Homogeneity and universal quantification in embedded questions[1]

Dominique BLOK — *University of Potsdam*
Jordan CHARK — *Leibniz-Zentrum Allgemeine Sprachwissenschaft (ZAS)*

Abstract. Based on experiments carried out in three languages (German, Dutch, Ulster English) we provide evidence for the claims that question-internal universal quantifiers (*who all*) can be made at-issue and collapse homogeneity in embedded contexts. We show that these question quantifying particles can be accounted for in a domain restriction analysis (Brisson, 2003). Couched within the account of homogeneity provided in Križ and Spector (2020), homogeneity removal follows as a result of these particles flattening the alternatives which enter into the computation of homogeneity.

Keywords: embedded questions, homogeneity, universal quantifiers, exhaustivity

1. Introduction

In several different languages, universal quantifiers can be used in questions and, as will be the focus of this paper, in embedded questions. This can be seen in the examples in (1)-(3) for Dutch, German, and Ulster English respectively.[2]

(1) Joanne weet wie er   allemaal een slang heeft gezien.
     Joanne knows who there all   a   snake has   seen.
     'Joanne knows who all saw a snake.'

(2) Joanne weiß, wer alles eine Schlange gesehen hat.
     Joanne knows who all a   snake   seen   has.
     'Joanne knows who all saw a snake.'

(3) Joanne knows who all saw a snake.

These universal quantifiers have been argued to remove the homogeneity meaning component of these sentences (Križ, 2015), i.e. the property of having a truth value only if the predicate holds for either all or none of the elements in the embedded clause. For instance, (3) receives a truth value only if Joanne knows of the entire set of people who saw a snake that they saw a snake or if she does not know of any snake-seers. If she has partial knowledge, the sentence is neither true nor false.

However, there is some disagreement about the exact status of universal quantifiers in embedded questions, particularly in the literature about the German version *alles*. Reis (1992) claimed that *alles* cannot be focused or made at-issue in these contexts. By contrast, Beck and Rullmann (1999) provide an account of *alles* in which the expression functions as an overt instantiation of their *answer1* operator, thereby explicitly allowing it to contribute to the at-issue content.[3]

To resolve this disagreement and to test whether universal quantifiers in embedded questions

[2]Ulster English is a dialect of English spoken in large parts of Northern Ireland (Henry, 2012; McCloskey, 2000).
[3]This operator returns the set of complete true answers, yielding a weakly exhaustive reading.

indeed break homogeneity, we ran an experiment on German *alles* where *alles* occurred with negation, as in (4).

(4)   Linda weiß   nicht, wer #(alles) Fahrräder gestohlen hat, aber sie weiß, dass Erika
            Linda knows not,   who #(all)   bikes   stolen   has, but she knows that Erika
            Fahrräder gestohlen hat.
            bikes   stolen   has.
            Linda doesn't know who (all) has stolen bikes, but she knows that Erika has stolen
            bikes.

Here the sentence without *alles* is expected to be semantically deviant: if Linda knows that Erika has stolen bikes, it seems at best incomplete and at worst false to state that she does not know who has stolen bikes. This is a result of the homogeneity property of the first conjunct: if Linda does not know who has stolen bikes, it follows from homogeneity that there is not a single person who Linda knows who has stolen bikes. This is contradicted by her knowledge that Erika has stolen bikes.

If *alles* indeed causes this homogeneity to be removed, then (4) with *alles* is expected to be felicitous. In that case, the first part of the sentence means that it is not the case that Linda knows for everyone in the domain whether they have stolen bikes or not. This is perfectly compatible with her knowing that Erika has stolen bikes. Furthermore, if the sentence with *alles* is indeed felicitous, it means that *alles* can be targeted by the negation *nicht*, thereby indicating that it does contribute to the at-issue content of the sentence.

We repeated this experiment in Dutch and Ulster English to make sure that it is indeed the role of the universal quantifiers in general that has this effect rather than an idiosyncrasy of German *alles*. We found that sentences like (4) with a universal quantifier were indeed judged as more acceptable by our participants than their equivalents without a universal quantifier, confirming our hypothesis that the universal quantifier contributes to the at-issue meaning and that it does so by removing the homogeneity requirement.

We tested sentences with *know* as well as sentences with two other question-embedding predicates: *forget* and *surprise*. We did this because these predicates differ in their monotonicity and distributivity properties, which we will have more to say on in section 2, where we will also discuss Križ's theory about the homogeneity properties of universal quantifiers in embedded questions. In section 3 we will discuss the design and results of the three experiments we ran. Our conclusions will be discussed in section 4, and we will provide a theory of universal quantifiers in embedded question in section 5. Our main point will be that these universal quantifiers limit the contextual covers of the interpretation to those that contain every mereological part of the plurality.

2. Theoretical background

2.1. Homogeneity in embedded questions

Križ (2015), building on work by Dayal (1996) and Gajewski (2005) notes a parallel between the behaviour of expressions containing definite plurals and embedded questions (see also Cremers 2018). Both, he argues, can be said to have the property of homogeneity, and in both cases this homogeneity property can be removed by using a universal quantifier. We will give

an overview of the data Križ describes here, leaving a more detailed discussion of the semantics of these expressions for the discussion section.

To see the parallel between definite plurals and embedded questions, first consider (5).[4]

(5)   Mr. Benfleet published the books.
      true iff Mr. Benfleet published all of the books.
      false iff Mr. Benfleet published none of the books.
      undefined otherwise (i.e. he published some but not all of the books)

Here the trivalent truth conditions capture the homogeneity property the definite plural gives rise to: the sentence only receives a truth value if Mr. Benfleet published either all or none of the books. When we insert the universal quantifier *all*, as in (6), the false and undefined truth values collapse.

(6)   Mr. Benfleet published all the books.
      true iff Mr. Benfleet published all of the books.
      false iff there is at least one book that Mr. Benfleet did not publish.
      undefined never

That is, (6) does not have the homogeneity property that (5) has: it receives a truth value regardless of whether Mr. Benfleet published all of the books, none of the books, or some but not all of the books.

The same pattern can be observed with embedded questions. Consider (7).

(7)   Agatha knows who came.
      true in *w* iff in all of Agatha's belief worlds, all the people who came in *w* came
      false in *w* iff in at least one of Agatha's belief worlds, none of the people who came in *w* came
      undefined otherwise

Here we see the homogeneity property in the embedded question *who came*. Assuming a weakly exhaustive reading, knowing who came means knowing that the maximal plurality of people who came, in fact, came. Thus, the sentence is true if Agatha knows this maximal plurality, false if she considers a possibility where it is not true that this maximal plurality of people came, and undefined otherwise. This means that if Agatha only has partial knowledge of the collection of people who came, the sentence does not receive a truth value. This is similar to (5), where the sentence does not receive a truth value if Mr. Benfleet published only a portion of the books.

Now let us turn to (8), which is a grammatical sentence in Ulster English.

(8)   Agatha knows who all came.
      true in *w* iff in all of Agatha's belief worlds, all the people who came in *w* came
      false in *w* iff in at least one of Agatha's belief worlds, at least one of the people who came in *w* did not come
      undefined never

---

[4]All examples in this section come from Križ (2015).

Here we observe the same process as in (6): the insertion of a universal quantifier removes the homogeneity of the sentence. Again, falsehood and undefinedness have been collapsed. Like (6), (8) always has a truth value, regardless of whether or not Agatha knows of the complete set of people who came that they, in fact, came.

Križ's observations correspond to our own judgments of the data in Dutch and German given in the introduction. Therefore, our hypothesis of the meaning of universal quantifiers in embedded questions is exactly this: that they function as homogeneity removers. We will describe the way in which we tested this in section 3. First, however, we will have more to say about the three question-embedding predicates we used in our experiment.

