Proceedings of Sinn und Bedeutung 18

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Introduction

The present volume contains a collection of papers presented at the 18th annual meeting “Sinn und Bedeutung” of the Gesellschaft für Semantik, which was held at the University of the Basque Country (UPV/EHU) in Vitoria-Gasteiz on September 11-13, 2013 and which was jointly organized by the University of the Basque Country (UPV/EHU), the CNRS lab IKER Basque Center for Basque Language and Texts (UMR5478), and the Laboratoire de Linguistique de Nantes (EA 3827).

181 abstracts were submitted to SuB18; of the 16 talks and 21 posters of the program, 28 were elaborated into the papers in this collection, which appears online:

http://semanticsarchive.net/sub2013/

The editors of the present volume would like to thank the authors for their contributions and all the anonymous reviewers for their collaboration. We also wish to thank the invited speakers, David Barner, Gennaro Chierchia, and Maribel Romero for contributing to the success of this conference.

The organizers of the 18th annual meeting of “Sinn und Bedeutung” would like to thank Javi Ormazabal, Myriam Uribe-Etxebarria, and Vidal Valmala for their support and help. Thanks also to Alejo Alcaraz, Ana Isabel Gil Apodaca, Olatz Etxeberria, Samantha Roach, Jose Javier Ruiz de Olano Ansorena and Rossy Silvestre for their help. We also wish to recognize the assistance and expertise of the multimedia technicians of the UPV/EHU (see https://sites.google.com/site/sub18bc/program).

The organizers of the SuB18 gratefully acknowledge financial and organizational support from the following institutions:

- University of the Basque Country (UPV/EHU).
- Facultad de Letras/Letren Fakultatea.
- Department of Linguistics and Basque Studies.
- Department of English and German Philology.
- Research group Hizkuntzalaritza Teorikoko Taldea / Basque Research Group of Theoretical Linguistics (HiTT) - IT769-13 and research project INTERSYNSEM FFI2011-29218.
- Unidad de Formación y Investigación “Hizkuntzalaritza Teorikoa eta Diakronikoa: Gramatika Unibertsala, Hizkuntza Indoeuroparrak eta Euskara” (HiTeDi) UFI11/14.
- Eusko Jaurlaritza/Basque Government.
- CNRS, IKER UMR5478.
- ANR project ISQI (ANR 2011 JSH2 004 1).
- Université de Nantes.
- Laboratoire de Linguistique de Nantes (LLING EA 3827).


Urtzi Etxeberria, Anamaria Fălăuş, Aritz Irurtzun & Bryan Leferman
Proceedings

Sinn und Bedeutung 18
in the Basque Country

Edited by U. Etxeberria, A. Fäläuş, A. Irurtzun & B. Leferman
University of the Basque Country (UPV/EHU) – September 11-13 2013
On the focus-sensitive presupposition triggers too, again, also, even
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Abstract. This paper proposes to derive the presupposition of additive particles too, as well, also and the temporal particle again. It argues that the presuppositions of these particles can be predicted by the same presupposition triggering mechanism that was proposed for so-called soft triggers in Abrusán (2011). It is shown that presupposition suspension facts, characteristic of soft triggers, do not arise with additive particles because of their anaphoric and focus-sensitive nature. Finally, the paper proposes that the soft-hard presupposition distinction can be explained not in terms of differences in the nature of the presupposition but rather as a consequence of the anaphoric/focus-sensitive nature of various triggers.

Keywords: presuppositions, anaphora, focus

1. Introduction

Additive particles such as too, also, as well and again presuppose the truth of some alternative proposition. For example, the sentence in (1) presupposes that John ate pizza at a previous time:

(1) John ate pizza again.
    presupposes: John ate pizza at some previous time.

Why is this content presupposed? After all, it could simply be part of the ‘at issue’ content of again. Such why-questions are not often asked in the presupposition literature. Traditionally, most research on presuppositions was concerned with the projection problem, and the why-question, i.e. the triggering problem has been mostly neglected or deemed too difficult to address. More recently, however, there have been attempts to explain the presuppositions of so-called soft triggers such as factives or questions (cf. Simons 2001, Abusch 2005, 2010, Abrusán 2011). Yet none of these works address the problem of predicting the presupposition of additive particles.

This paper shows that the presupposition of these items can be explained by Abrusán’s (2011) mechanism. The second aim of this paper is to discuss why cases of presupposition suspension can or cannot be observed. It will be shown that at least some such examples can be related to focus (cf. Beaver 2010) and that differences in the anaphoric properties and the focus-sensitivity of triggers might explain a big part of the differences in suspension data. As an upshot of this discussion I suggest that the often cited soft vs. hard presupposition trigger distinction, based on differences in the suspendability of presuppositions of the various triggers, can be reduced to differences in focus-sensitivity and anaphoricity.

Many thanks to the audience at SuB18 for their helpful comments. The research reported here was supported by a Marie Curie FP7 Career Integration Grant, Grant Agreement Number PCIG13-GA-2013-618550.
2. Background: Verbal presuppositions (Abrusán 2011)

Abrusán (2011) has proposed a triggering mechanism that can predict the presuppositions of attitude predicates, aspectual predicates and various ‘happens-before’ entailments of verbs. The central idea behind this paper was that presuppositions of such triggers arise from the way our attention structures the informational content of a sentence. Some aspects of the information conveyed are such that we pay attention to them by default, even in the absence of contextual information. On the other hand, contextual cues or conversational goals can divert attention to types of information that we would not pay attention to by default. Either way, whatever we do not pay attention to, be it by default, or in context, is what ends up presupposed.

More precisely, I have argued that any information that is also conveyed by the sentence but is not about the main event described is presupposed, unless there is some contextual factor that directs attention to this information as well. When this happens, what would normally be presupposed is not presupposed any more: i.e we have presupposition suspension. Note that what happens is not that attention is completely diverted, rather, extra information is brought under the spotlight of attention as well.

The central intuition behind the paper was that presuppositional assertions describe complex states of events, some parts of which are independent from the main events. So what we want to achieve is to tell independent events apart: select the main event described by the sentence, and decide what other information conveyed by the sentence describe independent events from the main one. But because of the complex mereological structure of events and further ontological difficulties with events corresponding to negated sentences or mathematical truths, etc., rather than making reference to events themselves, I have used event times. The idea of looking at event times instead of events themselves serves the purpose of making independence more tractable: events that might happen at different times are clearly different events.

Thus Abrusán (2011) assumed that the default main point of a sentence is given by those entailments that are by nature about the event time of the matrix predicate. Propositions that describe events that are not (or do not have to be) about the event time of the matrix predicate of S are independent, and hence presupposed. Let’s illustrate the idea with a simple example. Consider (2), in which \(t_1\) denotes the event time interval of the matrix predicate, and \(t_2\) is some interval before \(t_1\), given by the context. Let’s look at the sentence S and two of its (many) entailments, \(\varphi\) and \(\psi\):

\[
(2) \quad S = \text{John knows (at } t_1\text{) that it was raining (at } t_2\text{).}
\]

\[\text{a. } \varphi = \text{John believes (at } t_1\text{) that it was raining (at } t_2\text{).}\]

\[\text{b. } \psi = \text{It was raining (at } t_2\text{).}\]

In an intuitive sense, \(\varphi\) is about the time denoted by \(t_1\), but \(\psi\) is not: changing the properties of
the world at $t_1$ will not affect the truth value of $\psi$ but it might affect the truth value of $\varphi$.\(^1\) But with this simple example the obvious question arises: what about sentences such as (3)? The embedded proposition in (3) is not temporally independent from the main assertion, yet it seems to be presupposed:

(3) John knows (at $t_1$) that it is raining (at $t_1$).
   a. $\varphi\equiv$ John believes (at $t_1$) that it is raining (at $t_1$).
   b. $\psi\equiv$ It is raining (at $t_1$).

However, we need to distinguish accidental co-temporaneity from non-accidental one. In the above example, though it so happens that the embedded proposition and the matrix proposition are true at the same time, this is only an accident, it could be otherwise. But the co-temporaneity of the matrix time of $\varphi$ with the matrix time of S is not an accident, but follows from the lexical interpretation of *know*.

For this reason, Abrusán (2011) assumed that the default presupposition triggering mechanism looks beyond the actual sentence and assesses the properties of alternative sentences called temporal-alternatives (or just T-alternatives for short). T-alternatives are obtained by replacing the temporal arguments of the matrix and embedded predicates with different ones. More precisely, we replace the temporal variables with ones which the assignment function maps to different intervals than the original time of the matrix predicate. E.g:

(4) John knows (at time $t_1$) that it was raining (at time $t_1$)
   *T-alternative:* John knows (at time $t_1$) that it was raining (at time $t_2$)

(5) John managed (at time $t_1$) to solve the exercise (at $t_1$)
   *T-alternative:* *John managed (at time $t_1$) to solve the exercise (at $t_2$)

Let’s say that $p$ and $p'$ are corresponding entailments if they can be expressed by sentences that only differ in their temporal arguments. Take an entailment $p$ of S. If there is a well formed alternative $S'$ to S such that the corresponding entailment to $p$ (namely $p'$ of $S'$) can be expressed by a sentence that is not about the event time of the matrix clause of $S'$, then I will say that $p$ is only accidentally about the matrix event time of S. In (4), the entailment that it was raining (at time $t_1$) of the original sentence is only accidentally about $t_1$, because there is a T-alternative (*John knows (at time $t_1$) that it was raining (at time $t_2$)*) whose corresponding entailment (that it was raining at $t_2$) is not about the matrix tense of the T-alternative. On the other hand, (5) does not have a well formed T-alternative where the two temporal arguments differ (cf. Karttunen 1971a on temporal restrictions of implicatives): for this reason the entailment of the original sentence in (5) that John solved the exercise at $t_1$ is non-accidentally about the matrix event time. The default

\(^1\)Abrusán (2011) assumed that event times denote salient intervals whose value is assigned by the context. As such, they are rather like pronouns (cf. Partee 1973). *Aboutness* is defined as in Demolombe and Fariñas del Cerro (2000). See also Abrusán (2011) for details.
triggering mechanism is given in (6). In virtue of (6), the veridical entailment of (3) is predicted to be presupposed because although it is about $t_1$, it is only accidentally so.

(6)  
Presupposition triggering (to be revised)

Entailments of a sentence $S$ that can be expressed by sentences that are not necessarily about the event time of the matrix predicate of $S$ (i.e. they are either not about it, or only accidentally so) are presupposed.

Besides the default, grammatically defined main point, it is possible that the context or the intentions of the participants of the conversation raise interest in aspects of the entailed meaning of the sentence that would otherwise ‘pass under the radar’, and be presupposed. One factor that can bring extra elements under the spotlight of attention is focus. As Beaver (2010) observes, (7) does not suggest that the student has plagiarized his work, despite the fact that discover is normally factive.

(7)  
If the TA discovers that [your work is plagiarized], I will be [forced to notify the Dean]

Focus is usually taken to be the part of a sentence that conveys the new or highlighted information, thus the information that directly answers a background question. In this sense, focus grammatically signals the presence of a background question. Abrusán (2011) proposed that grammatically marked background questions can introduce a secondary (or pragmatic) main point. Secondary main points concern the event time of the sentence expressing the most direct proposition that answers the background question. The presupposition triggering mechanism looks both at the default (grammatical) and the secondary (pragmatic) main points and requires the presupposition to be independent from both of these. This derives the above data in the present framework.

(8)  
Presupposition triggering (final version)

Entailments of a sentence $S$ that can be expressed by sentences that are neither necessarily about the event time of the matrix predicate of $S$ nor about the event time of the sentence expressing the most direct answer to the (grammatically signaled) background question are presupposed.

Put more simply, the proposal above requires that presuppositions be independent from both the default and the secondary (pragmatic) main points. Secondary main points can be introduced by grammatical markers such as focus and evidential verbs (and presumably others). In (7), focusing the embedded clause indicates that the background question is What will I discover? The direct answer to this question is a proposition, namely the proposition denoted by the embedded clause your work is plagiarized. The pragmatic, secondary main point therefore concerns the information that is about the tense argument of the sentence expressing this proposition, i.e. the tense argument of the embedded clause. Thus the information conveyed by the embedded clause is not independent from the secondary main point, and is not predicted to be presupposed.
3. The presuppositions of additive particles *too, again, also, as well*

The mechanism presented above can be extended to explain the presuppositions of additive particles such as *too, again, also, even*. The presuppositions of these items have been shown in the literature to be special in various ways (cf. Kripke 2009, Krifka 1998, van der Sandt and Huitink 2003, van der Sandt and Geurts 2001, Zeevat 2003, Saebø 2004, Amsili and Beyssade 2010, Eckardt and Frankel 2012, Winterstein 2011 among others). I list their most important properties below.

3.1. Characteristic properties of additive particles

*Association with focus/contrastive topics* The first special property of additive particles is that they associate with an element in the sentence: the actual presupposition is determined by the interaction of this element and the particle (cf. Rooth 1985, 1992, Krifka 1998, Saebø 2004, among others). Traditionally, this associate was assumed to be the focused constituent in the sentence, cf. e.g. Rooth (1985, 1992), which is why they are also called focus particles. Krifka (1998), however, has argued that in the case of stressed additive particles the prosodic stress involved corresponds to contrastive topic. In (9a) the additive particle *too* associates with the subject. The presupposition is generated by replacing the subject with an existentially quantified variable that cannot take the referent of the subject as value. In (9b), the associate of the additive particle is *dinner*: the presupposition changes accordingly: this sentence presupposes that Peter invited Mary for something other than dinner.

(9) a. [Peter] invited Mary for dinner, too.
   presupposes: Somebody other than Peter had invited Mary for dinner.

   b. Peter invited Mary for [dinner], too.
   presupposes: Peter had invited Mary for something other than dinner.

Following Krifka (1999), I represent the meaning of additive particles schematically as below:

(10) \[ \text{ADD}_1 \left[ ... \right]: \text{asserts: } [...] \text{.presupposes: } \exists F' \neq F \left[ ... \right] \]

In this representation, F stands for the associated constituent. [...] stands for the scope of the particle. F’ ranges over alternatives of F that are semantically of the same type as F, and may be further restricted contextually.

The particles *also, as well* behave similarly to *too* exemplified above. The temporal particle *again* does not associate with contrastive topics (or foci) in a similar way. Although the constituent in its scope might contain a focused element, in the presupposition generated the focused element is not replaced by an alternative. Thus the presupposition of (11) is not that Fido ate somebody else’s shoes on a previous occasion, but that he ate mine.  

