$]' (see (5)) is explained by constraints on the choice function f that is used in the interpretation of fear, and by the interpretation of the DP shell the possibility: the dependence of f on fear restricts f to situations σ whose indices have the same or a 'later' time-coordinate than the (external) fearing situation, @ (i.e. it restricts f_C to situations j s.t. @ $\preceq j$; see Moltmann, 2003: 129). As a consequence of this restriction, the interpretation of fear from (19) is equivalent to the interpretation in (20):

(19) $[\![fear]\!]^i = \lambda p \lambda x [fear_i(x, \lambda j \exists f. j \leq \langle w_{f_C(S)}, t_{f_C(S)}\rangle \wedge p(j))]$

(20) $\equiv \lambda p \lambda x [fear_i(x, \lambda j \exists f. (j \leq \langle w_{f_C(S)}, t_{f_C(S)}\rangle \wedge i \preceq j) \wedge p(j))]$

Since one can fear situations that never come true, we assume that the world-coordinate of the index about which σ contains information may be different from the world-coordinate of the index that is associated with the external situation i (i.e. it may be the case that $w_{f_C(S)} \neq w_i$). The possible difference between $w_{f_C(S)}$ and w_i then captures the non-factivity of fear.

We assume that the DP shell the possibility has the interpretation in (21). This interpretation is supported by the restriction of possibilities to future situations or events.

(21) $[\![the\ possibility]\!] = \lambda p \lambda j [\mathbf{@ \prec j} \wedge p(j)]$

As in the case of remember and 'the fact $[_{CP}$]', the compatibility of the constraint-profile of fear with the constraint-profile of DPs of the form 'the possibility $[_{CP}$]' explains the natural truth-conditions of content-readings of (5b). However, since the constraint-profile of the possibility (i.e. $\lambda j [@ \prec j]$) is *stricter* than the constraint-profile of fear (i.e. $\lambda j [@ \preceq j]$), it only explains the equivalence of 'fear the possibility $[_{CP}$]'-reports with the result of restricting the complement of clausal fear-reports to future events (see (22)). The future tense of the complement in (5a) (i.e. that Bill <u>will</u> try to hug her) captures this restriction.

(22) $[\![Pat\ fears\ [_{DP}the\ possibility\ [_{CP}that\ p]]]\!]^i$
      $= fear_i(pat, \lambda j \exists f. j \leq \langle w_{f_C(S)}, t_{f_C(S)}\rangle \wedge (\mathbf{i \prec j \wedge p(j)}))$
      $\equiv fear_i(pat, \lambda j \exists f. (j \leq \langle w_{f_C(S)}, t_{f_C(S)}\rangle \wedge \mathbf{i \preceq j}) \wedge (\mathbf{i \prec j \wedge p(j)}))$
      $\equiv fear_i(pat, \lambda j \exists f. (j \leq \langle w_{f_C(S)}, t_{f_C(S)}\rangle \wedge \mathbf{i \prec j}) \wedge p(j))$
      $= [\![Pat\ fears\ [_{CP}that\ p\ will\ happen]]\!]^i$

Notably, as a result of its particular constraint-profile, fear is also compatible with the constraint-profile of DPs of the form 'the fact $[_{CP}$]'.[14] This compatibility explains the semantic acceptability of reports like (23) (see (24)):

(23) Pat fears $[_{DP}$ the fact $[_{CP}$ that will Bill buy a sports car]].

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[14]On January 22, 2019, a Google search of the string 'fear the fact' yielded 5.310 hits, while a search of the string 'fear the possibility' yielded 10.500 hits.