2.2. Question-embedding predicates

We chose to include the question-embedding predicates *know*, *forget*, and *surprise* in our experiment because of their differing monotonicity and distributivity properties.

First, *know* is distributive and upward monotone. We expected (4), repeated below, to be infelicitous without the universal quantifier and felicitous with it. As explained in the introduction, this is because Linda's knowledge that Erika stole bikes contradicts the homogeneous reading of the first conjunct, namely that Linda does not know for anyone whether they stole bikes or not. With *alles* and therefore without homogeneity, it is possible for Linda to have partial knowledge of the set of bike-stealers, and therefore she can know that Erika has stolen bikes.

(4)   Linda weiß   nicht, wer #(alles) Fahrräder gestohlen hat, aber sie weiß, dass Erika
         Linda knows not, who #(all)   bikes   stolen   has, but she knows that Erika
         Fahrräder gestohlen hat.
         bikes   stolen   has.
         Linda doesn't know who (all) has stolen bikes, but she knows that Erika has stolen bikes.

Forget is distributive and downward monotone. For this reason, we also tested sentences with negation in the second conjunct, such as the Dutch example given in (9).

(9)   Sanji is vergeten wie er   #(allemaal) een marathon gerend hebben, maar hij is niet
         Sanji is forgot   who there #(all)   a   marathon run   have,   but he is not
         vergeten dat Nami een marathon gerend heeft.
         forgot   that Nami a   marathon run   has.
         'Sanji forgot who (all) has run a marathon, but he didn't forget that Nami has run a marathon.'

Without *allemaal*, (9) is expected to be bad. As a result of homogeneity, the first conjunct means that Sanji does not remember for anyone whether they ran a marathon or not. The second conjunct conveys that he does remember that Nami ran a marathon, which contradicts the first. Exactly as in (4), *allemaal* removes homogeneity and renders the sentence felicitous. The meaning with *allemaal* is that Sanji does not remember for everyone whether they ran a marathon or not, but he remembers that Nami did. Thus, being downward monotone, *forget* is the mirror image of *know*.

The third predicate we included is *surprise*, which has the interesting property of being non-

distributive (Sharvit, 2002, 2004; Lahiri, 2002; Cremers, 2018). For instance, for (10) to be true, it is not necessary for Sanji to be surprised about everyone who had run a marathon. In fact, it suffices that he was surprised about only one marathon-runner.

(10)   It surprised Sanji who had run a marathon.

(10) not only shows that *surprise* is non-distributive, it also illustrates the related fact that the predicate does not give rise to homogeneity effects. Clearly, given that (10) is true if Sanji was only surprised about one person who had run a marathon, it follows that the meaning of (10) is not homogeneous. Furthermore, *surprise* is not upward entailing (so it is either downward entailing or non-monotone; see Cremers 2016 and references cited therein).

As a result of these properties, (11) is expected to be fine both with and without *all*.

(11)   Christian is surprised who (all) made their own clothes, but he is not surprised that Marius made his own clothes.

Without *all*, the first conjunct conveys that Christian is surprised about at least one person making their own clothes, which does not contradict his lack of surprise that Marius made his own clothes. With *all*, *surprise* has been argued to be about some remarkable property of the group (Theiler, 2014). Thus, 'Christian is surprised who all made their own clothes' means that Christian is surprised by the composition of people who made their own clothes, perhaps the number or the specific combination of individuals. This does not contradict him not being surprised about Marius making his own clothes.[5]

Interestingly, we do seem to observe a homogeneity effect when *surprise* occurs in the scope of negation, as in (12).

(12)   Christian is not surprised who (all) made their own clothes, but he is surprised that Marius made his own clothes.

(12) appears to pattern with (4) in that without *all*, the first conjunct suggests that Christian is not surprised about any of the people who made their own clothes, which contradicts the second clause. Just like we observed for (12), *all* improves the sentence. With *all*, the first conjunct expresses that Christian is not surprised about every person who made their own clothes, which does not contradict him being surprised about Marius making his own clothes. However, our introspective judgments about sentences like (12) are less strong than those about their equivalents with *know*, like (4). In addition, from a theoretical standpoint it is not clear why there would be a homogeneity effect only when the predicate is embedded under negation.

In sum, the distributive predicates *know* and *forget*, with their opposing monotonicity, are predicted to be mirror images of one another, displaying homogeneity effects that can be removed by a universal quantifier. *Surprise* is a bit of a wildcard: from a theoretical standpoint there is no reason to believe that the presence or absence of a universal quantifier would make a difference, given that *surprise* is neither distributive nor homogeneous. However, our introspective judgments do suggest a homogeneity effect when *surprise* occurs in the scope of negation.

---

[5]More specifically, there are three readings: two weakly exhaustive (one of which is distributive and the other is not; later on I refer to these as *WEdist* and *WEnondist* respectively) and one strongly exhaustive (*SE*), which is the overall composition reading.

3. Experiments

3.1. Experimental set-up

All three experiments had exactly the same experimental design: a 3x2x2 Latin square design with the factors predicate (*know*, *forget*, *surprise*), the universal quantifier, which was either present or absent, and negation, which occurred either in the first or in the second conjunct. The sentences were presented out of the blue with the question *Does this sentence make sense*? We chose a forced choice design rather than a scale, where the participants simply had to answer 'yes' or 'no'. There were 48 test items (16 per predicate) and 48 fillers, resulting in a total number of 96 items.[6] The fillers also contained contradictory and good controls. The items were presented after a practice round containing a coherent sentence, a coherent but unlikely sentence, and a contradictory sentence.[7]

The main predictions were as follows:

- For *know*, the [+all, neg1] condition was predicted to be better than the [-all, neg1] condition. For instance, (4) was predicted to be better with than without *alles*.

- For *forget*, the [+all, neg2] condition was predicted to be better than the [-all, neg2] condition. For instance, (9) was predicted to be better with than without *allemaal*.

- For *surprise*, the [+all, neg1] condition was predicted to be better than the [-all, neg1] condition. For instance, (12) was predicted to be better with than without *all*.

In summary, the main prediction for all predicates was that *all* would remove the homogeneity of the first clause, thus also removing the contradiction between the first and the second clause of the items.

3.2. Results

The Dutch results are given in Table 1 and in Figure 1.[8] The numbers represent the proportion of *yes* answers per condition. The boxplots were obtained by calculating the proportion of *yes* answers in each condition for every participant, and then deriving the means and standard deviations from those numbers.

We ran a generalised linear mixed model on these data and found a main effect for *all* for all predicates ($p<.001$).[9] In addition, we looked at nested effects and found that there was a significant effect of [+/- all] in the [neg1] condition for *know* ($p<.001$), confirming our main hypothesis for *know* that [+all, neg1] is rated as better than [-all, neg1]. In the [neg2] condition,

---

[6]For the German experiment we had to remove two items with the predicate *forget* due to errors in the items, resulting in a total number of 94 items.

[7]Participants for Dutch and English were recruited on Prolific Academic and self reported as native speakers of the languages in question. The German participants were recruited via the University of Potsdam experimental participant pool and were all students at the time of the experiment. They also self reported as native speakers of German. Inattentive participants were excluded based upon a threshold of 75% accuracy on designated fillers.