---

2It is possible that the constituent focused in the sentence is also understood as being focused in the presupposition.
(11) Fido ate [my]F shoes again

presupposes: Fido ate my shoes on a previous occasion.

The anaphoric requirement A characteristic property of the presuppositions of additive particles is that they have an anaphoric component, cf. Heim (1990), Kripke (2009). This is shown by the following examples:

(12) a. Sam had dinner in New York too.

presupposes: Somebody other than Sam had dinner in New York.

b. Sam also had dinner in New York.

presupposes: Somebody other than Sam had dinner in New York.

c. Sam ordered dessert again.

presupposes: Sam ordered dessert on some previous occasion.

The point made in Heim (1990) and Kripke (2009) was that if the presuppositions of the above examples were simple existential statements, they should be felicitous even without any particular background context. This is because in a typical context the presuppositions above are trivially satisfied simply by our world knowledge: on any given night, many people are having dinner in New York. Similarly, it is most likely Sam ordered dessert on some previous occasion too. Yet, the examples strike us as infelicitous if uttered out of the blue. They are only felicitous if the content of the presupposition has been mentioned recently, or is otherwise part of what Kripke calls the ‘active context’ of the conversational partners. For the moment, I will mark the anaphoric requirement informally with a subscript C on the existential quantifier in the description of the presuppositions.

Anaphora resolution The resolution of the anaphora in the presupposition of additive particles shows some surprising properties. First, additive particles are able to establish an anaphoric link with antecedents in positions that are normally unavailable for anaphors, cf. van der Sandt and Geurts (2001), van der Sandt and Huitink (2003), Zeevat (2003):

(13) A: Harry may well have dinner in New York.

B: John is having dinner in New York, too. (van der Sandt and Geurts 2001, p2)

Second, the presupposition of these particles can escape being ‘plugged’ by attitude contexts, and can thus be understood as if it had wide scope, cf. Heim (1992), van der Sandt and Geurts (2001):

M. Wagner (2013) presents examples of non-anaphoric too (partly based on a talk by Ruys 2012):

(i) This, too, shall pass (example of E. Ruys)

NB: This issue is connected to how we resolve the anaphora, not to what is actually triggered.
The point about the above example is that the utterance of B can be understood in such a way that its presupposition that somebody other than B is in bed is not satisfied in the belief context of the parents, but in the matrix context. In other words, the parents do not have to have any idea about anybody other than their own child being in bed.

Third, the resolution of the anaphora is also sensitive to various discourse factors, in particular a parallelism between the antecedent and the sentence with which the additive particle associates with is required (cf. Asher 1993, Amsili and Beyssade 2010, Winterstein 2011).

Redundancy/obligatoriness  The last interesting property of additive particles I mention here is their obligatoriness (cf. Krifka 1998, Zeevat 2003, Saebo 2004, Amsili and Beyssade 2010, Winterstein 2011). In a sentence such as (15a) the presupposition of the second clause is satisfied by the content of the first clause. Since the additive particle is usually assumed to only add its presupposed content to the meaning of the sentence, it is somewhat surprising that it cannot be omitted without the sentence becoming pragmatically infelicitous, as shown in (15b):

(15)  a. John ate pizza, and Mary ate pizza, too.
     b. #John ate pizza, and Mary ate pizza.

One promising path to resolve this question connects the infelicity of the sentence without the additive particle to the implicature arising from the contrastive focus on the first or the second constituent (Krifka 1998, Saebo 2004). Simplifying somewhat, the reasoning is that contrastively focusing a constituent normally suggests that the speaker was not in the position to supply a more complete answer to the background question. The second assertion however contradicts this implicature. The rationale behind inserting the additive particle is to avoid the infelicity that would arise from the clash between the implicature and the asserted meaning, by explicitly denying the implicature.

3.2. Basic proposal

I propose that presuppositions of additive particles can be derived similarly to the presuppositions of verbs, by applying essentially the same mechanism. I argue first that the presupposed content is also entailed (3.2.1). Given this, the overall reasoning is the following: the additive particle is inserted in order to avoid a clash between the content and implicatures (as suggested in Krifka 1998 / Saebo 2004). The particle contributes to the entailed meaning that there is a true, non-identical alternative to the sentence, as described in (16) below:
As before, $F$ stands for the associated constituent, $[...F...]$ stands for the scope of the particle and $F'$ ranges over alternatives of $F$ that are semantically of the same type as $F$, and may be further restricted contextually, which I represent by a subscript $C$ on the quantifier. Once the particle is inserted, contributing its requirement for an anaphoric alternative, the presupposition triggering mechanism kicks in and turns the entailment that there is a true anaphoric alternative into a presupposition (3.2.3).

**Entailment vs. presupposition** There are reasons to assume that the presupposition of additive particles is also part of their entailed meaning. Crediting H. Kamp, van der Sandt and Huitink (2003) observe that (17a) is contradictory, while (17b) is not.

(17)  
\(a. \# \text{Floppy will be on the run at Christmas, but she will never be on the run.}\)  
\(b. \text{Floppy will be on the run at Christmas, but she will never be on the run again.}\)

If the implication of the second clause was simply presupposed, the entailed meaning of (17b) should be contradictory just like (17a). The fact that it is not, suggests that the temporal condition, namely that Floppy was on the run at some contextually given previous time, is also part of the entailed meaning. This suggests that the presupposition of *again* is also entailed. Similar examples can be reproduced with other additive particles as well:

(18)  
\(a. \# \text{Mary went to the shop, but it is not the case that somebody went there.}\)  
\(b. \text{Mary went to the shop, but it is not the case that somebody went there as well.}\)

Note that assuming that the presupposition is also entailed does not change the observed behaviour of additive particles. In non-embedded cases, it is not possible to tell presuppositions and entailed meanings apart. In embedded cases, since the presupposition is *both* entailed and presupposed, it still projects (or not), and thus we observe the same behaviour as if the meaning in question was only presupposed. Given these arguments, and following Stalnaker (1974) and others, I will assume that the presupposed part of the meaning is also entailed.

If the implication that a salient alternative is true in the context is part of the entailed meaning, the triggering question in connection with additive particles becomes: why does a part of the entailed meaning become presupposed, and which part is it? Below, I propose an answer to this question.

**Representation** In the above descriptions (cf. (16)) I have used a contextually restricted existential quantifier to represent the individual time or entity that the alternative proposition has to be true of. The contextual restriction on the quantifier could be thought of as an anaphoric pronominal item that might be resolved in accordance with the observations on the availability of the antecedent that were made above.
Another possibility is to represent the individual (entity or time) of which the alternative proposition is true with an anaphoric pronoun that has to be resolved in context, cf. Heim (1992), van der Sandt and Geurts (2001), van der Sandt and Huitink (2003), among others. A schematic representation is given below, where $F'_C$ represents the anaphoric pronoun that needs to be resolved in discourse, and $F'_C \neq F$ is the condition that an anaphor cannot be resolved to the entity mentioned in the sentence:

\begin{equation}
(19) \text{ADD}_1 [\varphi(F_1)]: \quad \varphi(F) \& [\varphi(F'_C) \text{ and } F'_C \neq F]
\end{equation}

In what follows I will use the representation with anaphoric pronouns.  

\textit{Proposal}  

Let us now extend the mechanism presented in Section 2 to triggers such as \textit{too, again, also, even}. Observe first (20a), and the informal representation of its meaning in (20b), with $x_C$ standing for an anaphoric free variable that has to be resolved in context (e.g. according to the rules of anaphora resolution proposed by DRT, cf. e.g. van der Sandt and Geurts 2001).

\begin{enumerate}
\item [20] a. [Peter]$_{TF}$ invited Mary for dinner, too.
\item b. Peter invited Mary for dinner & $x_C$ invited Mary for dinner, where $x_C \neq$ Peter
\end{enumerate}

Interestingly, if we restrict the time-frame of the matrix clause with a temporal adverb such as \textit{yesterday}, the temporal span of the additive component does not have to be contained in this temporal restriction. This is shown by the acceptability of the sentence in (21).

\begin{equation}
(21) \quad \text{Two days ago, John invited Mary for dinner, and yesterday Peter invited Mary for dinner, too.}
\end{equation}

In fact, not even the tense on the matrix verb must be respected in the presupposition, as shown by (22):

\begin{equation}
(22) \quad \text{At this moment, John is inviting Mary for dinner, and yesterday Peter invited her for dinner, too.}
\end{equation}

This suggests that the additive meaning import of \textit{too} is not restricted by the tense on the matrix verb. In fact, this was already demonstrated by examples such as (13), in which the antecedent

\textsuperscript{5}In van der Sandt and Geurts (2001) and van der Sandt and Huitink (2003) the anaphoricity of the free variable inside the presupposition is captured as a presupposition, i.e. the presupposed proposition contains an anaphoric (presuppositional) pronoun. Thus there are two presuppositions that need to be resolved. In this paper I have nothing to say about the derivation of the presupposition of the anaphoric pronoun inside the presupposed proposition. The present paper is only interested in the explanation of why the alternative proposition introduced by additive particles becomes presupposed. The question of why this alternative has an anaphoric pronoun in it, or indeed how the anaphor is resolved is tangential to this. For solutions concerning the idiosyncratic anaphora resolution properties of additive particles see Heim (1992), van der Sandt and Geurts (2001), van der Sandt and Huitink (2003).
(besides not being accessible) is also not in the same tense. For this reason, I will assume that
the additive import of *too* is temporally insensitive:⁶ Accordingly, the meaning of (20b) should be
more properly described as in (23), where lack of inflection on the verb in the additive meaning
component is taken to represent a lack of tense restriction.

(23) Yesterday Peter invited Mary for dinner & x_C invite Mary for dinner, where x_C ≠ Peter.

Recall now that the presupposition triggering mechanism described in Section 2 stated that entail-
ments of a sentence S that can be expressed by sentences that are not necessarily about the event
time of the matrix predicate of S (i.e. they are either not about it, or only accidentally so) are pre-
supposed. Given that, as we have just seen, the additive meaning component does not have to be
true at the matrix event time, it is predicted to be presupposed by the mechanism described in the
previous section. It is easy to see that additive particles such as *as well, also* will work similarly
to *too*. The particle *again* requires that there be a previous time at which the prejacent is true, as
described in (24b):

(24) a. Last week John climbed Mount Kilimanjaro again.
   b. Last week John climbed Mount Kilimanjaro & John climbed Mount Kilimanjaro at
      some time t_C, where t_C < last week.

The additive meaning component of *again* fulfils the requirement for being a presupposition by
definition, and is thus also predicted to be presupposed.

4. Presupposition suspension: The role of anaphoricity and question-answer congruence

It has been observed since the seventies that presuppositions in embedded contexts are cancellable
cf. Karttunen (1971b), Stalnaker (1974), Gazdar (1979), van der Sandt (1992), Chierchia and
others. Examples of direct cancellation are in (25a,b). Unembedded presuppositions are normally
not cancellable, cf. (25c):

(25) a. The king of France did not eat the cake: there is no king of France.
   b. A: Did the king of France eat the cake?
      B: I doubt it: there is no king of France.
   c. #The king of France ate the cake, but there is no king of France.

Certain triggers can be understood as non-presuppositional in embedded contexts even without
explicit cancellation of their presupposition. This phenomenon has been called presupposition

⁶The future however might be excluded:

(i) *John will invite Mary for dinner, and yesterday Peter invited Mary for dinner, too.*
suspension (also as *contextual neutralization*, see Abbott 2006). Most typically, examples of presupposition suspension cited in the literature involve verbal triggers such as *discover* or *realize*. (26) is a classic example from Karttunen (1971b):

(26) If I discover/realize later that I have not told the truth, I will confess it to everyone.

Suspension data in the literature have been mostly given with verbal triggers and focus. Triggers such as *too, again* have been shown to resist suspension, usually available with factives:

(27) a. I have no idea whether John read the proposal. # But if Bill read it too, let’s ask them to confer and simply give us a yes/no response. (Abusch 2010)
b. I have no idea whether Jane ever rented Manhattan, #but perhaps she is renting it again. (Simons 2001)

This difference in suspendability of the various presuppositions have been argued by Abusch (2010), (and also some extent by Simons 2001, Abbott 2006) to show that there are two classes of presuppositions (or presupposition triggers): soft and hard presuppositions.

The oldest explanation as for why presuppositions of certain triggers can be suspended is that this happens when the presupposition clashes with an implicature. The most influential accounts in this spirit have been given by Stalnaker (1974), Gazdar (1979), van der Sandt (1992) (cf. also Chierchia and McConnell-Ginet 2000, Kadmon 2001, Simons 2001, Beaver 2010, 2001, Abbott 2006, Abusch 2010, Klinedinst 2009 and references therein for further discussion). Take the classic example from Karttunen (1971b) in (26) above. In this case the implicature of the conditional is that the speaker is ignorant about the truth of the antecedent of the conditional, namely whether (s)he will discover/realize that (s)he has not told the truth. This is in clash with the presupposition that the speaker assumes the truth of the complement of *discover/realize* to be true, therefore the presupposition is suspended. Examples such as (27) contrast with (28), which is hard to understand as non-presuppositional.

(28) If I regret later that I have not told the truth, I will confess it to everyone.

The reason for this, according to some of the above authors, is that in these cases the presupposition of the antecedent clause (that the speaker believes that he has not told the truth) does not clash with the ignorance implicature of the conditional (that it is open whether he will come to regret that he has not told the truth). The difference between examples such as (28) and (27) is also the prime reason why some presuppositional verbs such as *regret* are often not classified among soft triggers.

The idea that presupposition suspension is a result of a clash between presuppositions and implicatures has been challenged since the seventies. For once, a clash between presupposition and implicature is not predicted if the antecedent clause is in the 3rd person. Beaver (2010) however cites many naturally occurring examples where suspension occurs with the 3rd person as well:
(29)  
   a. If anyone discovers that Cook-n-Stirs are available to the US market please let the list know.
   b. If scientists discover that worms with ultra-long life spans are metabolically dynamic and not just hibernating in super-suspended animation, they could then attempt to induce similarly efficient metabolic activity, or a dauer stage, in humans.

Second, as it was already mentioned in Section 2, Beaver (2010) also suggests that the informational, focus structure of the sentence seems to be the determining factor for whether suspension is observed, rather than a clash with implicatures (cf. also Kadmon 2001). As Beaver observes, (30b), in which the verb is focused, suggests that the student is guilty. This contrasts with (30a), in which the embedded clause is focused, where there is no such implication:7

(30)  
   a. If the TA discovers that [your work is plagiarized]F, I will be [forced to notify the Dean]F.
   b. If the TA [discovers]F that your work is plagiarized, I will be [forced to notify the Dean]F.