(24) $[\![\text{Pat fears } [_{\text{DP}} \text{ the fact } [_{\text{CP}} \text{that } p]]]\!]^i$
$= fear_i(pat, \lambda j \exists f. j \leq \langle w_{fC(S)}, t_{fC(S)} \rangle \wedge (\boldsymbol{j \leq w_i \wedge p(j)}))$
$\equiv fear_i(pat, \lambda j \exists f. (j \leq \langle w_{fC(S)}, t_{fC(S)} \rangle \wedge \boldsymbol{i \preceq j}) \wedge (\boldsymbol{j \leq w_i \wedge p(j)}))$
$\equiv fear_i(pat, \lambda j \exists f. (j \leq \langle w_{fC(S)}, t_{fC(S)} \rangle \wedge (\boldsymbol{j \leq w_i \wedge i \preceq j})) \wedge p(j))$
$= [\![\text{Pat fears } [_{\text{CP}} \text{that } p \text{ is happening/will happen at } @]]\!]^i$

The constraint-profiles of the embedding verb and the embedded DP shell can also be used to explain the semantic markedness[15] of the result of combining remember with a DP of the form 'the possibility $[_{\text{CP}}]$' (see (25)): Our account explains this markedness through the incompatibility of the constraint-profiles of the combined expressions (esp. through the incompatibility of $j \prec i$ and $i \prec j$).

(25) $^{??}[\![\text{Pat remembers } [_{\text{DP}} \text{ the possibility } [_{\text{CP}} \text{that } p]]]\!]^i$
$= remember_i(pat, \lambda j \exists f. j \leq \langle w_{fC(S)}, t_{fC(S)} \rangle \wedge (\boldsymbol{i \prec j \wedge p(j)}))$
$\equiv remember_i(pat, \lambda j \exists f. (j \leq \langle w_{fC(S)}, t_{fC(S)} \rangle \wedge (\boldsymbol{j \leq w_i \wedge j \prec i})) \wedge (\boldsymbol{i \prec j \wedge p(j)}))$
$\equiv remember_i(pat, \lambda j. \bot) \equiv \bot$

We assume that this incompatibility can be resolved by 'adjusting' the interpretations of the DP and the verb to interpretations with compatible constraint-profiles. This adjustment can proceed, e.g., by modifying the interpretation of the DP shell the possibility to an epistemic interpretation (see Kripke, 1980; Edgington, 2004). The treatment of the above-discussed constraints on remember as a factive presupposition (rather than as an integral part of the verb's interpretation, as in (16)) and the cancellation of this presupposition in the described context (see Hazlett, 2012) then enables the desired compatibility. We leave the detailed development of these steps and the exploration of alternative explanations of the acceptability of (25) for another occasion.

3.3. Substitution with 'the proposition [cp]'

To explain the semantic deviance of content-readings of reports like (1b) to (3b), we assume that the DP shell the proposition has the interpretation from (26), where '$prop_j(p)$' is read as 'p is a proposition that is true of j'.

(26) $[\![\text{the proposition}]\!] = \lambda p \lambda j [prop_j(p)]$

The behavior of *prop* is constrained by the following axioms:

(**Ax1**) $\forall p \forall j [prop_j(p) \leftrightarrow p(j)]$

(**Ax2**) $\neg \exists p [\exists q. (\forall j. p(j) \rightarrow q(j)) \wedge (\exists k. prop_k(p) \wedge \neg prop_k(q))]$

Ax1 implements the 'contentfulness' of propositions (i.e. the requirement that all situations that constitute a certain proposition[16] are situations at which (the content of) this proposition is true). **Ax2** ensures the maximal generality of propositions (i.e. that propositions contain *all* situations at which they are true). **Ax1** is motivated by the need to explain the semantic accept-

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[15]A Google search on January 22, 2019 yielded 35.300 hits for the string 'remember the fact', but only 2.480 hits for the string 'remember the possibility'.

[16]i.e. that are set-theoretic members of a certain proposition

ability of 'propositional' belief reports like (10b) and to account for the equivalence of the two reports in (10) (see (27)):

(27) $\checkmark$ ⟦Pat believes $[_{CP}$ that $p]$⟧^{i}
   $= believe_i(pat, p)$
   $\equiv believe_i(pat, \lambda j.\textbf{\textit{prop}}_j(\textbf{\textit{p}}))$ (by **Ax1**)
   $=$ ⟦Pat believes $[_{DP}$ the proposition $[_{CP}$ that $p]]$⟧^{i}

Ax2 excludes the restriction to situations with particular temporal or spatial properties. As a result, it can be used to explain the semantic deviance of content-readings of reports like (1b):