[8]Schematically, the experimental conditions are as follows, they are presented in this order on the plots: **a.** [+all, neg1], **b.** [+all, neg2], **c.** [-all, neg1], **d.** [-all, neg2]

[9]For the nested models, we followed the procedure recommended in Schad et al. (2020). The complete stimuli and data can be found on OSF: `https://osf.io/agqk8/`.

	know	*forget*	*surprise*
[neg1, -all]	0.348	0.220	0.433
[neg1, +all]	0.841	0.329	0.591
[neg2, -all]	0.213	0.415	0.646
[neg2, +all]	0.189	0.707	0.774

Table 1: Proportion of *yes* answers per condition, Dutch experiment
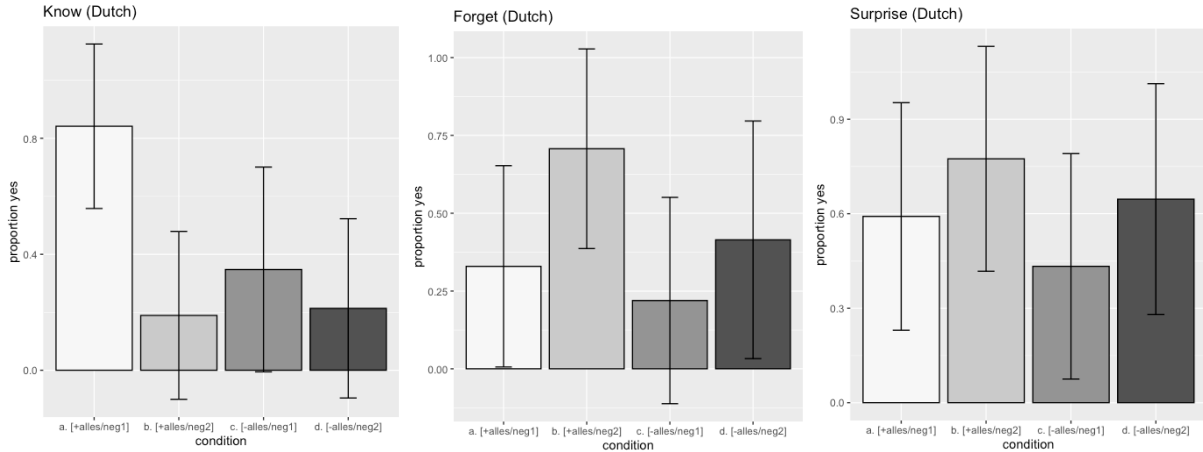

Figure 1: Dutch results for *know*, *surprise*, and *forget* respectively

there was no significant difference between [+all] and [-all]. For *forget*, we found that within the [neg2] condition, [+all] was rated significantly higher than [-all] (p<.001), which confirms our hypothesis about *forget*. Here the presence of *all* also had a significant effect in the [neg1] condition, albeit a smaller one (p<.01). Finally, [+/- all] (the difference between the two levels nested in the other condition) had a significant impact in both the [neg1] and [neg2] conditions for *surprise* (p<.001). This confirms the hypothesis that *all* improves sentences in the [neg1] condition, but it also does so in the [neg2] condition.

The English descriptive results can be found in Table 2 and Figure 2.[10]

	know	*forget*	*surprise*
[neg1, -all]	0.121	0.106	0.303
[neg1, +all]	0.750	0.197	0.432
[neg2, -all]	0.152	0.220	0.364
[neg2, +all]	0.061	0.561	0.561

Table 2: Proportion of *yes* answers per condition, English experiment

A separate generalised linear model was fitted to the English data for each embedder. We found a highly significant main effect of *all* under each of them (p<.001). We looked at nested effects in the English data and the results are as follows. For *know*, we found a significant effect of [+/-all] in the [neg1] condition (p<.001). In the [neg2] condition, no effect could be detected (p=.135). For *forget*, we found a significant effect of [+/-all] in [neg1] (p=.026) and a highly

---

[10]The English items were reviewed by a linguist who is a native speaker of Ulster English.
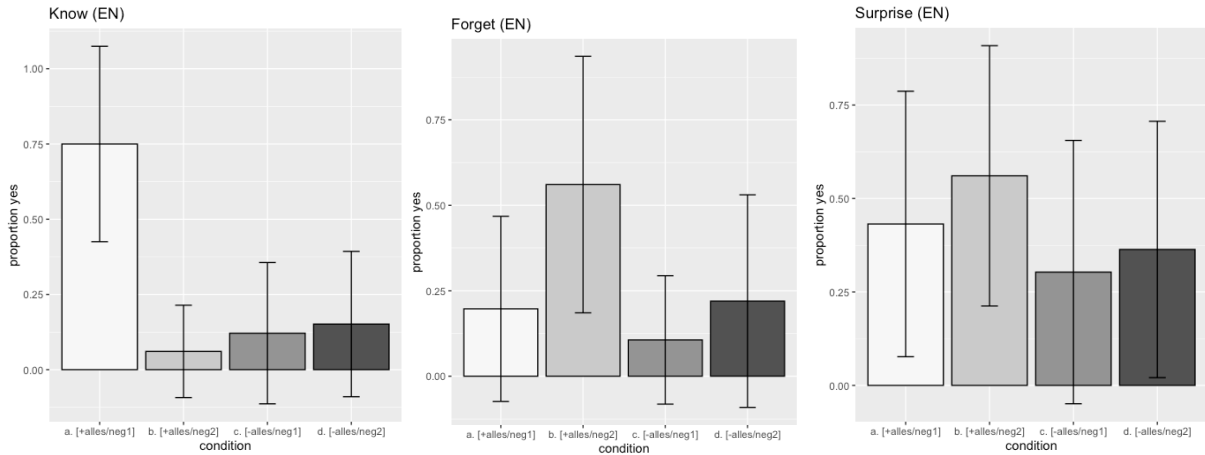
Figure 2: English results for *know*, *surprise*, and *forget* respectively

significant effect in [neg2] (p<.001). For *surprise* we found a significant effect in both [neg1] (p=.010) and [neg2] (p<.001).

Finally, the proportion of *yes* answers for the German experiment is given in Table 3, with the corresponding boxplots in Figure 3.

	know	*forget*	*surprise*
[neg1, -all]	0.129	0.118	0.339
[neg1, +all]	0.823	0.312	0.661
[neg2, -all]	0.210	0.261	0.452
[neg2, +all]	0.250	0.777	0.798

Table 3: Proportion of *yes* answers per condition, German experiment

For German, the overall models indicated a highly significant effect of *all* under each of the embedders (p<.001). The nested models revealed the following results. For *know*, a highly significant effect was found in [neg1] (p<.001) (corresponding to a difference between [+all] and [-all]), while no such difference was found for [neg2] (p=.743), in accordance with our predictions. Under *forget*, the difference between levels of [+/- all] was found to be significant in [neg1] (p=.037) and highly significant in [neg2] (p<.001). For *surprise*, the relevant comparison turned out to be highly significant in both [neg1] and [neg2] (p<.001 in both cases).

4. Discussion

The results of the nested models shown above confirm our main predictions in all three languages. For *know*, [+all, neg1] was found to be significantly better than [-all,neg1]. For *forget*, there was a significant difference between [+all] and [-all] in [neg2]. Finally, for *surprise*, both of the [+all] conditions came out significantly better than the corresponding [-all] conditions.