Beaver also notes that focusing the verb in the classic examples discussed above has the effect that either the presupposition projects, or the sentence is quite odd. Thus he concludes that focusing and information structure plays the crucial part in presupposition suspension, rather than a clash with implicatures.

Abrusán (2011) has described how the projection mechanism proposed there can explain presupposition suspension in the case of so-called soft triggers (see also section 2 of this paper for a brief summary). The remainder of this section presents the predictions of Abrusán’s system for presuppositions of additive particles. It is shown that presupposition suspension facts are not observed because of the anaphoricity and the topic (/contrastive topic) sensitivity of these items.

Let’s first look at a case of an unstressed additive particle that associates with focus:

(31)  
   A: Bill ate broccolis. Who else ate broccolis?
   B: [John]F also ate broccolis.

   implies: x_c ate broccolis & x_c ≠ John.

The additive implication is that somebody other than John ate broccolis. In the context provided above, the anaphoric pronoun in this implication will be resolved to Bill. The focus structure indicates that the question that B answers is Who else ate broccolis?, which is also the question that was asked by A, and where else is understood as relating to Bill. Thus the question is understood as Who other than Bill ate broccolis? Note that (31B) would be infelicitous as an answer to Who...
ate broccolis? The additive entailment that Bill ate the broccolis cannot answer the background question of the sentence, and therefore this entailment is neither about the default main point (i.e. about the matrix time), nor about the secondary main point (the event time of the most direct answer to the question under discussion), and is therefore predicted to be presupposed. Note that one crucial assumption was that the anaphoric pronoun needs to resolved first before the entailment is turned into a presupposition. But this is entirely natural: first we need to understand what is being said before the question of what is presupposed even pops up.

If the associate of the additive particle such as too is shifted, the entailed meaning of the whole sentence shifts as well. Suppose the associate of the additive particle is the object:

(32) A: John ate broccolis. What else did he eat?
    B: He also ate [beans]_F.

implies: John ate x_c & x_c ≠ beans.

The reasoning is entirely parallel to the one above. In this case the additive implication is that John ate something other than the beans. In the particular context provided above, the anaphora resolution will resolve the anaphoric pronoun to the broccolis. The question under discussion that can be recovered from the focus structure is What else did John eat?, where else is understood in relation to the broccolis. In other words the QUD for (32B) in the above context is What did John eat other than the broccolis? The entailment of the answer that John ate the beans directly answers this question. The additive entailment of the answer in (32B) that John ate the broccolis does not answer this question. Since this entailment is neither necessarily about the default main point (the matrix event time) nor about the secondary main point (the event time of the most direct answer to the question under discussion) it is predicted to be presupposed, just as in the previous section.

Let’s turn to cases of a stressed additive particle that associates with a contrastive topic. The exact analysis of contrastive topics is controversial, but most researchers agree that sentences with contrastive topics evoke two different background questions (Roberts 1996, Büring 1997, Büring 2003, Kadmon 2001, Wagner 2012, etc.). For example, (33c), in which the constituent John is contrastively focused can be related to the questions in (33a,b). The question to which (33c) is a direct (and complete) answer is (33b). But it also indirectly (and partially) answers another, larger question, namely (33a).

(33) a. Who ate what?
    b. What did John eat?
    c. [John]_CT ate the [beans]_F.

(33a) can be assumed to correspond to a set of questions of the form Who did a eat, where a can range over any individual in some contextually supplied set. If John is a member of this set, then a complete answer to (33b) also provides a partial answer to this larger question in (33a). Since contrastive focus evokes both questions, uttering (33c) as an answer to (33b) in some context
suggests that there were other eaters as well: this is because (33a) would not be felicitous if it only contained one element (in this case, one question) in its denotation. Thus, answering the question in (33b) with (33c) indicates that the answer is partial along the dimension indicated by the contrastive topic: this larger dimension is captured by (33a).

Recall now that the present proposal predicts that an entailment of a sentence will not be presupposed if it is a direct answer to a question under discussion that can be recovered from the focus structure of the sentence. In other words cases of so-called suspension arise because the presupposition is not generated to begin with. Observe now the question-answer pair in (33):

(34) A: Fred ate the beans. What did John eat?  
B: [John]$_{CT}$ ate the [beans]$_{F}$, too.

(35)  
SEMANTIC CONTENT OF [John]$_{CT}$ ate the [beans]$_{F}$, too :  
John ate the beans & x$_{C}$ ate the beans & x$_{C}$ $\neq$ John.

That John ate the beans is a direct answer to the question What did John eat?, but the additive component of B’s answer, namely that x$_{C}$ ate the beans is not a direct answer to this question. (In contrast, both the prejacent and the additive component are partial answers to the larger question Who ate what? This question is also signalled by the assertion preceding the question in (34A).)

The presence of focus and contrastive topic introduces a secondary main point: secondary main points concern the event time of the sentence expressing the proposition that most directly answers the background question. The presupposition triggering mechanism looks both at the default (grammatical) and the secondary (pragmatic) main points and requires the presupposition to be independent from both of these. In the case of additive particles such as too the focus structure of the answer will not interfere with the presupposition generating mechanism, and the additive component is predicted to be presupposed even by the context-sensitive version of the triggering mechanism just as in the basic version of the proposal presented in the previous section.

Coming back to the cases at the beginning of this subsection, suspension in these examples is not possible because of the anaphoric requirement of too or again. Observe the case of (27a), repeated below for convenience:

(36) I have no idea whether John read the proposal. # But if Bill read it too, let’s ask them to confer and simply give us a yes/no response. (Abusch 2010)

The introductory sentence (I have no idea whether John read the proposal) makes it clear that the associate of too is the subject, Bill. This arises from the anaphoric and the discourse properties of the meaning of too discussed in the previous sections: it needs an antecedent in the previous (‘active’) context, and the resolution of the antecedent needs to respect discourse parallelism. Given
this, the antecedent of the conditional can be analysed as follows:

(37) \([\text{Bill}]_{\text{CT}} \text{read} [\text{it}]_{\text{F}}, \text{too}\).

**SEMANTIC CONTENT OF** \([\text{Bill}]_{\text{CT}} \text{read} [\text{the proposal}]_{\text{F}}, \text{too}\) :

\[\text{Bill read the proposal} \land x_C \text{read the proposal} \land x_C \neq \text{Bill}.\]

The direct background question that can be grammatically generated from the contrastive topic marking is *What did Bill read?*, while the indirect background question is *Who read what?* As in the previous cases in this section, the presupposition will not be suspended (i.e. will not fail to be generated), because the implication that \(x_C\) read the proposal does not answer the first background question (and it only indirectly answers the second background question). Therefore the additive implication will be turned into a presupposition by the present mechanism, and it should project out of the antecedent of the conditional (by some projection mechanism). Nevertheless, pragmatically the discourse presented in (37) will be a failure: On the one hand, the anaphor will try to resolve to *John* in the previous sentence, observing the requirements of parallelism and discourse salience. However, the negative content of first clause (*I have no idea...*) will make this antecedent unavailable. This results in a contradiction, and therefore the discourse in (37) is infelicitous.

In general, the anaphoricity of the additive entailment precludes it from being a direct answer to the question under discussion. As a consequence, the focus-sensitive suspension discussed in connection with soft triggers will not happen in the case of additive particles: it will never be the case that the additive entailment directly answers the secondary main point, indicated by the focus / question under discussion. For this reason, the presupposition of additive particles will not be suspended.

5. **Soft vs. Hard triggers**

It has been claimed that there are two types of presuppositions: soft and hard (cf. Abusch 2005, 2010 and also Simons 2001, Abbott 2006, Romoli 2011 among others). The reasons for distinguishing the two were mainly based on the data pertaining to the suspendability of presuppositions in embedded contexts, discussed above. The explanation for the difference in the behaviour of soft-triggers from hard-triggers was that soft triggers are pragmatically triggered, while hard triggers are lexically given. But in this paper we have seen that the same mechanism can trigger both types of presuppositions and that this is also compatible with the differences in suspendability.

The upshot of the previous section has been that the observed difference in suspendability is a consequence of the fact that additive particles have an anaphoric presupposition. An anaphoric presupposition, in the sense employed here, means that the presupposition contains an anaphoric pronoun that needs to be resolved in the preceding discourse (i.e. it is anaphoric whether or not one thinks presuppositions are anaphoric in general, à la van der Sandt). The presuppositions of factives or change of state verbs are not anaphoric in this sense. Additive presuppositions cannot be suspended because the additive inference is constructed from the focus structure (/contrastive
topic structure) of the sentence by filling in an anaphoric pronoun in the place of the associate of the particle. As argued by Asher (1993), the anaphor in the additive implication needs to be resolved to an antecedent that is in a semantically and structurally parallel sentence. As a consequence though, it will never be the case that the additive implication is a direct answer to the background question signalled by focus. Given this, additive implications will not be suspended, i.e. they will not fail to be presupposed, as they cannot be the secondary main point. Changing the focus structure of the sentence will not suspend the presupposition either, only change it to become a different presupposition.

Thus the observed differences that motivated the soft-hard preposition distinction boil down to differences in focus sensitivity and anaphoricity of the two groups: soft triggers such as factives and change of state verbs are not anaphoric or focus sensitive. There is no reason to assume two different types of presuppositions, soft and hard, or pragmatic and semantic.

References


Abstract. Subset comparatives (Grant 2013) are amount comparatives in which there exists a set membership relation between the target and the standard of comparison. This paper argues that subset comparatives should be treated as regular phrasal comparatives with an added presuppositional component. More specifically, subset comparatives presuppose that: a) the standard has the property denoted by the target; and b) the standard has the property denoted by the matrix predicate. In the account developed below, the presuppositions of subset comparatives result from the compositional principles independently required to interpret those phrasal comparatives in which the standard is syntactically contained inside the target. Presuppositions are usually taken to be licensed by certain lexical items (presupposition triggers). However, subset comparatives show that presuppositions can also arise as a result of semantic composition. This finding suggests that the grammar possesses more than one way of licensing these inferences. Further research will have to determine how productive this latter strategy is in natural languages.

Keywords: Subset comparatives, presuppositions, amount comparatives, degrees.

1. Introduction

Amount comparatives are usually discussed with respect to their degree or amount interpretation. This reading is exemplified in the comparative in (1), where the elements being compared are the cardinalities corresponding to the sets of books read by John and Mary respectively:

(1) John read more books than Mary.
$$\{| \{ x : books(x) \land John\ read\ x \} \} \succ \{| \{ y : books(y) \land Mary\ read\ y \} \}$$

In this paper, I discuss subset comparatives (Grant (to appear); Grant (2013)), a much less studied type of amount comparative illustrated in the Spanish\(^1\) example in (2):\(^2\)

(2) Juan ha leído más libros que El Quijote.
Juan has read more books than El Quijote
$$\{ y : y\ is\ El\ Quijote \} \subset \{ x : books(x) \land Juan\ read\ x \}$$

\(^*\)Special thanks to Chris Kennedy and Karlos Arregi for all the feedback and encouragement they have given me throughout every stage of this project. I would also like to thank Itamar Francez, Jason Merchant, Anastasia Giannakidou, Rajesh Bhatt, Julian Grove, Meg Grant and the audiences of the student session at ESSLLI 2013 and Sinn und Bedeutung 18 for useful discussion on different aspects of the data and the analysis.

\(^1\)Unless noted otherwise, it should be assumed that all non-English examples belong to Spanish.

\(^2\)In Spanish, the phrase ‘El Quijote’ can be used to refer to both the name of the character and the title of the book. Throughout this paper, I will use ‘El Quijote’ to refer to the name of the book.
The term *subset comparative* refers to amount comparatives like (2) in which the target (‘books’) and the standard of comparison (‘El Quijote’) are in a set membership relation. This contrasts with non-subset amount comparatives like (1), where there does not exist any such relation between standard (‘Mary’) and target (‘John’). Subset comparatives also differ from other amount comparatives in that they are presuppositional. More specifically, subset comparatives presuppose that 1) the matrix predicate is true of the complement of ‘than’; and 2) the standard is in the extension of the target.

Subset comparatives have not been extensively discussed in the literature. To my knowledge, Grant (2013) is the only existing analysis of this construction. In a nutshell, Grant derives the meaning of subset comparatives by assuming a new lexical entry for ‘more’ that establishes a proper subset relation between two sets of individuals. The presupposition that the matrix predicate is true of the standard is encoded as part of the lexical semantics of this new meaning for ‘more’ (see §3 for a more detailed explanation of this account). In this paper I argue that it is possible to provide a semantics for subset comparatives without multiplying the repertoire of meanings for the degree head ‘more’. I show that the presuppositional status of subset comparatives is straightforwardly accounted for under a phrasal analysis. In this system, the presuppositions arise as a result of the compositional principles required for the interpretation of phrasal comparatives such as (2), in which the standard is syntactically contained in the target. The analysis has the advantage of predicting for which configurations we should expect subset readings to be available.

The paper proceeds as follows. In §2, I show that subset comparatives are presuppositional. In §3, I present Grant’s (2013) proposal. In §4, I develop my own analysis. Finally, in §5 I conclude.

2. Characterizing the meaning of subset comparatives

Subset comparatives have the same cardinality entailment as any amount comparative (see (1)). The meaning differences between subset and non-subset amount comparatives can be reduced to the fact that the former carry two presuppositions that are absent in the latter. In particular, subset comparatives presuppose that: a) the standard of comparison has the property denoted by the target; and b) the standard of comparison is in the extension of the matrix predicate. Thus, sentence (2), repeated below, licenses the inferences in (3a-b).

(3) Juan ha leído más libros que El Quijote.  
Juan has read more books than El Quijote  
‘Juan has read more books than El Quijote.’  
⇒ a) El Quijote is a book ∧ Juan read it.  
⇒ b) Juan read more than one book.

The assertion in (3b) consists of a statement about cardinalities. Sentence (3) entails that the cardinality of the books read by Juan is greater than one (the cardinality of ‘El Quijote’). This is
supported by the fact that the continuation in (4) results in a contradiction only in (4a), where the entailment is that Juan read more than one book. In (4b), on the other hand, the entailment is that Juan did not read more than one book. Therefore, the continuation is expected to be well-formed.