(28) $^{??}$⟦Pat remembers $[_{DP}$ the proposition $[_{CP}$ that $p]]$⟧^{i}
   $= remember_i(pat, \lambda j \exists f. j \leq \langle w_{fc(S)}, t_{fc(S)} \rangle \wedge \textbf{\textit{prop}}_j(\textbf{\textit{p}}))$
   $\equiv remember_i(pat, \lambda j. \bot) \quad \equiv \bot$ (by **Ax2**)

The equivalence of the second line in (28) with $\bot$ is based on the observation that $j \leq \langle w_{fc(S)}, t_{fc(S)} \rangle$ excludes from the remember-complement many situations k which are such that $p(k) \wedge \neg k \leq \langle w_{fc(S)}, t_{fc(S)} \rangle$. In Section 4, we will provide an alternative interpretation of (1b) that captures the report's semantically acceptable object-reading (see (8b)).

4. Part II: anchors and the objectivization effect

In Section 1.1, we have assumed that DP complements of attitude reports are interpreted as *objects* of the reported attitude in instances of Moltmann's objectivization effect (s.t. (1b) has the reading in (29), instead of the salient reading in (30)):

(29) Pat remembers $[_{DP}$ the proposition $[_{CP}$ that Bill bought a car]].
  $\equiv$ Pat's remembering has as its *object* the proposition that Bill bought a sports car

(30) Pat remembers $[_{DP}$ the fact $[_{CP}$ that Bill bought a car]].
  $\equiv$ a. *salient reading:* Pat's remembering has as its *content* (the fact) that Bill bought a sports car
  $\equiv$ b. *alternative reading:* Pat's remembering has as its *object* the fact that Bill bought a sports car

To explain the objectivization effect, we assume that DP/CP-neutral attitude verbs typically have a content-reading, but can be coerced into an object-reading (see Ginzburg, 1995; cf. Pustejovsky, 1993).[17] The content-reading of remember is given in (31a). This reading has exactly the interpretation of remember from (15). From this reading, the coerced reading (see (31b)) is obtained through a partial version of Potts' (2002) nominalization function, $^\cap$ (cf. Chierchia, 1984, 1998; Chierchia and Turner, 1988).[18] This function turns the (type *st*) proposition p that is denoted by the DP into an abstract individual (type *e*). To enable this change of argument-type, the 'propositional' relation *remember* from (15) is coerced into the 'objectual'

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[17]Ginzburg (1995) adopts a similar account to capture the complementation behavior of non-factive resolutive verbs (e.g. predict, tell, guess). This account interprets declarative complements of such verbs as propositions, and coerces interrogative complements to denote a fact (see Ginzburg, 1995: 589–590).

[18]$^\cap$ is a function of type $(st)e$ which sends propositions (in Potts 2002: sets of worlds; here: sets of situations) to their unique individual correlate. These correlates are abstract individuals that are included in all world-members

relation *remember-obj* (see (31b)).

(31) a. $[\![\text{remember}_{CONT}]\!]^i = \lambda p \lambda x [\text{remember}_i(x, \lambda j \exists f. j \leq \langle w_{fc(S)}, t_{fc(S)} \rangle \wedge p(j))]$

    b. $[\![\text{remember}_{OBJ}]\!]^i = \lambda p \lambda x [\text{remember-obj}_i(x, {}^{\cap}p)]$

The coerced reading of remember is triggered by an incompatibility between the constraint profiles of the verb remember and the DP (e.g. (1b)), or by an alternative (i.e. 'object'-)reading of the argument (e.g. (9a); see (32a)). The alternative reading gives rise to a mismatch between the type of the content-reading of remember (i.e. $(\boldsymbol{st})(e(st))$; see (31a)) and the type of its complement (type *e*). It requires a re-interpretation of remember along the lines of (31b). The objectivization effect is then explained through the following stipulation:

(32) a. *When a DP/CP-neutral attitude verb combines with a CP nominalization that is* compatible *with the constraint-profile of the verb (e.g. (4b)), it has as its salient interpretation an interpretation of the form of (31a), and can be assigned an alternative (non-salient) interpretation of the form of (31b);*

    b. *When a DP/CP-neutral attitude verb combines with a CP nominalization whose constraint-profile is* in*compatible with the constraint-profile of the verb (see (1b)), it is assigned an interpretation of the form of (31b).*