In order to put our experimental results into a wider context, in this section we discuss the interpretive effects of the embedding predicates under *all* (4.1), the matter of at-issueness (4.2), as well as the parallels between embedded interrogatives and plural definites with regard to homogeneity (4.3). The final section, section 5, provides an analysis of *all* as a domain restrictor
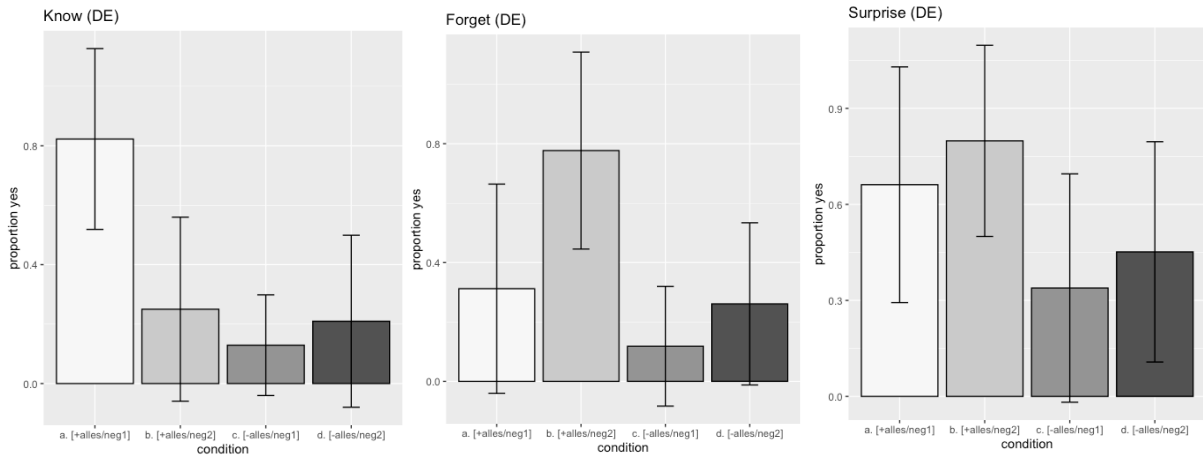
Figure 3: German results for *know*, *surprise*, and *forget* respectively

before elucidating how this results in homogeneity removal.

4.1. Interpretive effects

Before moving on to discuss at-issueness and homogeneity, in this subsection we briefly discuss the interaction of *all* and the three embedders in light of our experimental results, beyond the predictions discussed above in section 2.2. Firstly, the configuration *surprise w-all* can be made true on a few different readings, described in more detail below. Secondly, the configuration *know w-all* obligatorily results in a de-dicto reading. Finally, *all* seems to interact with the presuppositional content of *forget*.

4.1.1. Interpretive effects: surprise

Under *surprise*, *all* makes non-homogeneous readings available, which are otherwise more marked (Zimmermann, 2018).[11] Given our experimental setup, the non-distributive (and thereby non-homogeneous) reading *WEnondist* can be made true in the [+all, neg1] condition shown in (12), where surprise regarding at least one true answer is sufficient. Conversely, in the [+all, neg2] condition shown in (11), the object of surprise is the full list of true answers (*WEdist*). The *SE* reading, regarding the overall constitution of the answer, is entailed by both of these and is hence logically weaker (in this way, *SE* readings under *surprise* fundamentally differ from those under *know*, which are logically stronger). Peter can be surprised by the composition of the group that won the game if he is surprised by the full list of people who won the game, or by one (or more) game-winner and the negative extension. Zimmermann (2018) notes that one way to reason about the contribution of *all* in these cases is by assuming the *Strongest Meaning Hypothesis* (Dalrymple et al., 1998; Krifka, 1996); the *WE* readings are pragmatically preferred but the overtification of *alles* paves the way for *SE*.

Preliminary evidence of a markedness asymmetry can be found if we consider the [-alles, neg1]

---

[11]For more on the semantics of *surprise* see Guerzoni and Sharvit (2007); Sharvit (2002); Lahiri (2002); Cremers and Chemla (2017).

condition. On a truly homogeneous reading, which we predicted to find for *surprise* under the scope of negation based on introspection, this condition should have come out as contradictory. However, descriptively speaking this condition had better ratings for all three languages than the conditions involving other embedders which were correctly predicted to result in a contradiction due to homogeneity. While we expected that [-alles, neg2] could be made true on a non-distributive reading, the existence of a non-homogeneous reading under the scope of negation is especially theoretically interesting, as it provides evidence in favour of a *weak* semantics for *surprise* (Lahiri, 2002). A non-distributive semantics for *surprise* is otherwise challenged by the apparent homogeneity of *surprise* in negative contexts.[12]

4.1.2. Interpretive effects: know

Under *know*, *all* forces a de-dicto construal whereby *x* knows the complete answer and knows it is the complete answer (resolving to doxastically available worlds, the *SE* reading) (Theiler, 2014; Guerzoni and Sharvit, 2007). The epistemic access to a *complete* answer effectively prevents there from being any inconsistency between the knowledge state of the attitude holder and the state of affairs in the evaluation world (Zimmermann 2018). This is made clear in (13) (example due to Zimmermann 2018), where *knowing who-all* entails knowing the complete list of answers.

(13)   # Joe knows who all passed even if he does not know that it is the complete list.

4.1.3. Interpretive effects: forget

It would be desirable to account for the fact that the [+all, neg1] condition under *forget* did not turn out as badly as our baseline controls for contradictions. One avenue for explaining this is to appeal to an interaction between *all* and the presuppositions of *forget*. More specifically, we suggest that *all* may itself undergo local accommodation and be subject to presupposition cancellation under negation (Abrusán, 2016; Abrusán and Szendrői, 2013). Assuming, following Cremers (2018), that *forget* has a presupposition of prior non-false belief at a time *t'* preceding *t* and that this does not project past negation, there are two potential parses in this condition: the non-contradictory parse with cancellation in (14a) and the contradictory parse without it, shown in (14b).

(14)   a.   Peter has not forgotten who all won (because he did not previously know the exhaustive answer to who all won), but he has forgotten that Maria won (and he knew beforehand that Maria won).

        b.   Peter has not forgotten who all won (he previously knew and has since not forgotten the exhaustive answer to who won) but he has forgotten that Maria won.

In the [-all] cases, descriptively speaking [-all, neg2] came out better than [-all, neg1] in all three languages. Assuming presupposition cancellation, there is a non-contradictory parse:

---

[12]Under negation, the semantics for *surprise* in Lahiri (2002) comes out true iff for all doxastically accessible worlds compatible with past expectations w' it is not the case that there is one or more p which is false in w'. That is to say, not all alternative propositions are unexpected, as opposed to the homogeneous reading where no p is unexpected.

Peter previously knew and has since forgotten the full list of winners but he does (currently) know that Maria won (which he did not know previously).

4.2. At-issueness

One of the primary claims in this paper is that *all* can be made at-issue. We back this up with our experimental data demonstrating its visibility to negation cross-linguistically.[13]

For German *alles*, at-issueness represents a point of contention in the literature. Reis (1992) and Zimmmermann (2009) disagree as to whether *alles* can bear focus-accent and as a result be made part of the at-issue contribution. Reis argues that *alles* resembles modal particles in that it is syntactically clitic-like and claims that it can neither bear focus-accent nor be part of the truth-conditional meaning. It is, however, important to keep truth-conditionality and at-issueness separate. We additionally take it that ability to bear focus, generally speaking, entails at-issueness (Esipova, 2018).[14]

Zimmmermann (2009) contests the matter of focus-bearing ability by showing that quantifier particles in questions (henceforth QQPs: Zimmmermann 2007) have properties which instead resemble focus-sensitive operators. Adopting a structured propositions approach, which provides a formal relation between questions and focus semantics (Krifka, 2001), Zimmmermann demonstrates that *alles* must have access to the focused part of (the focus-background structure of) such structured propositions. In taking such an approach, he explicitly draws a parallel between QQPs and other operators which are considered more prototypically focus-sensitive like *only*. Under this view, QQPs can have focus-association by virtue of them making up a syntactic constituent with the wh-word, which are obligatorily focus-marked (Haida, 2008; Kotek, 2014). Zimmmermann (2009) proposes that *alles* can bear focus, though its meaning contribution is presuppositional.[15] We follow Zimmmermann (2009) and propose that QQPs can contribute to at-issue meaning without necessarily being truth-conditionally active.