(4) a. Juan ha leído más libros que El Quijote. #Sólo leyó El Quijote.
Juan has read more books than El Quijote. Only read El Quijote
‘Juan has read more books than El Quijote. He only read El Quijote.’
b. Juan no ha leído más libros que El Quijote. Sólo leyó El Quijote.
Juan not has read more books than El Quijote. Only read El Quijote
‘Juan has not read more books than El Quijote. He only read El Quijote.’

Example (3) triggers two more inferences that seem to be specific to subset comparatives. The first one is that ‘El Quijote’ is in the extension of the NP indefinite ‘libros’ (‘books’). The second one is that Juan read ‘El Quijote’. Evidence in favor of the presuppositional status of these inferences comes from their projection behavior. Examples (5)-(7) show that these inferences behave as presuppositions, since they project up through well known presupposition holes such as the antecedent of conditionals (5), questions (6) and negation (7):

(5) Si Juan lee más libros que El Quijote, no terminará su ensayo a tiempo.
If Juan reads more books than El Quijote, not finish.fut his essay in time
‘If Juan reads more books than El Quijote, he won’t finish his essay in time.’
⇒ a) El Quijote is a book ∧ Juan read it.                          Presuppositions

(6) Al final, Juan ha leído más libros que El Quijote?
To-the end Juan has read more books than El Quijote
‘All in all, did Juan read more books than El Quijote?’
⇒ a) El Quijote is a book ∧ Juan read it.                          Presuppositions

(7) Juan no ha leído más libros que El Quijote.
Juan not has read more books than El Quijote
≈Juan only read El Quijote.
⇒ a) El Quijote is a book ∧ Juan read it.                          Presuppositions
⇒ b) It is not the case that Juan read more than one book.        Assertion

This division of labor between asserted and presupposed meaning accounts for the only-reading of the negated subset comparative in (7). Sentence (7) presupposes that Juan read ‘El Quijote’ and asserts that he did not read more than one book. Therefore, it follows that Juan must have only
read ‘El Quijote’. This characterization of the meaning of subset comparatives also explains why subset comparatives are available with more-comparatives but ill-formed in less-comparatives:

(8) # Juan ha leído menos libros que El Quijote y La Celestina.
Juan has read less books than El Quijote and La Celestina
⇒ a) El Quijote and La Celestina are books ∧ Juan read them.  
⇒ b) Juan read less than two books.  

Presuppositions
Assertion

The semantic oddness of (8) results from the contradictory relation between the assertion and one of the presuppositions. Example (8) presupposes that Juan read ‘El Quijote’ and ‘La Celestina’, but asserts that he read less than two books. These two propositions are not consistent and therefore the sentence is semantically ill-formed.

Taken together, the facts discussed in this section suggest that subset comparatives should be treated as amount comparatives that carry some extra presuppositions. The question that remains to be addressed is: what feature of subset comparatives makes them presuppositional? A satisfactory analysis of subset comparatives should be able to explain how the presuppositions of this construction come about, while also accounting for the restricted distribution of these inferences. In the following section, I present Grant’s (2013) account and discuss how well her proposal fares with respect to these issues.

3. Previous account

Examples of subset comparatives can be found in the literature (see Fults and Phillips (2004)). However, Grant (2013) is the only existing attempt at providing a fully fledged account of the syntax/semantics of this type of amount comparatives. Grant discusses English examples like (9).

(9) More computers than laptops got stolen.

Grant pursues the line of thought that the syntax of subset comparatives is essentially the same as that of DP-internal subcomparatives, illustrated in (10), which can only receive an amount interpretation.

(10) More cell phones than laptops got stolen.

In order to implement this idea, Grant adopts Izvorski’s (1995) DP-shell analysis of comparatives. Izvorski’s proposal is to treat ‘more’ as a two-place determiner that projects a DP-shell structure. The determiner moves out of the most embedded DP, where it selects for the standard, to a higher DP, where it selects for the target NP as its complement.
My goal in this section is to focus on the semantic aspects of Grant’s analysis, so I will abstract away from the syntactic motivations that lead her to adopt the structure in (11) for sentences like (9) and (10). The core of Grant’s proposal is that the subset and the amount readings in (9) and (10) involve two different lexical entries for ‘more’.

(12) a. \[ \text{More}_{\text{deg}} Q_1 \text{ than } Q_2 \text{ } P \text{ } = \{ d : Q_2(d) \cap P \} \subset \{ d : Q_1(d) \cap P \} \]

b. \[ \text{More}_{\text{sub}} Q_1 \text{ than } Q_2 \text{ } P \text{ } = \{(Q_2 \cap P) \subset (Q_1 \cap P)\}, \text{ where } Q_2 \cap P \neq \emptyset \]

‘More_{\text{deg}}’ derives the amount interpretation by establishing a proper subset relationship between two sets of degrees (12a). On the other hand, ‘more_{\text{sub}}’ establishes a proper subset relationship between two sets of individuals (12b). This second lexical entry is responsible for the subset interpretation. In this account, the presupposition that the matrix predicate is true of the standard is encoded as a definedness condition in the lexical entry of ‘more_{\text{sub}}’. Grant encodes this presupposition as an existential statement by ensuring that the intersection of the VP and the standard is non-empty.

Since ‘more_{\text{sub}}’ takes three properties of individuals as arguments, it cannot be used to interpret subset comparatives in which the standard is an individual-denoting DP like ‘El Quijote’ (see (3)). In order to overcome this issue, Grant assumes a type-shifting operation (Partee (1987)) that raises the type of the DP from \(e\) to an \(\langle e, t \rangle\) predicate. This is not a trivial assumption, since subset comparatives always present standards that denote individuals: aside from proper names, as in (3), the standard of a subset comparative can also consist of a demonstrative, or a complex DP containing an individual-denoting relative clause, as in (13) and (14), respectively.
(13) Juan ha leído más libros que esos.
Juan has read more books than those
‘Juan has read more books than those.’

(14) Juan ha leído más libros que los que escribió Pedro.
Juan has read more books than the.m.p that wrote Pedro
‘Juan has read more books than the ones Pedro wrote.’

Sentence (9), repeated below, might at first sight seem a counterexample to the claim that the standards of subset comparatives always denote individuals.

(15) More computers than laptops got stolen.

Grant’s proposal can very straightforwardly account for cases like (15), which superficially seem to contain an NP standard. However, if ‘laptops’ in (15) denotes a property of individuals, the contrast in (16) remains unexplained.

(16) a. ?? More computers than computers that I borrowed from the campus tech center got stolen.
    b. More computers than the computers that I borrowed from the campus tech center got stolen.

In (16a), the standard denotes a property indefinite, whereas in (16b) the standard is definite and therefore denotes an individual. Note that the degraded status of (16a) cannot be due to the property indefinite being interpreted as the subject, as shown by the the grammaticality of (17).

(17) Computers that I borrowed from the campus tech center got stolen.

Under Grant’s account, the fact that there exists an asymmetry in acceptability between (16a-b) is unexpected. I take the contrast in (16) to further support the claim that the standard of a subset comparative must denote an individual, not a set. However, the question remains as to how to account for (15). In fact, (15) stops being problematic once we take into consideration that in this example the standard can only receive a kind interpretation (Carlson (1977)), in which case it would also be of type e.³ Sentence (15) could be paraphrased as ‘more types of computers, aside from laptops, were stolen.’ Based on the evidence in (13)-(16), and provided that subset comparatives with set-denoting standards are unattested, the use of type shifting seems unmotivated.

³Grant also mentions that the standards of some subset comparatives can receive a kind interpretation.
A second problem for this analysis is that the subset presupposition is not guaranteed to project under negation. In (12b), the set membership relation between standard and target follows from the proper subset relation. In fact, in Grant’s account, this inference is not modeled as a presupposition, but rather as part of the assertion. However, this system ends up deriving truth-conditions for negated subset comparatives that are too weak.

\[(18)\]

\begin{enumerate}
\item John didn’t see more students than Olivia.
\item \[18a\] = \[\neg([\{Olivia\} \cap \{y: \text{John saw } y\}] \subset ([\{x: x \text{ is a student}\} \cap \{y: \text{John saw } y\}]),
\]

where \[\{Olivia\} \cap \{y: \text{John saw } y\}\] \(\neq\) \(\emptyset\)
\end{enumerate}

The subset inference does not follow from the meaning in (18b). No presupposition failure is predicted if Olivia is not a member of the set of students. By the same logic, the only-reading of negated subset comparatives (cf. (7)) is not guaranteed to be derived, unless the two sets of individuals being related by the proper subset relation are extensionally identical. Consider, for instance, a scenario in which John saw both Olivia and Max, where only Max is a student. In this situation, the meaning in (18b) incorrectly predicts both that all the presuppositions of (18a) should be satisfied and also that the sentence is true.

A third problem with Grant’s proposal is that an unconstrained application of the lexical entries in (12) over-generates readings. Grant notices that in her account nothing prevents sets of individuals in a proper subset relationship to be compared by ‘more\_deg’. This is an undesired result, since ‘more\_deg’ cannot derive the presuppositions observed in subset comparatives. Grant rules out this possibility by invoking a new pragmatic principle that states that if the subset part of the meaning of ‘more\_deg’ follows from world knowledge, then ‘more\_sub’ must be deployed. This type of solution is not unreasonable. After all, the subset reading is stronger than the amount reading, since the former always entails the latter. Thus, the principle of using ‘more\_sub’ whenever possible could be motivated in terms of the Gricean Maxim of Quantity. However, it is unclear whether world knowledge is the driving force that determines when ‘more\_sub’ should be deployed. When the standard consists of a demonstrative, as in (13), repeated below, the sentence only has a subset interpretation, even when uttered out of the blue.

\[(19)\]

Juan ha leído más libros que esos.

‘Juan has read more books than those.

‘Juan has read more books than those.’

Whatever principle ensures that (19) is interpreted with ‘more\_sub’, it is clear that it could not be the result of conceptual relationships or world knowledge. Rather, it seems that subset readings arise as a result of the grammatical properties of this construction. This is the idea I pursue in the

\[4\] I thank Julian Grove for pointing this out to me.
next section, where I present the proposal. I argue that it is possible to account for the semantic properties of subset comparatives without resorting to lexical ambiguity and without encoding the presuppositions as part of the meaning of any of the lexical items involved in the construction.

4. Proposal

4.1. Subset comparatives are phrasal

From a descriptive point of view, phrasal comparatives are comparatives where the complement of the standard marker (‘than’ in English) is a DP (20a). In clausal comparatives like (20b), on the other hand, the complement of the standard marker is a CP that has undergone some reduction operation via ellipsis.

(20) a. John is taller than Mary.
    b. Johns is taller than Mary is.

Whereas it is clear that comparatives like (20b) can only receive a clausal analysis, cases like (20a) present at least two possible analytical options. The first one would be to assimilate (20a) to (20b) by assuming extra structure that has been elided (Bresnan (1973); Lechner (2001), among many others). Under this view, (20a) is a reduced clausal comparative that can be interpreted as its overt counterpart in (20b). The second option would be to not assume any unpronounced material. This approach is referred to as the Direct Analysis (DA). In the DA, the degree head combines with an individual (21a), instead of a property of degrees (21b), as is commonly assumed in the (reduced) clausal analysis (Hankamer (1973); Heim (1985); Kennedy (2007); Bhatt and Takahashi (2011)).

(21) a. [more\textsubscript{phrasal}] = λy.λg(d,e,t)λx.e. max\{d: g(d)(x)\} > max\{d': g(d')(y)\}
    b. [more\textsubscript{clausal}] = λD.(d,t)λD'.(d,t). max(D) > max(D')

The degree relation \(\langle d, \langle e, t \rangle \rangle\) that ‘more\textsubscript{phrasal}’ takes as its second argument is created by a series of LF movements.

(22)

\[
\begin{array}{c}
\text{John} \\
\text{DegP} \\
\text{-er than Mary} \\
\text{\quad λdλx. x is d-tall} \\
\text{\quad λx.tx} \\
\text{\quad is t_d-tall}
\end{array}
\]
In (22), the target moves, creating a predicate of individuals. Next, the degree head and the standard, which are assumed to form a logical constituent (i.e. the DegP), scope out targeting the \langle e, t \rangle-predicate created by movement of the target. This latter movement is an instance of parasitic scope (Barker (2007)), since it is contingent upon the movement of the target. Once the degree relation has been created, the meaning derived by phrasal ‘more’ ends up being equivalent to the meaning obtained through the clausal analysis, as seen in (23).

\begin{align*}
(23) & \quad \text{a. } [more] (Mary) (\lambda d \lambda x. x \text{ is } d\text{-tall}) (John) \\
& \quad \text{b. } \max \{ d: \text{John is } d\text{-tall} \} \succ \max \{ d': \text{Mary is } d'\text{-tall} \}
\end{align*}

In languages like English, it is hard to determine whether comparatives like (20a) are phrasal or reduced clausal comparatives. Spanish ‘que’ is just like English ‘than’ in not marking the phrasal/clausal distinction morphologically. However, there are languages that distinguish (reduced) clausal and phrasal comparatives by means of different standard markers. Merchant (2009) shows that Greek is such a language. In Greek, clausal comparatives present the marker ‘apo’ti’, whereas phrasal comparatives always contain the marker ‘apo’.

The prediction is that if subset comparatives are phrasal, they should only be available with the phrasal standard marker ‘apo’, and unavailable with the clausal standard marker ‘apo’ti’. As seen in (24), this prediction is borne out.

\begin{align*}
(24) & \quad \text{I } \text{Ariadne diavase parapano vivlia apo*/apo’ti tin } \text{Odysseia.} \\
& \quad \text{the Ariadne read further books from/that the.acc } \text{Odysseia.acc} \\
& \quad \text{‘Ariadne read more books than the Odyssey.’}
\end{align*}

Phrasal comparatives also differ from (reduced) clausal comparatives in that only the latter allow multiple remnants. Example (25) shows that subset comparatives parallel phrasal comparatives.

\begin{align*}
(25) & \quad \text{*Juan ha leído más libros en clase que [El Quijote] [en casa].} \\
& \quad \text{Juan has read more books in class than El } \text{Quijote } \text{in home}
\end{align*}

Finally, just as in phrasal comparatives, the standard of a subset comparative must always denote an individual. When the complement of the standard marker is an adverbial, as in (26), the subset interpretation is unavailable.\footnote{\textup{I have marked the unavailable reading with the symbol $\otimes$.}}
(26) Hoy he visto a más amigos que ayer.
    Today have.1sg seen to more friends than yesterday
    Amount: ‘I saw a greater number of friends today than I saw yesterday.’
    ⊗Subset: ‘Yesterday I saw some friends. Today I saw those friends and at least one more.’