The above yields the interpretation of stylized variants of (1b) and (25) as (33) and (34), respectively, and predicts the ambiguity of (4b) between the salient interpretation (35a) (see (18)) and the alternative interpretation (35b):

(33) $[\![\text{Pat remembers } [_{DP} \text{the proposition } [_{CP} \text{that } p]]]\!]^i$
$= [\![\text{Pat remembers}_{OBJ} [_{DP} \text{the proposition } [_{CP} \text{that } p]]]\!]^i$
$= \text{remember-obj}_i(\text{pat}, {}^{\cap}(\lambda j.\boldsymbol{prop}_j(\boldsymbol{p})))$

(34) $[\![\text{Pat remembers } [_{DP} \text{the possibility } [_{CP} \text{that } p]]]\!]^i$
$= [\![\text{Pat remembers}_{OBJ} [_{DP} \text{the possibility } [_{CP} \text{that } p]]]\!]^i$
$= \text{remember-obj}_i(\text{pat}, {}^{\cap}(\lambda j.\boldsymbol{i} \prec \boldsymbol{j} \wedge \boldsymbol{p}(\boldsymbol{j})))$

(35) $[\![\text{Pat remembers } [_{DP} \text{the fact } [_{CP} \text{that } p]]]\!]^i$
    a. $[\![\text{Pat remembers}_{CONT} [_{DP} \text{the fact } [_{CP} \text{that } p]]]\!]^i$
$= \text{remember}_i(\text{pat}, \lambda j \exists f. j \leq \langle w_{fc(S)}, t_{fc(S)} \rangle \wedge p(j))$
$= [\![\text{Pat remembers } [_{CP} \text{that } p]]\!]^i$

    b. $[\![\text{Pat remembers}_{OBJ} [_{DP} \text{the fact } [_{CP} \text{that } p]]]\!]^i$
$= \text{remember-obj}_i(\text{pat}, {}^{\cap}(\lambda j.\boldsymbol{j} \leq \boldsymbol{w_i} \wedge \boldsymbol{p}(\boldsymbol{j})))$
$\neq [\![\text{Pat remembers } [_{CP} \text{that } p]]\!]^i$

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of the nominalized proposition. Potts (2002: 57–58) uses such correlates to interpret nominals like the proposal that we destroy Alaska's priceless wilderness. In Potts (2002), this DP is interpreted as $\iota x[\text{proposal}(x) \wedge x = {}^{\cap}(\lambda i.\text{destroy}_i(\text{we}, \text{alaska}))]$.

Note that the interpretations from (33) to (35) preserve the intuitive difference between remembering a proposition, remembering a fact (on the object-reading), and remembering a possibility. As desired, these interpretations support the intuitive *in*validity of the substitution in (1) (which exemplifies Moltmann's objectivization effect) and the validity of the inferences from (4a) and (5a) to the salient readings of (4b) (see (8a)) and (5b). At the same time, they explain the possible invalidity of the inference from (4a) to (4b) (namely, on the alternative reading of (4b); see (9a)).

This completes our account of the objectivization effect. We close this paper by presenting some challenges for the proposed account that have been mentioned in the literature and by sketching initial answers to these challenges. The detailed development of these answers is left as a project for future work.

5. Objections and replies

Seeming challenges to our account include the observation that some DP/CP-neutral factive verbs (e.g. see, hear) do not allow complements of the form 'the fact $[_{CP}$]' (see Moltmann, 2015), that some attitude verbs (e.g. predict, require) only allow a substitution by descriptions of entities other than propositions, facts, or possibilities (see Asher, 1993; Elliott, 2016), and that close relatives of our account (e.g. Asher, 1993; King, 2002, 2007; Parsons, 1993) are unable to explain the possibility of simultaneously quantifying over the object DPs of different attitude verbs. The last-mentioned problem is sometimes called *the problem of doxastic shift* (see Moffett, 2003). We discuss each of these challenges below:

5.1. Challenge 1: non-fact factive complements

Our account interprets factive verbs (e.g. remember) as verbs that restrict the choice function f to situations that are located in the world $w_@$, and interprets DPs of the form 'the fact $[_{CP} p]$' as sets of informational approximations of $w_@$ in which p is true (see Sect. 3.1). These interpretations are challenged by the observation that some factive verbs (esp. perception verbs like see[19] and hear) resist the truth-preserving substitution of their CP complement by a DP of the form 'the fact $[_{CP}$]' (see (3a), copied in (36a); cf. (37)). Example sentence (37) is due to Moltmann (2015):

(36) a. Pat sees $[_{CP}$ that Bill is waiting for her].
      b. #Pat sees $[_{DP}$ the fact $[_{CP}$ that Bill is waiting for her]].
(37) a. Bill heard $[_{CP}$ that Mary was next door].
      b. #Bill heard $[_{DP}$ the fact $[_{CP}$ that Mary was next door]].

We propose to explain the above substitution-resistance through the selectional restrictions of the matrix factive verb. This proposal is based on the observation that the described substitution-

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[19] The factivity of see is evidenced by the observation that the truth-at-@ of the visual perception report (36a) entails the truth-at-@ of the report's CP complement. It is further evidenced by the observation that the factive presupposition of see is preserved under negation, such that (‡a) still entails (‡b):

(‡) a. Pat does not see $[_{CP}$ that Bill is waiting for Pat].
   ⇒ b. Bill is waiting for Pat.

resistance is restricted to the complements of verbs whose selectional restrictions exclude abstract object-denoting complements (for see) or non-physical object-denoting complements (for hear). This observation suggests the following addition to our account of DP/CP substitution behavior from Section 3.1:

(38)   a.   *In the complements of factive verbs whose selectional restrictions* admit *abstract object-denoting complements, a CP allows for the truth-preserving substitution by a DP of the form 'the fact* [CP]*';*

       b.   *In the complements of factive verbs whose selectional restrictions* exclude *abstract object-denoting complements, this substitution is not licensed.*

5.2. Challenge 2: the need for other content DPs

The presented account of the substitution problem is further challenged by the observation that some DP/CP-neutral attitude verbs (e.g. predict, overhear) restrict the substitution of their CP complement to DPs like 'the result/outcome [CP]' or 'the rumor/gossip [CP]' (see Elliott, 2016; Moltmann, 2015; cf. Asher, 1993).

(39)   a.   Pat predicted [CP that Bill would be disappointed].
       b. $^{??}$Pat predicted [DP the fact [CP that Bill would be disappointed]].
       c. $^{\checkmark}$Pat predicted [DP the result/the outcome [CP that Bill would be disappointed]].

(40)   a.   Mary overheard [CP that Bill had a crush on Pat].
       b. $^{\#}$Mary overheard [DP the fact/the possibility [CP that Bill had a crush on Pat]].
       c. $^{\checkmark}$Mary overheard [DP the rumor/the gossip [CP that Bill had a crush on Pat]].

Since some of these verbs and DPs (e.g. 'overhear', 'the rumor [CP]') intuitively do not show the kind of temporal or 'world-specific' properties that have been used to explain the substitutivity with DPs of the form 'the fact [CP]' or 'the possibility [CP]', they pose a potential challenge to our account.

We propose to solve this challenge by exploiting other relevant semantic properties of the above verbs. In particular, we claim that predict and overhear are still sufficiently systematic to have a 'verb-relevant' constraint-profile. The associated interpretations of the DP shells the outcome and the rumor are given in (41) and (42), respectively, where '$said_j(p)$' := 'p is uttered at j', '$action_@(\sigma)$' := 'σ is an action or event that takes place in @', and '$cause_j(p,\sigma)$' := 'σ brings it about that p is true at j'. The latter implies that σ temporally precedes j, i.e. $\sigma \prec j$.

(41) $[\![\text{the outcome}]\!] = \lambda p \lambda j [p(j) \wedge (\exists \sigma^s. action_@(\sigma) \wedge cause_j(p,\sigma))]$
(42) $[\![\text{the rumor}]\!] = \lambda p \lambda j [said_j(p)]$

The above interpretations capture the resultative factive nature of outcomes and the verbal non-factive nature of rumors.