4.3. Homogeneity and plurality in questions

In the context of homogeneity effects, it is illustrative to examine the parallels between definite plurals and embedded interrogatives. Before doing so in more detail, we outline our background assumptions regarding question composition.

We adopt a Hamblin-Karttunen approach to question composition (Hamblin, 1973; Karttunen,

---

[13]An anonymous reviewer points out that focus under negation is not usually considered to be a matter of truth-conditionality. While it is true that negation is not typically considered to be focus-sensitive in the same way that an exclusive such as *only* is, some researchers have indeed taken negation to exhibit *pragmatic focus-sensitivity* ("quasi-association with focus") (Beaver and Clark, 2008).

[14]This follows from the view that at-issueness constitutes relevance to the Question-Under-Discussion and that focus serves to make salient what the QUD is (Simons and Roberts, 2010).

[15]There is broader cross-linguistic evidence supporting the status of QQPs as focus-sensitive expressions. Zimmmermann (2009) mentions the QQP *dou* in Mandarin Chinese (Shin, 2007), which has the same distribution as focus-sensitive particles in the language: it must precede its associate and is subject to surface closeness constraints. Moreover, Zimmmermann (2009) points to data from Hausa, which has two separate QQPs *su* and *nee/cee* encoding plurality and exhaustivity respectively. The latter can also be shown to be focus-sensitive (Hartmann and Zimmermann, 2007). See Zimmermann (2007) for a summary of the relevant cross-linguistic facts.

1977): the denotation of questions is a set of propositional answers and wh-expressions are existential quantifiers analogous to *someone*, as shown in (15a).[16] In order for a Hamblin set to be derived, there needs to be a proto-question operator in the syntax as shown in (15b).[17] The wh-word quantifies into the identity relation resulting in a set characterized by the function in (15c) given the verb *came*.

(15) a. $[\![\text{who}]\!]^w = [\![\text{someone}]\!]^w = \lambda f_{e,t}.\exists x[\text{hmn}_@(x) \wedge f(x)]$
      b. $[\![?]\!] = \lambda q_{st}\lambda p_{st}.p = q$
      c. $\lambda p_{s,t}.\exists x[\text{hmn}_@(x) \wedge p = came_w(x)]$

We assume there is an *ANS*(werhood) operator present in both embedded and unembedded environments, shown in (16a), that takes Q (and the world of eval. *w)* as its arguments and returns the strongest/most informative proposition in *w*. The ι-operator resembles definite article applied to a plurality, illustrated in (16b) (Dayal, 1996).

(16) a. $ANS_w(Q) = \iota p \in Q[p(w) = 1 \wedge \forall q \in Q\ [q(w) = 1 \rightarrow p \subseteq q]]$
      b. $[\![\text{the *P}]\!] = \sigma x.[\![*P]\!](x)$
          $= \iota x.[[\![*P]\!](x) \wedge \forall y([\![*P]\!](y) \rightarrow y \leq x)]$

The discussion of homogeneity here draws on Cremers (2018) and Križ (2015). This view involves two primary assumptions:

1. Distributive predicates in combination with pluralities give rise to trivalent truth conditions.

2. The complement of question embedders is an algebraic object which is homomorphic to the domain of plural individuals. Homogeneity effects are found in both domains.

This first assumption has been discussed earlier on in this paper. As far as the second goes, the semi-lattice homomorphism between the question domain Q (with distributive predicates) and the domain of plural individuals can be illustrated as in (17). Homogeneity is a property of this algebraic object.

(17) a. $\langle D_e, \geq, \oplus \rangle$ to $\langle Q, \rightarrow, \wedge \rangle$
      b. $Q = [\![\text{Who came to the party?}]\!] = \lambda p.\exists x[\text{hmn}_@(x) \wedge p = came_w(x)] = \{came_w(x)$
          $\mid x \in \text{hmn}_@(x)\}$
      c. $[\![\text{Anna} \oplus \text{Benni came}]\!] \equiv [\![\text{Anna came}]\!] \wedge [\![\text{Benni came}]\!]$
      d. $a \oplus b \geq a$
      e. $[\![\text{Anna} \oplus \text{Benni came}]\!] \rightarrow [\![\text{Benni came}]\!]$

5. Analysis

In the following section, we advance an account of *all* as a domain restrictor. Its meaning contribution is to restrict the contextual covers made available in the interpretation such that the only viable covers are those which contain every member of the plurality with which *all* associates. First, in 5.1, we discuss non-maximality in plural predication. We sketch an account of *all* in subsection 5.2. In the subsection that follows, 5.3, we then show how homogeneity

---

[16]Here *hmn_@* abbreviates that the object of quantification is a human in the actual world.
[17]For more details on question composition along these lines see Rullmann and Beck (1998); Dayal (1996).

removal results from combining the domain restriction approach with the view of homogeneity in Križ and Spector (2020).[18]

5.1. Non-maximality

There are a few main analytical possibilities for *all*, at first glance (Fox, 2018): **(i)** *all* combines with a plural individual and outputs a generalised quantifier, or **(ii)** it is a function from a predicate of individuals to a predicate of individuals. Further possibilities would be to treat it as an overt distributor or overt exhaustivity operator, but it seems more appropriate to treat it as an operator which may optionally associate with a covert distributivity operator, given the collective-distributive ambiguity exhibited by *all* in the three languages. The analysis we pursue here takes a third route to derive homogeneity removal: domain restriction (in the domain of individuals). The conceptual motivation behind this is that *all*'s primary semantic contribution is (in the terms of de Vries 2019) "plurality enforcement". It makes non-maximal readings impossible.

The source of non-maximality in plural prediction is a matter of contention in the literature (Winter, 2001; Brisson, 1998). Given standard assumptions about how plural predication arises due to sum-closure of predicates, one would not predict to find a difference in interpretation between universal quantification and plural predication. This is contrary to fact, as shown in (18): (18b) does not allow for any exceptions though (18a) can be true even if there is a girl in the context who did not eat dinner.

(18)   a.   The girls ate dinner.
          b.   All the girls ate dinner.

There are a few existing solutions for accounting for non-maximality. On the one hand, it is possible to allow distributivity to apply only to relevant subdomains of the plurality, not necessarily down to atoms, utilising sub-partitions of the domain called *covers* (Schwarzschild, 1996). On the other hand, if as Winter (2001) argues, plural predication can *only* be maximal, non-maximality instead involves predication over what he terms *impure atoms*; conceptually plural (group-like) but semantically singular entities.

5.2. Contribution of *all*: local and maximal

In order to maintain a principled connection between non-maximality and homogeneity, we adopt a cover-based account. We will see that this move is advantageous for two reasons. First, it allows us to maintain the insights in Zimmmermann (2009) regarding the compositional mechanism of *alles* in German.[19] Due to the way in which this domain restriction comes about, *all* has access to the set of individuals corresponding to the question domain as well as (in the terms of Zimmmermann 2009) the backgrounded predicate. Second, this approach is amenable to the account of homogeneity in Križ and Spector (2020).[20]

---

[18]For more information on the relationship between homogeneity and non-maximality, see Križ and Spector (2020) and references therein.

[19]A shorter version of this analysis can be found in Zimmermann (2007).

[20]An approach to the semantics of *all*, which assumes that plural predication is inherently maximal, is provided in de Vries (2019): she argues that *all* prevents impure atomisation by lifting entities to their GQ denotations.