There exists, however, a piece of data that is problematic for the view that subset comparatives are phrasal. The standard of a phrasal comparative is usually assumed to be a DP. Nevertheless, subset comparatives can present PP-standards.

(27) Juan se ha deshecho de más libros que (d)el Quijote
    Juan SE has gotten-rid of more books than of-the Quijote
    ‘Juan has gotten rid of more books than El Quijote.’

Based on well established assumptions regarding the syntax of phrasal comparatives, examples such as (27) cannot be easily accounted for. Unlike the clausal analysis, the phrasal analysis does not have much to say about how the preposition in the standard of (27) is selected. At the moment, I do not have a worked out solution to this problem. However, I should point out that in examples like (27) the preposition is optional. The sentence is grammatical, and has a subset interpretation, regardless of whether the preposition is present.

As long as the PP standard denotes an individual, examples like (27) become unproblematic for the analysis presented in §4.2. To the extend that prepositional standards are licensed in subset comparatives, the proposal developed below predicts that it should be possible to analyze them as individual denoting. Thus, if the phrasal analysis for subset comparatives is on the right track, the solution to the worry posed by (27) should be syntactic in nature. Specifically, it should involve a more complex theory of the constraints imposed on the selectional requirements of the standards in phrasal comparatives.

Even though not all the issues discussed above are fully understood, the syntactic evidence in (24)-(26) seems to provide support for a phrasal analysis of subset comparatives. In the following subsection, I show that the semantic properties of subset comparatives can be straightforwardly accounted for if subset comparatives are treated as phrasal comparatives.

4.2. Analysis

The LF in (28) contains the proposed analysis for the subset comparative in (3). As discussed in §4.1, in the Direct Analysis the degree head and the standard clause form a logical constituent that undergoes movement to create a constituent of the appropriate type \( \langle d, \langle e, t \rangle \rangle \) for the second argument of ‘más’ (Heim (1985); Barker (2007); Kennedy (2007); Bhatt and Takahashi (2011)). The
silent ‘many’ is a degree function (equivalent to the gradable adjective in an adjectival comparative) that maps an individual into its cardinality.\footnote{In the metalanguage, this degree function is represented with the \# sign.}

\begin{equation}
\lambda y. \exists \lambda d \lambda x. \text{read}(y, x) \land \text{books}(x) \land \#(x) = d
\end{equation}

I assume that indefinites in object position (‘libros’ in (28)) denote properties that work as predicate modifiers. Property indefinites compose with the verb by the mode of composition Restrict (Chung and Ladusaw (2004)). This operation narrows down the domain of the predicate function (i.e. the verb) to a subdomain consisting of individuals in the extension of the property-indefinite. The output of this operation is a predicate of the same semantic type as the input. The remaining unsaturated argument is \(\exists\)-closed at the VP level later in the derivation.

In (28), the DegP moves to the edge of the VP below the \(\exists\)-quantifier. The scope of the DegP does not need to be stipulated. If the DegP moved right above \(\exists\)-closure, the derivation would crash, since the second argument of ‘más’ would not be of type \(\langle d, \langle e, t \rangle \rangle\), but rather \(\langle d, t \rangle\). On the other hand, the fixed scope of the indefinite predicts that it should always have narrow scope with respect to other propositional operators such as negation, as in (29), or universal modals, as in (30). Examples (29)-(30) show that this prediction is borne out.\footnote{The same holds for other propositional operators such as universal quantifiers and intensional verbs.}

\begin{equation}
\lambda d \lambda x. \text{read}(y, x) \land \text{books}(x) \land \#(x) = d
\end{equation}

(29) Juan no ha leído más libros que El Quijote.
Juan has not read more books than El Quijote
'It is not the case that Juan read more books than El Quijote.'
\(\neg \triangleright \triangleright \exists / \neg \exists \triangleright \triangleright \neg\)
(30) Juan está obligado a leer más libros que El Quijote.
‘Juan is required to read more books than El Quijote.’
\[ \Box \triangleright \exists \Diamond \triangleright \Box \]

In the following subsection, I go over how the analysis derives the presuppositions observed in subset comparatives. Finally, in §4.4, I show that the proposal has the advantage of predicting when the presuppositions should be licensed.

4.3. Deriving the presuppositions

Presuppositions are usually taken to be inferences that are triggered by the presence of certain lexical items (i.e. the presupposition triggers). For instance, in Grant’s analysis the presupposition trigger is ‘more\textsubscript{sub}’. In what follows, I argue for a different view, namely that the presuppositions of subset comparatives follow from the semantic interpretation of LF’s like (28). In (31), I present a slightly simplified interpretation of (28):

\begin{align*}
    \text{(31) a. } & [\mathit{más}](\mathit{EQ})(\lambda d \lambda x. \text{read}(y, x) \land \text{books}(x) \land \#(x) = d) \\
    \text{b. } & \exists x \max \{d \colon \text{read}(y, x) \land \text{books}(x) \land \#(x) = d\} \succ \\
    & \max \{d' \colon \text{read}(y, \mathit{EQ}) \land \text{books}(\mathit{EQ}) \land \#(\mathit{EQ}) = d'\} \\
    \text{c. } & [\lambda y. \exists x \max \{d \colon \text{read}(y, x) \land \text{books}(x) \land \#(x) = d\} \succ \\
    & \max \{d' \colon \text{read}(y, \mathit{EQ}) \land \text{books}(\mathit{EQ}) \land \#(\mathit{EQ}) = d'\}](\text{Juan}) \\
    \text{d. } & \exists x \max \{d \colon \text{read}(j, x) \land \text{books}(x) \land \#(x) = d\} \succ \\
    & \max \{d' \colon \text{read}(j, \mathit{EQ}) \land \text{books}(\mathit{EQ}) \land \#(\mathit{EQ}) = d'\}
\end{align*}

In prose, (31d) states that there is an individual \(x\) such that \(x\) is a plurality of books read by Juan, and the cardinality of \(x\) is greater than the cardinality of ‘El Quijote’, which is also a book read by Juan. In order to derive the presuppositions of (3), I make the following assumption regarding the maximality function built in the meaning of phrasal ‘more’.

\begin{align*}
    \text{(32) } & \text{max is undefined when the set of degrees it takes as an argument is empty.}
\end{align*}

(32) is the only new element needed in order to derive the meaning of (3). Once (32) is assumed, it follows that in order for (31d) to be defined, it must be the case that Juan read ‘El Quijote’ and that ‘El Quijote’ is a book. In a scenario in which Juan did not read ‘El Quijote’ or ‘El Quijote’ is not a book, the set of degrees to the right of the \(\succ\) relation would be empty (since at least one
of the conjuncts would not be satisfied), triggering the expected presupposition failure when $max$ applies to the empty set.

The proposal also makes the correct predictions for negated subset comparatives like (7), repeated below. (34) contains the interpretation of (33):

(33) Juan no ha leído más libros que El Quijote.
    Juan not has read more books than El Quijote
    $\approx$Juan only read El Quijote.

(34) $\neg\exists x[\max\{d: \text{read}(j, x) \land \text{books}(x) \land \#(x) = d\} \succ$
    $\max\{d': \text{read}(j, EQ) \land \text{books}(EQ) \land \#(EQ) = d'\}]$

(34) states that there is no plurality of books $x$ such that Juan read $x$, whose cardinality is greater than the cardinality of ‘El Quijote’, a book read by Juan. The only-interpretation follows from (34). We have already seen that in order for (34) to be defined, it must be the case that Juan read ‘El Quijote’ and that ‘El Quijote’ is a book. Given this, and provided that (34) asserts that Juan did not read more than one book, it follows that Juan must have only read ‘El Quijote’. Notice that in (34), negation can uniquely target the meaning corresponding to the assertion (the set of degrees to the left of $\succ$), never the meaning corresponding to the presuppositions. This is exactly what we would expect given the projection behavior of these inferences.

Adopting (32) entails that any comparative construction whose semantics makes use of $max$ is presuppositional. This claim seems uncontroversial when it comes to subset comparatives or adjectival comparatives. In order for the adjectival comparative in (35a) to be felicitous, it must be the case that Mary has some degree of height. The question is whether the claim accurately describes amount comparatives like (35b).

(35) a. John is taller than Mary.
    b. John read more books than Mary.

Sentence (35b) carries the inference that Mary read at least one book.$^8$ This inference is certainly weaker than that of subset or adjectival comparatives, but is nevertheless present. The source of

$^8$Example (1) might appear as a counterexample to the claim that all amount comparatives are presuppositional.

(1) John read more books than Mary: he read two, and she didn’t read any.

Some speakers do not think that (1) is a good way to report the actual facts (i.e. that Mary did not read any book). This could be taken as an indication that, in uttering the second sentence, the speaker of (1) is playing with the presupposition failure.
the variability in the strength of the presuppositions associated with the different types of comparatives is a poorly understood issue that deserves careful examination. Unfortunately, an exhaustive exploration of this question is beyond the scope of this paper.

In the proposal developed in this section, the presuppositions of subset comparatives are not lexically triggered (contra Grant (2013)). Rather, the presuppositions are the byproduct of the compositional principles independently needed to interpret phrasal comparatives. The only new assumption required by the analysis is that the maximality function be undefined for the empty set. Under this view, the fact that presuppositional comparatives like subset comparatives exist is not surprising, given that natural languages make use of phrasal syntax as one of the strategies to express comparison. This raises the interesting question of how many ways natural languages go about licensing presuppositions. On the one hand, presuppositions can be lexically triggered; on the other, subset comparatives suggest that presuppositions can also be the result of semantic composition. Future research will need to determine how pervasive this latter strategy is in natural languages.

4.4. Predicting the presuppositions

Subset comparatives present a distinctive syntactic configuration that sets them apart from other amount comparatives. More specifically, in subset comparatives the standard is syntactically contained in the target in the position where both are base-generated. This contrasts with non-subset amount comparatives in which this containment relation is not present. This observation can be stated in the following generalization.

(36) In subset comparatives, the standard and the target are base-generated as part of the same syntactic argument.

To see how the generalization in (36) helps explain the distribution of the presuppositions, consider the following example.

(37) Juan visitó más ciudades búlgaras que Sofía.
    Juan visited more cities Bulgarian than Sofía
    Amount: ‘Juan has visited a greater number of Bulgarian cities than Sofía has.’
    Subset: ‘Juan has visited more Bulgarian cities than Sofía (the capital).’

(37) is ambiguous between a subset and an amount interpretation. The subset reading arises when ‘ciudades búlgaras’ is interpreted as the target, in which case ‘Sofía’ is interpreted as the name of the capital. If, on the other hand, ‘Juan’ is interpreted as the target, ‘Sofía’ can only be construed as the subject and be interpreted as a female name. In the latter syntactic configuration there is
no containment relation between the target and the standard. Thus, the subset interpretation is not licensed and the amount reading is the only one available. The LF’s corresponding to the subset and the amount reading are given in (38) and (39) respectively.

\[(38)\]
\[
\text{Juan} \quad \lambda y \quad \exists \quad \text{más que Sofía} \\
\quad \quad \lambda d \lambda x. \text{visited}(y, x) \land \text{Bulgarian-cities}(x) \land \#(x) = d \\
\quad \quad \quad \lambda d \quad t_y \\
\quad \quad \quad \quad \text{visitó} \\
\quad \quad \quad \quad t_d \quad \text{many} \\
\quad \quad \quad \quad \text{ciudades Búlgaras}
\]

\[(39)\]
\[
\text{Juan} \quad \lambda d \lambda y. \exists x [\text{visited}(y, x) \land \text{Bulgarian-cities}(x) \land \#(x) = d] \\
\quad \quad \lambda d \quad \lambda y \\
\quad \quad \quad \exists \quad t_y \\
\quad \quad \quad \quad \text{visitó} \\
\quad \quad \quad \quad t_d \quad \text{many} \\
\quad \quad \quad \quad \text{ciudades Búlgaras}
\]

The interpretations of (38)-(39) are given in (40)-(41). As seen in (40)-(41), the different scope of the degree clause determines whether the standard will be interpreted as the object (subset reading), or the subject (amount reading).⁹

⁹A third possibility would be to interpret the DegP in situ. As far as semantic composition goes, nothing rules out this possibility. However, this LF derives an unattested amount interpretation of (37). This reading can be paraphrased...
The analysis correctly predicts that the presuppositions should only be licensed in those cases in which both standard and target are interpreted as part of the same argument. In order to derive the correct truth-conditions, the degree phrase must scope below the $\exists$-quantifier. If it scopes above it (see (39)), only the subject reading of the standard can be derived, in which case none of the presuppositions are present. This is a welcome result, since it explains the generalization in (36) and accounts for the fact that the presuppositions are only licensed when the syntactic configuration described in (36) is met.

5. Conclusion

I have provided a compositional analysis for subset comparatives. I proposed that subset comparatives share entailments with amount comparatives, but present additional presuppositions. Specifically, subset comparatives presuppose that 1) the standard is in the extension of the denotation of the target; and 2) the standard of comparison has the property denoted by the matrix predicate. In the analysis presented above, the presuppositions associated with subset comparatives are not lexically triggered. Rather, they emerge as a result of the compositional principles required to interpret phrasal comparatives in which the standard is base-generated as part of the same syntactic argument as the target.

as ‘Juan visited more than one Bulgarian city.’ Based on the unavailability of such reading, it seems plausible to conclude that the DegP must obligatorily scope out of its base position. At the moment I do not have a principled way of ruling out the in situ interpretation of the DegP. However, I will suggest two possible approaches to this problem that eventually might lead to a solution. The first type of solution would be configurational. It is possible that there exists an independent parallelism requirement on the relation between target and standard that cannot be satisfied when the latter is contained in the former, thus forcing the DegP to scope out. The second type of solution would rely on a pragmatically motivated blocking mechanism. In the reading derived by the in situ scope, the use of the referential DP ‘Sofia’ seems unnecessary. The same exact truth-conditions would be achieved with any other standard that denoted a singular referential term or by just saying ‘more than one’. It is therefore possible that, under some generalized version of the Maxim of Manner, the referentially more complex DegP ‘more than Sofia’ blocks the parse in which the DegP stays in situ.
The proposal has several advantages with respect to Grant’s (2013) lexical-ambiguity based analysis. First, it is more economical, since it does not involve multiplying the lexical entries for the degree head. The analysis developed above only makes use of machinery that has been shown to be needed in order to compositionally interpret phrasal comparatives (Heim (1985); Kennedy (2007); Bhatt and Takahashi (2011)). The only new assumption required by the analysis is that the maximality function be undefined for the empty set. Second, the analysis straightforwardly accounts for the otherwise puzzling fact that the presuppositions are not licensed across the board. Subset comparatives all present the same syntactic configuration in which the standard and the target are part of the same syntactic argument. The scopal configuration that derives the object reading of the standard also derives the two presuppositions that characterize subset comparatives. On the other hand, when the DegP scopes above the VP, only the subject reading of the standard is derived. In this configuration, none of the presuppositions observed in subset comparatives are licensed.