We assume that the choice function for predict is constrained by the condition $\lambda j [@ \prec j]$ (i.e. predictions are restricted to possible future situations or events) and that overhear has the in-

terpretation from (45). As a result of its constraint, the interpretation of predict from (43) is equivalent to (44):

(43) $[\![\text{predict}]\!]^i = \lambda p \lambda x [predict_i(x, \lambda j \exists f. j \leq \langle w_{fc(S)}, t_{fc(S)} \rangle \wedge p(j))]$

(44) $\equiv \lambda p \lambda x [predict_i(x, \lambda j \exists f. (j \leq \langle w_{fc(S)}, t_{fc(S)} \rangle \wedge \boldsymbol{i \prec j}) \wedge p(j))]$

(45) $[\![\text{overhear}]\!]^i = \lambda p \lambda x [overhear_i(x, \lambda j \exists f. j \leq \langle w_{fc(S)}, t_{fc(S)} \rangle \wedge p(j))]$
$\equiv \lambda p \lambda x [overhear_i(x, \lambda j \exists f. (j \leq \langle w_{fc(S)}, t_{fc(S)} \rangle \wedge$
$(\boldsymbol{\exists y. \textit{is-a-sound-indicative-of}_j(y, p)})) \wedge p(j))]$

The above interpretations explain the semantic acceptability (or 'naturalness') of (39c) and (40c), and the semantic deviance of (40b). Notably, the constraint-profile of predict also explains the possibility of combining predict with 'the possibility [$_{CP}$]'. This is due to the identity of the constraint-profiles of predict (see (44)) and the possibility (i.e. $\lambda j [@ \prec j]$, see (21)).

5.3. Challenge 3: the problem of doxastic shift

Our account of the DP/CP substitution behavior uses a formal version of Moltmann's Unique Determination Property (UDP) of clausal complements (see Moltmann, 2013: 129). This Property assumes that the semantic value of a CP varies with the attitude verb that takes this CP as its complement. Depending on its embedding attitude verb, a CP will thus denote a *fact* (in the complement of past-oriented factive verbs like remember; cf. Parsons, 1993; Kiparsky and Kiparsky, 1970), a *possibility* (in the complement of negative future-oriented verbs like fear), a *proposition* (in the complement of mental action verbs like believe), or some other proposition-like object. UDP is further supported by different versions of the *ambiguity thesis* about CPs. This thesis asserts a semantic ambiguity (or polysemy) of CPs between propositions, facts, possibilities, and other proposition-like objects. Different versions of the ambiguity thesis have been proposed by Asher (1993), Parsons (1993), Moffett (2003), and King (2002, 2007).

For many ambiguity accounts, the semantic variation of CPs with their embedding verb gives rise to the problem of *doxastic shift* (see Moffett, 2003). This problem describes the inability of these accounts to explain the possibility of simultaneously quantifying over the objects of different attitudes[20] (see (46a–c); cf. Harman, 2002; King, 2002: 355) and of embedding a CP under the result of coordinating two attitude verbs (see (47)). In particular, on these accounts, there are no objects that serve both as the content of Pat's fearing and of Mary's believing (i.e. $\neg \exists p. \exists i. fear_i(pat, p) \wedge believe_i(mary, p)$): any object (here: a possibility) that would qualify as a suitable content of Pat's fearing would disqualify as a content of Mary's believing. Inversely, any object (here: a proposition) that would qualify as a suitable content of Mary's believing would disqualify as a content of Pat's fearing.

(46) a. Pat fears what Mary believes.
b. Pat fears something/everything (that) Mary believes.
c. Pat fears the proposition that Mary believes.

(47) Mary believes, and Pat fears, that Bill will try to hug Pat.

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[20]Moltmann (2015: 9) describes this possibility as *cross-attitudinal quantification*.