Why is it that we do not consider an approach where *all* operates over propositions? Zimmermann (2007) has argued against such an approach, demonstrating that the analysis in Beck and Rullmann (1999) does not stand up to empirical scrutiny. Beck and Rullmann (1999) provide an analysis of *alles* and *allemaal* as yielding the singleton set comprised of the conjunction of all true propositions in *w*. This analysis faces problems, however, when presented with instances of multiple *all* occurrences. The local association of *all* with the wh-item does affect the interpretation, which would be unexpected if *all* were to operate at the propositional level. Consider the data in (19) given in the context of a papal election where each cardinal has only one vote (Zimmermann, 2007). The only licit answer to (19) is a pair-list in which the maximal list of voters is named, and in such a context any other placement of *all* is infelicitous.[21]

(19)   Wer hat alles bei der gestrigen   Wahl   für wen   gestimmt?
        who has all   at   the yesterday's election for whom voted
        'Who all voted for whom in yesterday's election?'

On the basis of these data, we take it that *all* operates in the domain of individuals and is subject to strict locality conditions, namely an LF sisterhood constraint with the wh-item, resulting in co-indexation (Zimmermann, 2007).[22].

Zimmermann (2007) provides an account of German *alles* in a structured propositions approach (Krifka, 2001). This framework assumes a bi-partite structure for questions: a background predicate and the question domain (which is focused). On this analysis, QQPs modify the question domain, which is denoted by the wh-expression.[23] Zimmermann (2007) proposes that *alles* restricts the domain to (mereologically) maximal, divisible individuals (constituting a plurality requirement) which satisfy the background predicate. Both of these components are adopted in our analysis and further elucidated below.[24]

We claim that *all* maximizes in the domain of individuals by restricting the domain the VP has access to. Homogeneity arises as a consequence of plural predication and *all* collapses pluralities (Löbner, 2000; Križ, 2015; Križ and Spector, 2020; Schmitt, 2019). The way in which we achieve this compositionally is two-fold.

1. **Locality:** As evidenced earlier on in this section, *all* and the wh-item or trace are in a strictly local relationship. We assume that the wh-item can reconstruct into the question nucleus (Rullmann and Beck, 1998; Hirsch and Schwarz, 2019) and that *all* is obligatorily

---

[21]This holds for the Ulster English translation as well. For instance: Cardinal X voted for Ratzinger, cardinal Y for the African candidate...

[22]There is syntactic evidence for this from all three languages investigated, *all* always surfaces where it may be taken there is a lower copy of the wh-item, under a successive cyclic approach (Koopman, 2010; Henry, 2012).

[23]It is nonetheless important to note that this account is not *strictly* local in the sense of strict compositionality: the QQP here modifies the question domain, but it does not directly modify the wh-expression. Zimmmermann (2009), moreover, argues convincingly against other more strictly compositional accounts. It does not appear viable to treat QQPs as wh-modifiers of type $\langle et, et \rangle$ (modifying wh-indefinites), since in such a configuration the QQP is too low to access the backgrounded predicate. An account of QQPs as quantificational determiners of type $\langle et, ett \rangle$ is also not satisfactory: they exhibit no agreement effects and also co-occur with *which*-phrases. Finally, there is a potential line of analysis where wh-expressions themselves are type $\langle et, et \rangle$ and QQPs are $\langle \langle et, et \rangle \langle et, et \rangle \rangle$, which Zimmmermann (2009) considers undesirable citing a lack of independent motivation for analyzing wh-expressions as predicative modifiers.

[24]The background predicate constitutes the lambda abstracted remainder, not including the wh-item, which then is applied pointwise to members of the question domain to derive a set of propositions.

the sister of this wh-item at LF (Zimmermann, 2007). For lack of space, we do not discuss the syntactic details and instead refer the reader to Hirsch and Schwarz (2019); the sets of propositions we provide (comprising the Hamblin set) assume that the overt wh-word reconstructs into the question nucleus and is existentially bound higher up by a covert element.

2. **Contribution:** *all* constrains the kinds of covers the VP has access to by imposing a *good fit* requirement (Brisson 2003), defined iff the question domain contains divisible non-atomic individuals (Zimmermann 2007). This definedness condition accounts for the fact that *all* is only licit if it can be presupposed that there is a plurality of individuals in the domain.

Following Brisson (1998), we assume that *all* in questions shares its denotation with *all* in other environments. It is not a modifier at the level of truth-conditions, but rather it imposes restrictions on which construals are viable for interpretation, by operating over contextually determined covers of the domain.[25] The cover variable is supplied by a cover-sensitive distributivity operator, which we assume is a VP modifier (Schwarzschild, 1996). The distributivity operator quantifies over parts of the plurality, which are, as previously mentioned, not necessarily atomic; a definition for the distributivity operator is given in (20) and a definition of covers in (21).

(20) $[\![DIST]\!] = \lambda P.\lambda x.\forall z[z \le x \wedge Cov(z) \rightarrow P(z)]$

(21)   C covers X iff: (Xiang, 2016: 53)
         a. *Cov* is a set of subparts of X
         b. every subpart of X belongs to a member in *Cov*.

The meaning contribution of *all* is to ensure that only certain covers may enter into the interpretation: those which are a *good fit* with regard to the domain. In prose, a cover constitutes a *good fit* iff there is a member of the cover which contains every mereological part of the plurality.

(22)   For some cover *Cov* and some entity X, *Cov* is a *good fit* iff:
         $\exists Z[Z \in Cov \wedge \forall y[\text{Atom}(y) \wedge y \le X \rightarrow y \le Z]]$ (Brisson, 1998: 94)

In order to illustrate the effect of restricting the question domain to a *good fit*, let us look at (23) and the characteristic function of the corresponding set of propositions, given our assumptions about locality and composition, shown in (24).

(23)   Who went all to the party?   (Henry, 2012:27)

(24) $\lambda p_{s,t}.\exists x[p = \lambda w'.hmn_{w'}(x) \wedge went_{w'}(x)]$

If the domain consists of three relevant individuals who satisfy the predicate: $*\{a, b, c\}$, the result is a singleton containing the maximal plural individual such that it participated in going to the party. This answer set never contained atomic individuals, due to the *good fit* requirement. Prior to the application of *ANS*, the answer set for the equivalent question without *all* does contain atomic individuals, but after the application of *ANS*, it returns the same maximal set. This is the desired result, as *all* in positive contexts yields a weakly exhaustive reading just

---

[25]On this approach, the contribution of *all* is not truth-conditional, but it also does not seem to project like a presupposition (Brisson, 1998). For arguments in favour of a presuppositional approach, see Zimmermann (2007).

as in unmarked questions.[26] We need to expand the account, however, in order to account for homogeneity removal.

5.3. Homogeneity removal with *all*: flattens domain alternatives

In order to derive homogeneity removal, we first need a theory of homogeneity which is sensitive to the structure of domain (sub-)alternatives. The account in Križ and Spector (2020) does exactly this. Križ and Spector (2020) argue that homogeneity and non-maximality are intertwined: both are a result of reasoning about different interpretations of definite descriptions (see also Malamud 2012). The effect of *all* is, then, to collapse the alternatives which arise from the interpretation of plural predication in such a way that they correspond to universal quantification.

The analysis in Križ and Spector (2020) involves a few ingredients, which we will sketch below. Križ and Spector (2020) relativise their interpretation function to a model, variable assignment, world, as well as a homogeneity parameter $\mathscr{H}$. $\mathscr{H}$ takes an argument index and an individual and returns a generalised quantifier based on that individual. A homogeneity parameter is defined iff for all argument indices n and individuals x, $\mathscr{H}(n,x) \in Cand_x$. Henceforth I will, for ease of exposition, represent candidates as individuals, though they are actually Montagovian individuals.