The broader theoretical implications of this study have to do with the grammatical mechanisms of presupposition licensing. Presuppositions are usually thought of as inferences that are attached to certain lexical items, or presupposition triggers. Subset comparatives reveal that presuppositions can also emerge as a consequence of semantic composition. To the extent that the claims defended in this paper are headed in the right direction, we would expect to find other constructions in natural languages that carry these compositionally generated presuppositions.

References


Abstract. The paper provides an analysis for the obligatory occurrence of the presupposition triggers “too”, “again” and “know”. The claim is that these triggers are inserted to avoid a mandatory exhaustivity implicature that contradicts the context. Two main empirical arguments for why this account is to be preferred over analyses of these obligatory triggers that make use of a principle Maximize Presupposition will be presented.

1. Introduction

Recently the maxim Maximize Presupposition (Heim (1991)) has been reformulated and extended to explain not only the obligatory occurrence of the definite determiner but all kinds of different presupposition triggers (Percus (2006), Sauerland (2008), Chemla (2008), Schlenker (2012)). The set of examples that are being explained with Maximize Presupposition are given in (1) to (5) below.

(1)  a. #A sun is shining.
    b. The sun is shining.

(2)  a. #All of John’s eyes are open.
    b. Both of John’s eyes are open.

(3)  a. #John thinks/believes that Paris is in France.
    b. John knows that Paris is in France.

(4)  John came to the store.
    a. #Bill did.
    b. Bill did, too.

(5)  Jenna went ice skating.
    a. #Today she went ice skating.
    b. Today she went ice skating, again.

The assumption behind these recent proposals is that lexical items or sentences are ordered on a scale with regard to their presuppositional strength. They predict that the item or sentence that is presuppositionally weaker will lead to a specific inference (“antipresupposition”, Percus (2006) or “implicated presupposition”, Sauerland (2008)). I will argue that at least a subset of phenomena
that have been explained by using *Maximize Presupposition* should be accounted for by assuming that exhaustification of an implicit or explicit Question Under Discussion (QUD; Roberts (1996)) is sometimes obligatory. The proposal is that the insertion of the triggers “too”, “again” and “know” is mandatory when it avoids a contradiction that the sentence without the trigger would yield due to this exhaustivity implicature. The account is able to explain the fact that these triggers are not obligatory in complex sentences and under negation. A possible extension to definite determiners will be discussed. In addition to the empirical advantages explained in further detail below the present account has a number of conceptual advantages. No lexical scales of presuppositional strength have to be postulated (as for a similar proposal made by Magri (2009)). No additional pragmatic maxims (Singh (2009)) or inferences with special status have to be introduced into the grammar. The insertion follows from an independently needed mechanism under the present account.

The paper is structured as follows. Section two gives a theoretical background on obligatory presupposition triggers. Accounts working with *Maximize Presupposition* and the potential empirical problems they face will be discussed in the first part of section two. Then the alternative account working with obligatory exhaustivity implicatures will be explained and argued for in the second part of section two. Some of the competing predictions of the two theories are tested in an empirical study which is reported and discussed in section three of the paper.

2. Theoretical Background

2.1. *Maximize Presupposition*

Heim (1991) observes that Grice’s Maxim of Quantity cannot capture the fact that the sentence with the definite determiner in (1-b) is to be preferred over the sentence with the indefinite in (1-a) since both are equally informative: they share the same assertion and only differ in their presuppositions. She hence introduced the maxim *Maximize Presupposition*. 

*Maximize Presupposition* (Heim (1991)) Make your contribution presuppose as much as possible!

This principle can explain why the sentence with the presupposition trigger in (1-b) is preferred over the sentence without the presupposition trigger in (1-a). It also accounts for why the sentence without the trigger has an inference that the presupposition is not true: via pragmatic reasoning the hearer assumes that since the presupposition has not been introduced it is not verified by the context.

Recently the principle has been reformulated and applied to other presupposition triggers besides the definite (Percus (2006), Chemla (2008), Sauerland (2008)). These recent approaches focused...
more on the fact that using a lexical item that is an alternative to a presupposition trigger creates the inference that the presupposition of that trigger is not verified by the context. An example is given in (6) below. The sentence in (6-a.) has the inference in (6-c.) since the alternative in (6-b.) has not been used.

(6)  
  a. Peter believes it is raining.
  b. Peter knows it is raining.
  c. It is not certain that it is raining.

The basic assumption behind newer proposals is that sentences (Sauerland (2008)) or lexical items (Chemla (2008), Percus (2006)) are in global or local pragmatic competition. Sentences with stronger presuppositions or presuppositionally stronger items are assumed to be preferred. A local version of Maximize Presupposition is given in (7). In this case competition is based on (ordered lexical) scales of presuppositional strength. These scales are given in (8).

(7)  **Maximize Presupposition (Percus 2006)**
  a. Alternatives are only defined for lexical items. For any lexical item, the alternatives consist of all “presuppositionally stronger” items of the same syntactic category.
  b. Do not use \( \phi \) if a member of its Alternative Family is felicitous and contextually equivalent to \( \psi \)  \( \phi \) is contextually equivalent to \( \psi \) iff for all \( w \) in the common ground, \( \phi(w) = \psi(w) \).

(8)  \{the, a\}, \{know, believe\}, \{too, \emptyset\}, \{again, \emptyset\}, \{both, all\}

Both local and global versions of Maximize Presupposition, assume that this competition creates another type of inference that should be distinguished from implicatures and presuppositions based on the characteristics in (9) (Sauerland (2008)).

(9)  
  a. Weak epistemic status
  b. Projection behaviour

The inferences arising from not using the trigger share the weak epistemic status with implicatures but exhibit projection behaviour just like presuppositions. The last property follows from the fact that presuppositions project under negation. As a result, presupposition triggers should be obligatory under negation as well. Not inserting the trigger should lead to same inferences in negated sentences (and other kinds of embedding). The inferences resulting from leaving out the trigger thus have been argued to form their own class of inferences (implicated presuppositions/antipresuppositions).
Maximize Presupposition faces an empirical challenge when trying to extend its scope to the whole set of presuppositional items in (1) to (5). It would predict that all triggers are obligatory under negation. Accordingly, the sentences in (10-b), (11-b) and (12-b) should have to be used and the sentences in (10-a), (11-a) and (12-a) should be degraded in the contexts below.

(10) Jenna went iceskating yesterday.
   a. Today she didn’t go.
   b. Today she didn’t go again.

(11) Mary came to the party.
   a. It is not the case that Peter came to the party.
   b. It is not the case that Peter came to the party, too.

(12) Mary is pregnant.
   a. Joe does not believe she is.
   b. Joe does not know she is.

It does not seem to be the case that the triggers “again”, “too” and “know” are obligatory under negation or that the missing trigger leads to the described inference under negation. Furthermore, versions of Maximize Presupposition which work with local competition cannot explain why (13-a) should not be considerably worse than (13-b). The same holds for (14-a) and (14-b).

(13) a. John came to the party and Peter came.
    b. John came to the party and Peter came, too.

(14) a. Peter was in Norway last year and Peter was in Norway this year.
    b. Peter was in Norway last year and Peter was in Norway this year, again.

I will provide an alternative explanation for the insertion of the triggers “know”, “again” and “too” which captures these empirical facts. It will be explained in the next section.

2.2. Alternative Explanation: Obligatory Implicatures

The following explanation of the obligatory insertion of the triggers “too”, “again” and “know” is based on a grammatical approach to scalar implicatures (Chierchia (2004), Fox and Hackl (2006), Fox (2007), Chierchia and Spector (2011)) and makes use of a covert exhaustivity operator which
functions like overt “only”. This operator identifies a proposition as the most informative out of a given set. A simple version is given in (15).

\[(\text{exh})(A_{<s,t>,t>})(p_{<s,t>}) = \lambda w. p(w) = 1 \land \forall q \in A \rightarrow p(w) \models q(w)\]

The proposal I want to make is inspired by observations made by Sæbø (2004) and Krifka (1999) regarding obligatory additives. They argue that a sentence with focus and without “too” generates a contrastive implicature of the form given in (16). It says that there exists no proposition in the focus alternatives besides q (the proposition uttered) that is true.

\[\neg \exists p [p \in C \land p = 1 \land p \neq [q]_0]\]

For example, a sentence like (17-a.) has the contrastive implicature in (17-b.) that there is no proposition of the form “x came to the party” in the alternatives that is true besides “Mary came to the party”.

\[(17)\]
\[\begin{align*}
\text{a.} & \quad \text{MARY} \_F \text{ came to the party.} \\
\text{b.} & \quad \neg \exists p [p \in \{ p : \exists x. \text{person}(w)(x) \land p = \lambda w. x \text{ came to the party in w} \} \land p = 1 \land p \neq [\text{Mary came to the party}]_0]\end{align*}\]

The claim of these approaches is that “too” has to occur obligatorily when this implicature is contradicting the context (when it is clear that there is a relevant alternative). This is the case in contexts that verify the presupposition of “too” because they have to entail that there is a relevant alternative. The presupposition of “too” that ensures that is given in (18).

\[(18)\]
\[\exists p [p \in C \land p = 1 \land p \neq [q]_0]\]

The sentence in (19-a.) is only defined in contexts which entail (19-b.), for example. Using (17-a.) in this context would yield a contradiction.

\[(19)\]
\[\begin{align*}
\text{a.} & \quad \text{MARY} \_F \text{ came to the party, too.} \\
\text{b.} & \quad \exists p [p \in \{ p : \exists x. \text{person}(w)(x) \land p = \lambda w. x \text{ came to the party in w} \} \land p = 1 \land p \neq [\text{Mary came to the party}]_0]\end{align*}\]
My proposal extends the idea that the insertion of additives follows from contrastive implicatures to the obligatory occurrence of the triggers “again” and “know”. Moreover, it modifies the accounts from Krifka (1999) and Sæbø (2004) by combining their idea with a grammatical approach to scalar implicatures. Under the following explanation the implicatures which force the insertion of the triggers are exhaustivity implicatures resulting from the sometimes mandatory insertion of an exhaustivity operator which identifies propositions as the most informative answer to the QUD. To see how the proposal works for “too” and “again” one has to see first what the inferences of sentences missing these triggers would look like, again. Under the assumption that there are competing sentences with “too” and “again” for (20-a.) and (21-a.) the inferences resulting from the missing triggers would be the ones in (20-b.) and (21-b.), respectively.

(20) a. Mary was at the party
    b. No one else was at the party

(21) a. Peter was in Norway last year.
    b. There is no time before last year where Peter was in Norway.

With focus on “Mary” in (20-a.) and focus on “last year” in (21-a.) these sentence have the exhaustivity implicatures in (20-b.) and (21-b.), respectively. The implicatures of these sentences without “too” or “again” are thus equivalent to their “antipresuppositions” or “implicated presuppositions”. I assume that these implicatures arise because people interpret sentences exhaustively with respect to the implicit QUD. I further assume that this is mandatory when there is obligatory focus which marks the implicit QUD, also in cases of contrastive focus (Beaver and Clark (2008)). Under this view the inferences described above are exhaustivity implicatures derived by the grammar. The alternatives the operator works on are defined by the question set, which is the set of propositions that are possible answers to the QUD. It identifies one answer as the most informative (the one that has to entail all other true answers). The version of an exhaustivity operator working on the question set and returning the most informative answer is given in (22).

(22) \[
\vDash \text{exh} \left[ Q < s, t > \left( p < s, t > \right) \right](w) \iff p = (\tau p)(Q(p)(w)) = 1 \land \forall q[Q(q)(w) = 1 \rightarrow Q(p)(w) = Q(q)(w)]
\]

For the example in (20-a) this would mean that the proposition “Mary was at the party” with focus on “Mary” would be interpreted as the exhaustive answer to the implicit question “Who was at the party?”. The result of this is given in (23).

(23) \[
\vDash \text{exh} \left[ \text{Who was at the party} \right](\left[ \text{Mary was at the party} \right])
\iff [\lambda w. \text{Mary was at the party in } w] = \tau p[\exists x\. \text{person}(w)(x) \land p] = \lambda w[ x \text{ was at the party}]
\]
The obligatory insertion of the presupposition trigger follows from the fact that mandatory exhaustive interpretation can result in a contradiction as in (24).

(24) Peter was at the party. Mary was at the party # (too).

If “too” is left out in the second sentence and it is interpreted exhaustively with respect to the QUD “Who was at the party?” due to the obligatory focus on “Mary” a contradiction arises: “Peter and only Mary came to the party”. A parallel explanation holds for examples with “again”.

(25) Peter was in Norway last year. Peter was in Norway # (again) this year.

“Peter was in Norway this year” is interpreted exhaustively with respect to the question “When was Peter in Norway?” due to obligatory focus on “this year”. The result is that “Peter was in Norway this year” is identified as the most informative answer and has to entail all other true answers. This is shown in (26).

(26) \[
\text{exh}[\text{When was Peter in Norway }](\text{Peter was in N. this year })
\Leftrightarrow [\lambda w. \text{Peter was in Norway this year in } w ](\exists t[\text{time}(w)(t) \land p = \lambda w[ \text{Peter was in Norway at } t \text{ in } w ] \land q(w)]) : p(w) \models q(w)
\]

A contradiction arises when “Peter was in Norway last year” is in the common ground and “Peter was in Norway this year” is interpreted exhaustively with respect to the implicit question “When was Peter in Norway?”. The contradiction resulting from this exhaustivity implicature can be avoided when the trigger is inserted. To see why the insertion of, for example, again blocks the implicature one has to look at the truth conditions of “Peter was in Norway again this year” (Beck (2007)) in (27).