Our account avoids the above problem by distinguishing the semantic contribution of an attitudinally embedded DP (or CP) (in the existential case of (46b): the interpretation of the quantifier something, i.e. $(\exists)p$) from the interpretation of this DP as the argument of the different attitude verbs (i.e. $\lambda j \exists f. j \leq \langle w_{fC(S)}, t_{fC(S)} \rangle \wedge p(j)$ (as the argument of *fear*) and $\lambda j. prop_j(p)$ (as the argument of believe)). The identification of the semantic contribution of the DP something to the interpretation of the complements of fear and believe enables quantification over the (propositional) content that is common to propositions and possibilities (or facts) (see (48)):

(48) $[\![$Pat fears $[_{DP}$ something Mary believes$]\!]^i$
$= \exists p \, [fear_i(pat, \lambda j \exists f. j \leq \langle w_{fC(S)}, t_{fC(S)} \rangle \wedge p(j)) \wedge believe_i(mary, p)]$
$\equiv \exists p \, [fear_i(pat, \lambda j \exists f. j \leq \langle w_{fC(S)}, t_{fC(S)} \rangle \wedge p(j)) \wedge believe_i(mary, \lambda k. prop_k(p))]$
$=$ one of the possibilities that Pat fears has the same content as one of the propositions that Mary believes

Since abstract object DPs always make the same semantic contribution, our account also gives a suitable interpretation of (46c) (in (49)):

(49) Pat's fearing has as its *object* the proposition that is the *content* of Mary's believing
$= \exists p. prop_i(p) \wedge [fear\text{-}\textbf{obj}_i(pat, {}^{\cap}(\boldsymbol{\lambda j. prop_j(p)})) \wedge believe_i(mary, \boldsymbol{\lambda j. prop_j(p)})]$

The incompatibility of the contraint-profiles of proposition and fear excludes the interpretation of 'content/content'-readings of the above report (see (50); cf. (28)):

(50) $^{\#}$Pat's fearing has as its *content* the proposition that is (also) the content of Mary's believing
$= \exists p. prop_i(p) \wedge [fear_i(pat, \boldsymbol{\lambda j \exists f. j} \leq \langle \boldsymbol{w_{fC(S)}, t_{fC(S)}} \rangle \wedge \boldsymbol{prop_j(p)}) \wedge$
$believe_i(mary, \boldsymbol{\lambda j. prop_j(p)})]$
$\equiv \exists p. prop_i(p) \wedge [fear_i(pat, \boldsymbol{\lambda j. \perp}) \wedge believe_i(mary, \boldsymbol{\lambda j. prop_j(p)})]$
$=$ Pat's fearing has a *different* content from Mary's believing

6. Outlook

In this paper, we have developed a uniform account of the different phenomena that surround the substitution of CP complements by DPs of the form 'the proposition/fact/possibility $[_{CP}\ ]$'. These phenomena include the observation that different DP/CP-neutral attitude verbs restrict the substitution of their CP complement to different DPs and that – depending on the identity of the substituted DP – the substitution of a CP by a DP may effect a semantic shift (i.e. objectivization) of the semantic attitude complement. Our investigation of this shift has identified a new (sub-)class of instances of Moltmann's *objectivization effect* (see (9b) $\Rightarrow$ (9a)).

This paper has taken as its point of departure the non-substitutivity of CPs with DPs of the form 'the proposition $[_{CP}\ ]$' (i.e. Prior's *substitution problem*). However, our considerations from this paper have shown that the substitution of CP complements with DPs other than 'the proposition $[_{CP}\ ]$', e.g., with 'the fact $[_{CP}\ ]$', 'the possibility $[_{CP}\ ]$', or 'the rumor $[_{CP}\ ]$', is fairly well-attested: even verbs (e.g. believe, prove) which are commonly predicted to select for DPs of the form 'the proposition $[_{CP}\ ]$' (see (10)) much more frequently combine with other CP nominalizations. Thus, on January 18, 2019, a Google search of the string 'believe the proposition

that' only yielded 593 hits, while a search of the strings 'believe the fact that' and 'believe the rumo(u)r that' yielded 19.400 hits and 162.300 hits, respectively.

We take these findings to suggest that the historical focus on Prior's substitution problem has distracted research on DP/CP substitution from more productive linguistic phenomena (e.g. the above successful substitutions). We leave the experimental and/or corpus-linguistic study of these phenomena as a project for future research.

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