(25) $Cand_x := \{\bigvee S \mid S \subseteq Part(x) \wedge \forall y \in Part(x): (\exists s \in S : s \sqsubseteq y) \rightarrow y \in S\}$

Given a domain consisting of two individuals, plugging in all values of $\mathscr{H}$ results in the following candidate denotations, corresponding to all potential mereological disjunctions of the plurality, shown in (26).

(26)   a or b or $a \oplus b$
         a or $a \oplus b$
         b or $a \oplus b$
         $a \oplus b$

The main principle behind this account is that homogeneity arises from *truth on all candidate interpretations*, represented schematically in (27).

(27)   The students ate = 1 iff all resulting candidate interpretations (subdomain alternatives) are true; for all x s.t x is a student, x ate.

If we then combine these candidate denotations with a distributive predicate *ate*, we derive the following interpretation.[27]

(28)   a. $[\![\text{the students DIST}_i \text{ ate}_j]\!] = [\![DIST_i]\!]^{w,\mathscr{H}}(\text{ate}_j^{w,\mathscr{H}})(\mathscr{H}(i,\oplus students'_w)$
         b. $[\![DIST_i]\!]^{w,\mathscr{H}}(\text{ate}_j^{w,\mathscr{H}}) = \lambda x.\forall z[z \leq x \wedge Cov(z) \rightarrow ate'_w(z)]$

---

[26]The *all* question also presupposes plurality, as mentioned earlier on in this section.

[27]We do not go into the technical details here; on the original account Križ and Spector (2020) need to assume a mechanism of indexation for re-introduction of candidate formation at the phrasal level, as the distributive operator would break homogeneity as it is formulated. We will simply assume that candidate formation is re-introduced by the distributive operator, since phrasally distributive predicates are still homogeneous.

The predicate combines with the set of disjunctive alternatives and is true iff the predicate is true of at least one such alternative and for some such alternative every $Cov \in D_i$ is in ate'$_w$. This captures the intuition that homogeneity requires truth on all interpretations (falsity, then, involves falsity on all interpretations). In order to apply this account to the interrogative case, for the utterance in (29), all of the relevant lexical entries have to be relativised to the homogeneity parameter $\mathcal{H}$. These lexical entries are displayed in (30).[28]

(29)   Who ate?

(30)   a. $[\![\text{who}]\!]^{g,w\mathcal{H}} = \lambda f_{e,t}.\exists x[\text{hmn}_@(x) \wedge P(x)]$
         b. $[\![\text{ate}]\!]^{g,w\mathcal{H}} = \lambda x.\text{ate}'_w(\mathcal{H}(i,x))$

The resulting set of interpretations is thus as shown in (31). Importantly, all of these alternatives are underspecified, as $\mathcal{H}$ determines entailment relations

(31) $\{\lambda w'.\text{ate}_{w'}(\mathcal{H}(i,a \oplus b \oplus c)), \lambda w'.\text{ate}_{w'}(\mathcal{H}(i,a \oplus b)), \lambda w'.\text{ate}_{w'}(\mathcal{H}(i,b \oplus c)), \lambda w'.\text{ate}_{w'}(\mathcal{H}(i,a \oplus c)), \lambda w'.\text{ate}_{w'}(\mathcal{H}(i,a)), \lambda w'.\text{ate}_{w'}(\mathcal{H}(i,b)), \lambda w'.\text{ate}_{w'}(\mathcal{H}(i,c))\}$

This underspecification invites a new formulation of maximal informativity encoded in the answerhood operator, which is defined iff (32a) holds.

(32)   a. $[\![\text{ANS}]\!]^{g,w\mathcal{H}}$ def. iff $(\exists! p \in Q)(\forall \mathcal{H}')(Q^{g,w,\mathcal{H}'}(p)(w) = 1 \wedge (\forall q \in Q)((\forall \mathcal{H}')(Q^{g,w,\mathcal{H}'}(q)(w) = 1) \rightarrow [\lambda w'.(\forall \mathcal{H}')(Q^{g,\mathcal{H}'}(p)(w') = 1)] \subseteq [\lambda w'.(\forall \mathcal{H}')(Q^{g,\mathcal{H}'}(q)(w') = 1)]))$
         b. $[\![\text{ANS}]\!]^{g,w\mathcal{H}} = (\iota p \in Q)(\forall \mathcal{H}')(Q^{g,w\mathcal{H}'}(p)(w) = 1 \wedge (\forall q \in Q)((\forall \mathcal{H}')(Q^{g,w,\mathcal{H}'}(q)(w) = 1) \rightarrow [\lambda w'.(\forall \mathcal{H}')(Q^{g,\mathcal{H}'}(p)(w') = 1)] \subseteq [\lambda w'.(\forall \mathcal{H}')(Q^{g,\mathcal{H}'}(q)(w') = 1)]))$

In prose, the maximally informative true answer is the alternative which is true under all interpretations, such that the conjunction of these true interpretations entails the conjunction of all interpretations of every other alternative which is true under all interpretations. Given the same domain of three individuals, if only a and b ate in the evaluation world, the maximally informative alternative is shown in (33).

(33) $\lambda w'.\text{ate}_{w'}(\mathcal{H}(i,a \oplus b)$

If we now embed this under a factive such as *know* assuming the same world of evaluation as in (33) and that the composition proceeds as discussed in 4.3, we derive the set of alternatives shown in (34b). The result is homogeneous: (34b) is true iff for each x s.t. x ate, Mary knows x ate.

(34)   a.   Mary knows who ate.
         b. $\{\lambda w'. K_{a,w'}^{w''} \text{ate}_{w''}(a \oplus b), \lambda w'. K_{a,w'}^{w''} \text{ate}_{w''}(a), \lambda w'. K_{a,w'}^{w''} \text{ate}_{w''}(b)\}$

Now we are in a position to see how *all* removes homogeneity. It does so by limiting the contextual covers which can be part of the interpretation to those which contain every mereological part of the plurality, defined above in (22). Adding *all* to (34), we derive the collapsed set of alternatives in (35b).[29]

---

[28]Following the account in Križ and Spector (2020), all lexical entries must be relativised to this parameter with the exception of nominal restrictors of determiners.

[29]Križ and Spector (2020) provide an analysis for adnominal and adverbial *all* which effectively accomplishes the same result. We choose to not adopt their account directly, as our approach seeks to maintain insights about the syntactic particulars of QQPs, including a principled connection to the wh-item. No additional co-indexation

(35)   a.   Mary knows who all ate.
       b. $\{\lambda w'.\ K^{w''}_{a,w'}\ ate_{w''}\ (a \oplus b)\}$

It is now easy to see how our primary experimental contrast can be derived, if we negate the set in (35b). Given (36b), it follows that "but she does know that James ate" is a licit continuation.

(36)   a.   Mary does not know who all ate.
       b. $\{\lambda w'.\ \neg K^{w''}_{a,w'}\ ate_{w''}\ (a \oplus b)\}$

6. Conclusion

Question particles like *all* are ideal probes into the properties of interrogative meaning. In this paper, we have demonstrated that the homogeneity-removing properties of German *alles*, Ulster English *all* and Dutch *allemaal* are amenable to a unified analysis in terms of domain restriction. Question-internal *all* displays considerable stability across the languages investigated here, which is perhaps unexpected if one takes into account that it is a functional item.

One major potential direction for further research would be to broaden the cross-linguistic base (looking both at micro-variation within Germanic as well as elsewhere), in order to determine more definitively whether these particles share the same properties. Patrick Grosz (pc) reports that intuitions regarding Austrian German *aller* diverge from those for German-German *alles*.