(27) \text{[Peter was in Norway again in this year]}_w = \text{is defined only if Peter was in Norway at } g(1) \text{ and } g(1) < \text{this year. If defined, it is true iff Peter was in Norway this year.}

Since “again” is anaphorically referring to “Peter was in Norway last year” the alternative that was excluded by the exhaustivity operator is presupposed to be true. It can hence not function as an
excludable alternative anymore. Excluding “Peter was in Norway last year” would make “Peter was in Norway again this year” undefined.

The present account straightforwardly predicts that “too” and “again” are not obligatory under negation and in complex sentences. The facts are repeated in (28) and (29) below.

(28)  
a. Mary came to the party. Peter did not come.
b. Peter was in Norway last year. Peter was not in Norway this year.

(29)  
a. Mary came to the party and Peter came.
b. Peter was in Norway last year and he was in Norway this year.

Negation changes the QUD to either a polar question (“Did Peter come or not?”) or to “Who did not come” in the case of (28-a.). Parallely, the QUD changes to “Was he in Norway this year or not?” or “Where was he not this year” in the case of (28-b.). Exhaustifying the second sentences in (28-a.) and (28-b) with respect to either of these questions will not yield a contradiction with the context. The insertion of the trigger is only necessary under the present account when an exhaustivity implicature arises which leads to a contradiction. Hence, obligatory insertion of the trigger is not expected in (28-a.) and (28-b.) which seems to fit the empirical picture.

The present account can also explain why both sentences in (29) are not degraded. A standard analysis of the discourse connective “and” assumes that it takes two propositions \( p \) (Mary came to the party) and \( q \) (Peter came to the party) and returns a truth value true if both propositions are true. It is hence asserted by the sentence in (29-a.) that both Peter and Mary came to the party. “And” is moreover the strongest item on a Horn scale. The insertion of an exhaustivity operator into the second conjunct in (29-a.) is blocked since the exclusion of either would yield a weaker meaning than the asserted meaning. In the sense of Fox (2007) neither \( p \) nor \( q \) are innocently excludable alternatives. Since no implicature is assumed to occur in (29-a.) or (29-b) the acceptability of both sentences is expected under the present account. According to - at least local versions of - Maximize Presupposition, however, there should be a competing sentence “Mary came and Peter came to the party, too” for (29-a.) which has the same assertion but stronger presuppositions. As a result, the second sentence in (29-b.) should have the inference that someone else besides Peter came and hence should be degraded.

A parallel explanation holds for the data regarding the propositional attitude verbs “know” and “believe”. “Know” is inserted when the implicature that “believe” triggers contradicts the context. This implicature is the reason for the oddness of (30-b.) in the context in (30-a.).

(30)  
a. Peter has a sister.
b. #John believes that Peter has a sister.
The most natural place to put focus on in the second sentence in (30) is “believe”. This is because in the given context what is at issue is John’s attitude towards the proposition $p$ in (30-a.) and not $p$ itself. The QUD with respect to which the sentence is mandatorily exhaustified is hence “What is the $R$ such that John $R$ that Peter has a sister?”. The result of this exhaustification is given in (31) below.

$$
(31) \quad \bigg[ \text{exh}\big[\big[\text{What is the } R \text{ John } R \text{ Peter has a sister}\big]_w\big]\bigg](\big[\text{John believes Peter has a sister}\big]) \\
\iff [\lambda w. \text{John believes Peter has a sister in } w] = \lambda p. [\exists R [\text{PropAtt}(w)(R) \land p \Rightarrow \lambda w [\text{John } R \text{ Peter has a sister in } w] \land p(w) \equiv q(w)] \\
\quad \forall q[\exists R [\text{PropAtt}(w)(R) \land q = \lambda w [\text{John } R \text{ Peter has a sister in } w] \land q(w)] : p(w) \Rightarrow q(w)]
$$

The $R$ that is asked for is assumed to be restricted to propositional attitudes that are salient alternatives to “believe” in the context. The most salient alternative to “believe” is “know” since both express a degree of certainty with regard to the proposition that follows and stand in an entailment relation to one another. Under this assumption the question set that is exhaustified only contains “John knows that Peter has a sister” and “John believes that Peter has a sister” (making the QUD “Does John believe or know that Peter has a sister?”). Approaches to obligatory triggers that make use of Maximize Presupposition would assume that these two propositions are identical with respect to their assertion. Exhaustifying the sentence with “believe” should hence not exclude the sentence with “know”. Recently, however, “know” has been shown to be a soft trigger (Abusch (2010)) whose complement in unembedded contexts should rather be seen as an entailment, not a presupposition (Romoli (2011)). It has furthermore been argued that in embedded contexts the complement of “know” is an implicature (Romoli (2011)) which can explain that the presupposition of “know” sometimes does not seem to project.

$$
(32) \quad \text{Mary might not be in NY but if Peter knows that she is he will definitely meet her.}
$$

There are other analyses of “know” and its projection behaviour which share the idea that its complement is special in that it only sometimes behaves like a PSP, i.e. projects. Simons et al. (2011) argue that the PSP of “know” does project when its content is explicitly marked as not at-issue. Abrusan (2011) argues for a separate mechanism related to the topic which can turn the complement of “know” into a presupposition in certain contexts. For the present account it is only important that asking the question whether John believes or knows that $p$ which is evoked by the sentence in (30-b) clearly implies that the truth of $p$ is still at issue and not entailed by the context. It seems that at least in this competition with “believe” the complement of “know” does not behave like a presupposition.

I adopt the view that the complement of “know” is an entailment in simple affirmative sentences. I assume that $\text{know } p = \text{believe } p \land p$. The obligatory insertion of “know” can then be explained by
exploiting the mechanism described above and accounts for the fact that “know” is not obligatory under negation. The result of exhaustifying the sentence that contains “believe” in (33) below with respect to the restricted question set given in (33-a.) would be the one in (33-b.)

(33) John believes Peter has a sister.
   a. \( Q = \{ (\forall w' \in \text{BEL}(J)(w) \rightarrow (P \text{ has a sister})(w')), (\forall w' \in \text{BEL}(J)(w) \rightarrow (\text{Peter has a sister})(w') \land \text{Peter has a sister}(w) \} \)
   b. \( Exh(Q) = (\forall w' \in \text{BEL}(J)(w) \rightarrow (\text{Peter has a sister})(w')) \land \neg (\forall w' \in \text{BEL}(J)(w) \rightarrow (\text{Peter has a sister})(w') \land \neg \text{Peter has a sister}(w) \)

Since “John knows Peter has a sister” is not entailed by “John believes that Peter a sister” exhaustifying the latter sentence will result in the implicature that the former sentence is false. Under the assumption that know \( p \) is equal to believe \( p \land p \) this amounts to saying that \( p \) is false since believe \( p \) is part of the assertion of (33) and cannot be false. The implicature of the second sentence that is the result of mandatory exhaustive interpretation contradicts what is entailed by the context. It can also be explained why the negated sentence is not infelicitous in the same context as can be seen in (34) below.

(34) Peter has a sister. John does not believe it.

Parallely to the examples discussed above negation is taken to change the QUD. The QUD is most likely the polar question “Does John believe or not that Peter has a sister?” in the case of (34). This explains why the sentence in (34) seems to mean that John refuses to believe something uncontroversial. Exhaustifying the sentence with respect to this question will not result in a contradiction.

The account just presented faces a serious challenge when trying to explain the obligatory insertion of definite determiners. The inferences resulting from non-presuppositional determiners as the indefinite are the only ones that survive under negation and in complex sentences. This can be seen by the fact that both (35-a.) and (35-b.) are equally unacceptable.

(35) a. #A father of the victim arrived.
   b. #A father of the victim did not arrive.

When trying to maintain and extend the analysis of the obligatory insertion of “too”, “again” and “know” in the previous section it could be argued that this so called “antiuniqueness” effect of the indefinite arises because (35-a.) triggers the scalar implicature “Not all fathers arrived” which requires that there is at least one father that did not arrive and thereby contradicts common knowledge. This line of reasoning cannot explain the oddity of the following sentences, however.
Since “every” is the strongest item on the Horn scale there is no implicature which could lead to the oddness of the sentences in (36-a.) and (36-b.). Maximize Presupposition makes the right predictions for determiners whereas an account working with implicatures needs to assume that additional mechanisms are at play here. There have been some attempts to capture the facts which do not require Maximize Presupposition and are in accordance with the alternative explanation presented. Magri (2009) extends his account of blind mandatory scalar implicatures to the presuppositional domain and assumes that sentences with determiners are exhaustified with respect to their presuppositions. This approach has the conceptual disadvantage of introducing scales of presuppositional strength into the grammar after all. Singh (2009) proposes another maxim Maintain Uniformity which forbids the introduction of an already answered question (How many fathers arrived?) instead. If the account just laid out is correct in assuming that insertion of the trigger is related to the structure of discourse then combining Singh’s (2009) view with the present perspective might be a suitable way of subsuming all occurrence of obligatory triggers under the same mechanisms. Further investigations of the empirical picture is needed to confirm that.

To sum up, at least for a subset of cases (iteratives, additives, propositional attitude verbs) there seems to be a principled way of explaining the obligatory occurrence of presupposition triggers that does not require the maxim Maximize Presupposition. The insertion of these triggers follows from the fact that exhaustivity implicatures are sometimes mandatory and can lead to a contradiction. The insertion of the presupposition trigger prevents this contradiction from arising. The present proposal has some empirical and conceptual advantages over Maximize Presupposition. First, it predicts that inferences resulting from leaving out the trigger are in fact implicatures and thus do not project under negation or occur in complex sentences with “and”. Second, the present account predicts a connection between exhaustification and the obligatoriness of the trigger. The experimental evidence supporting this point will be presented in the next section. One conceptual advantage of the account presented is that one does not have to stipulate scales of presuppositional strength for “too”, “again” or “know” or inferences with special status. The mechanism used is needed for independent reasons, e.g. for strong or weak versions of answers to questions (Heim (1994)) and other generalized conversational implicatures (Chierchia (2004), Fox and Hackl (2006)).

3. Experiment

3.1. Hypotheses

To test some of the predictions of the two competing theories just outlined (referred to as Maximize Presupposition and Obligatory Implicatures in the subsequent discussion) I conducted an experimental study on the German presupposition trigger “auch” (“too”). One general aim of the study
was to find empirical evidence for the prediction of both theories that sentences without the trigger in a context where their PSP is verified will lead to oddness due to an inference which is contradictory to the context. For that purpose, people were asked to provide an interpretation for and judge the acceptability of sentences with and without “auch” (“too”) in context where its PSP was fulfilled.

To distinguish between Maximize Presuppositions and Obligatory Implicatures sentences with the German discourse connective “und” (“and”) were tested in the same contexts as sentences with and without “auch” (“too”). The prediction of Maximize Presupposition is that these sentences should have the same status as sentences without the trigger. This is due to the fact that “and” is not a presupposition trigger and that there is a competing sentence with “too” which is presuppositionally stronger. Since the inferences Maximize Presupposition predicts result from this competition the sentence with “and” should have the inference that the sentence with “too” is false and be odd in contexts where the PSP of “too” is fulfilled. Opposed to that view Obligatory Implicatures predicts that the insertion of “and” should have the same effect as inserting “too”. The connective combines with two propositions and asserts that both are true. The exhaustivity operator cannot exclude any of these two as false since this would a weaker meaning than what is asserted.

Additionally, Maximize Presupposition does not predict any influence of discourse or information structure on the obligatoriness of the trigger. Obligatory Implicatures predicts that the effect of obligatory insertion of the trigger depends on whether exhaustification is made mandatory through the structure of discourse, e.g. focus or the presence of a question. That is, when an explicit QUD is given in the context exhaustification should be forced and the resulting implicature should make the sentences without the trigger contradictory and less acceptable in a context where the PSP is fulfilled than when no overt question is present. The predictions of the two theories are summarized in table one below.

<table>
<thead>
<tr>
<th></th>
<th>Maximize Presupposition</th>
<th>Obligatory Implicatures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sentences with the trigger “too”</td>
<td>Not contradictory</td>
<td>Not contradictory</td>
</tr>
<tr>
<td></td>
<td>High acceptability</td>
<td>High acceptability</td>
</tr>
<tr>
<td>Sentences without the trigger (no expression)</td>
<td>Contradictory</td>
<td>Contradictory</td>
</tr>
<tr>
<td></td>
<td>Low acceptability</td>
<td>Low acceptability</td>
</tr>
<tr>
<td>Sentences with “and”</td>
<td>Contradictory</td>
<td>Not contradictory</td>
</tr>
<tr>
<td></td>
<td>Low acceptability</td>
<td>High acceptability</td>
</tr>
<tr>
<td>Presence of a question</td>
<td>Contradictory</td>
<td>Contradictory more often</td>
</tr>
<tr>
<td></td>
<td>Low acceptability</td>
<td>without question</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Lower acceptability</td>
</tr>
<tr>
<td></td>
<td></td>
<td>than without question</td>
</tr>
</tbody>
</table>

Table 1
3.2. Method

36 comic-like stimulus sets consisting of 4 pictures each were constructed. The comic showed three people having a conversation. The first picture of the comic showed one of the three people making a general statement. Then the second person replied either with a general remark (e.g. “cool”) or a question in the second picture. After that the person who started the dialogue made a statement again in the third picture. In the version with the question in the second picture this statement could function as an answer. The third person gave a parallel answer in the fourth picture. His/her answer included “und” (“and”) or “auch” (“too”) or no trigger/“and” (∅). The general pattern of the dialogue is illustrated in (37) below. The corresponding stimulus set (in the condition no question/no expression) is given in Figure 1.

(37) a. A: Peter had a party at his house last night.
   b. B: Cool. / B: Who came to the party?
   c. A: Mary came to the party.
   d. C: And Julia came to the party./ C: Julia came to the party./ C: Julia came to the party, too.

Figure 1: Visual Stimulus

The design thus crossed the 2-level factor CONTEXT (ctxt; no question/question) with the 3-level factor EXPRESSION (xpr; auch/und/∅). Every item was realized in six conditions. A variant of each item was assigned to one of six lists so that every condition appeared six times in every list. The items were pseudo-randomized over these six lists. Additionally, 72 filler items were intermixed.

24 native speakers of German with normal or corrected to normal vision participated in the experiment. They received 10 Euros for their participation. The stimulus set was presented on a computer...
screen. Participants first read the dialogue and then gave an interpretation. They indicated their interpretation by opting between saying that the last speaker agrees with the statement made by the speaker before him/her (interpretation=1, “both Mary and Julia came”) or contradicts/corrects him/her (interpretation=0, “Only Julia came”). After choosing between these interpretative options participants were asked to judge the acceptability of the utterance of the last speaker on a scale from 1 (unacceptable) to 5 (completely acceptable).