---

mechanism between *all* and its associate is necessary, as is the case on their analysis.

References

Abrusán, M. (2016). Presupposition cancellation: explaining the 'soft-hard' trigger distinction. *Natural Language Semantics 24*, 165–202.

Abrusán, M. and K. Szendrői (2013). Experimenting with the king of France: Topics, verifiability and definite descriptions. *Semantics & Pragmatics 6*(10), 1–43.

Beaver, D. and B. Clark (2008). *Sense and Sensitivity: How Focus Determines Meaning*. Chichester: Wiley-Blackwell.

Beck, S. and H. Rullmann (1999). A flexible approach to exhaustivity in questions. *Natural Language Semantics 7*(3), 249–298.

Brisson, C. (1998). *Distributivity, Maximality and Floating Quantifiers*. New Brunswick, NJ: Rutgers PhD Dissertation.

Brisson, C. (2003). Plurals, all and the non-uniformity of collective predication. *Linguistics & Philosophy 26*, 129–184.

Cremers, A. (2016). *On the semantics of embedded questions*. Ecole Normale Supérieure dissertation.

Cremers, A. (2018). Plurality effects in an exhaustification-based theory of embedded questions. *Nat. Lang. Semantics 26*, 193–251.

Cremers, A. and E. Chemla (2017). Experiments on the acceptability and possible readings of questions embedded under emotive-factives. *Natural Language Semantics 25*(3), 223–261.

Dalrymple, M., M. Kanazawa, Y. Kim, S. Mchombo, and S. Peters (1998). Reciprocal expressions and the concept of reciprocity. *Linguistics and philosophy 21*(2), 159–210.

Dayal, V. (1996). *Locality in WH quantification: Questions and relative clauses in Hindi*. Kluwer: Dordrecht.

de Vries, H. (2019). Weak all. Manuscript. Accessed at hcommons.org.

Esipova, M. (2018). Focus on what's not at issue: Gestures, presuppositions, supplements under contrastive focus. In U. Sauerland and S. Solt (Eds.), *Sinn und Bedeutung vol. 22*, Berlin, pp. 385–402. Leibniz-Centre General Linguistics.

Fox, D. (2018). Partition by exhaustification: Comments on Dayal 1996. In *Proceedings of Sinn und Bedeutung 22*, pp. 403–434.

Gajewski, J. (2005). *Neg-Raising: Presupposition and Polarity*. Ph. D. thesis, Massachusetts Institute of Technology.

Guerzoni, E. and Y. Sharvit (2007). A question of strength: on NPIs in interrogative clauses. *Linguistics & Philosophy 30*, 361–391.

Haida, A. (2008). The indefiniteness and focusing of question words. In *Semantics and linguistic theory*, Volume 18, pp. 376–393.

Hamblin, C. L. (1973). Questions in Montague English. *Foundations of language 10*, 41–53.

Hartmann, K. and M. Zimmermann (2007). Exhaustivity marking in hausa: A re-evaluation of the particle nee/cee. *Focus strategies in African languages: On the interaction of focus and grammar in Niger-Congo and Afro-Asiatic*, 241–266.

Henry, A. (2012). Phase edges, quantifier float and the nature of (micro-) variation. *Iberia: An International Journal of Theoretical Linguistics, 4 (2), 23-39.*.

Hirsch, A. and B. Schwarz (2019). Singular which, mention-some, and variable scope uniqueness. In K. L. J. R. Katherine Blake, Forrest Davis (Ed.), *Semantics and linguistic theory (SALT) vol. 29*, pp. 748–767.

Karttunen, L. (1977). Syntax and semantics of questions. *Linguistics and Philosophy 1*(1).

Koopman, H. (2010). On Dutch allemaal and West Ulster English all. *Structure preserved: Studies in syntax for Jan Koster*, 267–276.

Kotek, H. (2014). *Composing questions*. Ph. D. thesis, PhD Thesis, Massachusetts Institute of Technology.

Krifka, M. (1996). Pragmatic strengthening in donkey sentences and plural predications. In *SALT*, Volume 6, pp. 136–153.

Krifka, M. (2001). For a structured meaning account of questions and answers. *Audiatur vox sapientia: A Festschrift for Arnim von Stechow 52*(2055), 287–319.

Križ, M. and B. Spector (2020). Interpreting plural predication: homogeneity and non-maximality. *Linguistics and Philosophy*.

Križ, M. (2015). Homogeneity, trivalence, and embedded questions. In T. Brochhagen, F. Roelofsen, and N. Theiler (Eds.), *Proceedings of the 20th Amsterdam Colloquium*.

Lahiri, U. (2002). *Questions and Answers in Embedded Contexts*. Oxford: Oxford University Press.

Löbner, S. (2000). Polarity in natural language: Predication, quantification and negation in particular and characterizing sentences. *Journal of Semantics 23*, 213–308.

Malamud, S. (2012). The meaning of plural definites: a decision-theoretic approach. *Semantics & Pragmatics 5*, 1–58.

McCloskey, J. (2000). Quantifier float and wh-movement in an Irish English. *Linguistic Inquiry*, 57–84.

Reis, M. (1992). The category of invariant *alles* in wh-clauses: on syntactic quantifiers vs. quantifying particles in German. In R. Tracy (Ed.), *Who climbs the grammar-tree*, pp. 465–492. Niemeyer.

Rullmann, H. and S. Beck (1998). Presupposition projection and the interpretation of 'which'-questions. In D. Strolovitch and A. Lawson (Eds.), *Semantics and linguistic theory (SALT) vol. 8*, pp. 215–232.

Schad, D. J., S. Vasishth, S. Hohenstein, and R. Kliegl (2020). How to capitalize on a priori contrasts in linear (mixed) models: A tutorial. *Journal of Memory and Language 110*, 104038.

Schmitt, V. (2019). Pluralities across categories and plural projection. *Semantics & Pragmatics 12*(17).

Schwarzschild, R. (1996). *Pluralities*. Kluwer: Dordrecht.

Sharvit, Y. (2002). Embedded questions and 'de dicto' readings. *Natural Language Semantics 10*, 97–123.

Sharvit, Y. (2004). Some remarks on quantificational variability and question-embedding predicates (u. lahiri, *questions and answers in embedded contexts*). *English Linguistics 21*(2), 541–569.

Shin, J. (2007). Topic-focus structure and quantification of dou. *Taiwan Journal of Linguistics 5*(1), 49–75.

Simons, Mandy, J. T. D. B. and C. Roberts (2010). What projects and why. In N. Li and D. Lutz (Eds.), *Semantics and Linguistic Theory (SALT) 20*, pp. 309–327. Ithaca, NY: CLC.

Theiler, N. (2014). A multitude of answers: embedded questions in typed inquisitive semantics. *Master's thesis, University of Amsterdam*.

Winter, Y. (2001). Flexibility principles in boolean semantics.

Xiang, Y. (2016). *Interpreting Questions with Non-exhaustive Answers*. Cambridge, MA:

Harvard University. PhD dissertation.

Zimmermann, M. (2007). Quantifying question particles in German: Syntactic effects on interpretation. In L. McNally and E. Puig-Waldmüller (Eds.), *Sinn & Bedeutung 11*, pp. 627–640.

Zimmermann, M. (2018). Embedded wh-questions as definites and the import of question particles. Talk at UBC Linguistics Colloquium, Vancouver. Sept, 21. 2018.

Zimmmermann, M. (2009). Quantifying question particles and the non-exhaustiveness of wh-questions. Unpublished Ms., Universität Potsdam.