3.3. Results

**Acceptability** Acceptability judgments were aggregated across items and within participants and condition and were subjected to a repeated measure analyses of variance (ANOVA). The ANOVA revealed no significant main effect of context (question/no question) \(F(1,23)=1.311, p<.264\). Expression had a highly significant main effect on acceptability \(F(2,46) = 39.703, p <.001\). For the three level factor expression a difference contrast (reverse Helmert contrast) was calculated comparing “too” against “and” in a first step and then comparing the mean of these two conditions with “no expression”. The contrast revealed that the main effect expression is due to a difference between the conditions no expression versus “and” and “too” \(F(1,23)= 41.43, p <.001\). There was no difference between “and” and “too” \(F(1,23)=2.3, p<.142\) (see Figure 2).

**Interpretation** This analysis is based on arcsine square root transformed mean relative frequencies for the dependent variable interpretation. The data were transformed after they were aggregated across items and within participants and condition. The aggregated data were subject to a repeated measure analyses of variance (ANOVA). The ANOVA revealed that the choice of expression had a highly significant main effect on interpretation \(F(2,46) = 199.43, p <.001\). For the three level factor expression a difference contrast was calculated. It showed that the
effect rests on a difference between the conditions “no expression” and “too” and “and” ($F(1,23) = 224.12, p<.001$). There was no difference between “and” and “too” in interpretation ($F<1$). The context (question/no question) had no significant main effect on interpretation ($F<1$). There was, however, a significant interaction between the conditions context and choice of expression in interpretation. This interaction is due to a contrast between no expression and “too” and “and” ($F(1,23) = 6.1, p<.02$). There was no contrast between “and” and “too” ($F<1$) (see Figure 3).

![Figure 3: Left: Transformed mean relative frequencies of interpretation 1 (“both”) in contexts with a question (1) and without a question (2) for sentences with “too” (1), “and” (2) and no expression (3) Right: Untransformed mean percentage of interpretation 1 (“both”) in contexts with and without a question for “too”, “and” and no expression](image)

### 3.4. Discussion

The predictions of both theories discussed above are identical for sentences without and with the trigger in contexts that verify its presupposition. The sentences without the trigger should be unacceptable and read as a contradiction/contrastive due to the special inference/exhaustivity implicature they possess. The results show that this prediction is borne out: sentences with no expression are read contrastive in most cases (71% on average) and are significantly less acceptable than sentences with “too” ($\emptyset 3.62$ vs. $\emptyset 4.72$) or “and” ($\emptyset 3.62$ vs. $\emptyset 4.78$).

At first glance the total average acceptability of sentences without the trigger seems a bit high from the point of view of both theories. The same holds for the percentage of answers corresponding to a non-contrastive reading of these sentences (29%). In all likelihood the results can be explained with the fact that the sentences were presented as a dialogue. It is clearly less coherent and acceptable when a person is contradicting her/himself than correcting or contradicting other interlocutors in a conversation. Moreover, it is not clear within the dialogue what is individual and
common knowledge and what relations hold between the speaker. This might very well influence how likely and acceptable contradicting each other is. Furthermore, the plausibility of an “Only”-reading of the sentence of the last speaker crucially changed with the context, i.e. type of question that is explicitly or implicitly introduced. Looking at the interpretation of singular items in the experiment revealed that in contexts with questions for which by definition more than one true answer is expected (Who was at the party?, Who went to the concert?) the last sentence without the trigger was less likely to be identified as the only true proposition (according to the belief of the speaker). Answers to questions like “What did Mary plant in the garden?” and “Where does Birgit work?” were more likely to be perceived as contrastive. This speaks in favour of an analysis of obligatory triggers that is sensitive to the question type and context which pertains to Obligatory Implicatures but not Maximize Presupposition. However, this requires the assumption that implicatures are pragmatic default, rather than absolutely mandatory. This default can be overruled by certain contextual factors the specification of which is up for further investigation. It is related to the still open research question under which circumstances answers can be interpreted as so called “mention some” answers as opposed to strongly exhaustive answers. A systematic investigation regarding the influence of the question type on the obligatoriness of the trigger is necessary to confirm these preliminary findings.

Regarding the sentences containing the discourse connective “and” the prediction of Maximize Presupposition but not Obligatory Triggers is that these sentences should be interpreted as contradictory or contrastive to the proposition in the context and thus be less acceptable than sentences with “too”. This prediction is, however, not borne out. Sentences with “and” are not read contrastive in almost all cases (98% on average) and are not significantly less acceptable than sentences with “too” (∅ 4.78 vs. ∅ 4.72). This is explicable with the theory advocated for making use of obligatory implicatures. No exhaustification is expected in the sentences with “and” since the resulting implicature would yield a weaker meaning than the asserted.

Moreover, no impact of the presence of an explicit question is expected under Maximize Presupposition. Even though no main effect of context (presence of question) was found for acceptability or interpretation there was an interesting and significant interaction between the choice of expression and the presence of an explicit question. This interaction resulted from a contrast between sentences with no expression and sentences with “and” or “too”. Sentences without “too” or “and” were read contrastively significantly more often, when there was a question in the discourse (76% of the time) than in contexts where there was no question (68% of the time). Maximize Presupposition cannot explain that the question has an influence on the obligatoriness of the trigger. Obligatory Implicatures, however, straightforwardly predicts that the presence of a question should make the exhaustivity implicature which results from leaving out the trigger more prominent.
3.5. Conclusion and Outlook

The study provided additional empirical evidence for the view that “too” is inserted obligatorily to avoid an exhaustivity implicature from arising which ends up contradicting the context. The findings are in accordance with the fact that “too” as well as the triggers “again” and “know” are not obligatory under negation. The insertion of at least the triggers “too”, “again” and “know” should hence be considered to follow from the independently needed mechanism of exhaustification and not a general pragmatic principle *Maximize Presupposition*.

It is up for further research whether the present account operating with the QUD and exhaustivity implicatures as a default is to be preferred and can be distinguished from theories working with contrastive implicatures (Krifka (1999), Sæbø (2004)). One needs to find more evidence for the relation between the factors for when questions are exhaustified and the necessity of inserting the trigger, especially the triggers “again” and “know”. Moreover, more research is necessary on the possible connection between discourse and information structure and the insertion of definite determiners. It has to address the question whether the general mechanism of exhaustification and the arising of implicatures is responsible for the insertion of definites or whether scales of presuppositional strength have to be postulated for determiners after all.

References


Hebrew *kol*: a universal quantifier as an undercover existential

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Abstract. Constructions containing the Hebrew determiner *kol* have a prominent interpretation as involving universal quantification. In light of this, it has traditionally and almost unarguably been considered to be truth-conditionally a universal quantifier. The goal of this paper is to argue that contrary to the widely accepted analysis, *kol* is an existential quantifier and that the universal import of constructions containing *kol* results from grammatical strengthening. Such an argument is backed by *kol*’s interpretation in Downward-Entailing environments, its behavior as a Free Choice item and more importantly, its indefinite interpretation in interrogatives. The proposal is carried out using a mechanism of exhaustification and the assumption that *kol* is special among existential quantifiers in lacking a scalar (i.e., universal) alternative.

Keywords: Quantification, Alternative semantics, Exhaustification, Grammatical Strengthening, Hebrew, *kol*, Negative Polarity, The grammatical view of scalar implicatures.

1. Introduction

The Hebrew determiner *kol* has a prominent interpretation as a (distributive) universal quantifier. This can be seen in the following examples (for convenience, we label this interpretation U-*kol*).

(1) (etmol) *kol* yeled ciyer et acmo b-a-maxberet Selo
(yesterday) *kol* boy drew ACC self in-the-notebook his
(Yesterday,) every boy drew himself in his notebook.

(2) *kol* yeled higi’a

*kol* boy arrived

Every boy arrived.

In light of typical examples such as these, *kol* has traditionally and almost unarguably been considered to be truth-conditionally a universal quantifier.\(^1\)

\(^1\)We owe a lot to the following people and would like to thank them for inspiring discussions, helpful advice and support: Danny Fox, Gennaro Chierchia, Luka Crnić, Nora Boneh, Edit Doron, Ivy Sichel, Elitzur Bar-Asher Siegal, Yael Greenberg, Ivano Caponigro, Veneeta Dayal, Salvador Mascarenhas, Eli Asor, Gali Bary, Itai Bassi, Henry Brice, Naomi Granofsky, David Kashtan, Ran Lanzet, and Elior Sulem. We would also like to thank Sinn und Bedeutung 18 audience, 3 anonymous reviewers for Sinn und Bedeutung 18, and 5 anonymous reviewers for ESSLLI 2013. All mistakes and shortcomings are our own.

\(^2\)Note that the very Hebrew term for universal – *kolel* or *klali* – is an adjectival form of *kol*.
The goal of this paper is to argue that contrary to the widely accepted analysis, *kol* is an existential quantifier whose universal import is a result of strengthening.

In section 2 below we provide data showing that in Downward-Entailing and Free-Choice contexts, *kol* has an interpretation that challenges the traditional view, and that parallels with Negative Polarity and Free-Choice Items (NPIs, FCIs), such as English *any*. In section 3 we discuss a potential analysis that maintains universal truth-conditions for *kol*, according to which it always takes wide scope, yielding the desired interpretations; we reject such an analysis on the basis of *kol*'s behavior in interrogatives. In section 4 we present our proposal, according to which *kol* is an existential quantifier that (i) obligatorily undergoes grammatical strengthening, and (ii) introduces domain alternatives but lacks scalar alternatives. In section 5 we suggest a way to incorporate our proposal in a general theory of polarity sensitivity along the lines of Chierchia (2013) and discuss several open issues. Section 6 concludes the paper.

2. *Kol* in Negative Polarity and possibility modality contexts

2.1. The NPI-like behavior of *kol* [=NPI-*kol*]

As we have seen in (1)-(2), U-*kol* can be described as a parallel of English *every*. Interestingly enough, in DE environments *kol*'s interpretation parallels with that of *any* (for convenience, we label this interpretation NPI-*kol*):

(3) lo nigram *kol* nezek  
    NEG was.caused *kol* damage  
    *No damage was caused*.

(4) sarat ha-miSpaṭim hitnagda Se-yevuca *kol* Sinui be-takciv beit  
    minister the-law objected that-will.be.performed *kol* change in-budget house  
    ha-miSpaṭ ha-'elyon  
    the-court the-supreme  
    *The minister of justice objected to performing any change in the budget of the supreme court.*

(5) ha-mu’amad lo kibel *kol* tSuva  
    the-candidate NEG received *kol* response  
    *The candidate did not receive any response.*

(3), for instance, is not translated into *it is not the case that every damage was caused* but rather into *it is not the case that any damage was caused*. If *kol* is indeed a universal quantifier, that might be surprising.
Such data call for a non-trivial modification of the traditional analysis. That is, if one is to take a naive view,according to which kol is a plain universal quantifier, one needs to explain why only the \[\forall > \neg\] readings in (3)-(5) should result, in spite of surface structure being of the form \[\neg > \forall\].\(^3\)

An example to such a modification is found in Doron and Mittwoch (1986)’s treatment of kol, cited in Francez and Goldring (2012). Considering examples such as (3), Doron and Mittwoch (1986) submit that in certain cases kol is an NPI.

Note that if one is to analyze NPI-kol as an existential quantifier, one could keep the surface structure and derive the aforementioned interpretation, due to the equivalence between \[\forall > \neg\] and \[\neg > \exists\].\(^4\) Before elaborating on this issue, let us consider the related phenomenon of Free-Choice-kol.

2.2. Free choice inferences with kol [=FC-kol]

In addition to U-kol and NPI-kol, a further interpretation of kol is that found with possibility modals, which is evident in (6) (we label this interpretation FC-kol):

(6) yosi raSai le’exol kol ugiya
    yosi is.allowed to.eat kol cookie
    Yossi is allowed to eat any cookie.

In (6), we infer that Yossi is free to choose whatever cookie(s) he wants to eat. As in the case of NPI-kol, we can see here a similar pattern to that of English any. Assuming that kol is a universal quantifier, we would have expected it to yield an interpretation compatible with that of every, according to which the given permission is to eat all the cookies \[\diamond > \forall\].\(^5\)

\(^3\)Assuming, for the case of (4), that the predicate object scopally-interacts with kol in a way similar to that of negation.

\(^4\)This has been proposed by Levy (2008). See our discussion of her proposal in 5.2.1. This point can be seen as echoing the long lasting debate about the quantificational force of any. See Quine (1960); Klima (1964); Ladusaw (1980); Krifka (1995) and references therein.

\(^5\)A question may arise as to whether or not Yossi is allowed to eat all of the cookies, and not just choose between them. See discussion in 4.2.3 below.
3. Reconsidering the universal analysis of kol

3.1. An immediate analysis: wide scope universal

How could the traditional universal analysis of kol be reconciled with the data on NPI-kol and FC-kol? A potential unified account might be that kol has the semantics of a universal quantifier and that it obligatorily takes wide scope.

Kol’s universal semantics is then reflected trivially in the cases of U-kol, such that (7a) is the LF of (2). NPI-kol is derived by the universal scoping above DE operators present in the LF, forming (7b) for (3). Similarly, FC-kol would be derived by scoping kol above a possibility modal, yielding (7c) as the result of (6).

(7)  a. kol boy arrived
     \(\forall x[\text{boy}(x) \rightarrow \text{arrived}(x)]\)
     b. \([\text{kol damage}], \text{NEG was.caused } x\]
     \(\forall x[\text{damage}(x) \rightarrow \neg(\text{was.caused}(x))]\)
     c. \([\text{kol cookie}], \text{allowed yossi eat } x\]
     \(\forall x[\text{cookie}(x) \rightarrow \diamond(\text{eat}(x)(\text{yossi}))]\)

This account remains within the lines of the traditional view, assumes a unified universal semantics for kol and thus derives U-kol, NPI-kol and FC-kol altogether. However, such a solution runs into a major problem in predicting kol’s interpretation in questions, as discussed in the following lines.

3.2. Problem: interpretation in interrogatives

Consider the following context:

(8)  a. **Context:** A governmental office is waiting for three responses to three questions it has sent out. An hour ago, the first response has arrived. No additional responses have arrived.
     In this context, the following question is asked:
     b. ha’im hitkabla kol tSuva?
     Q was.received kol response
     Was any response received?
Given the context in (8a), the answer to (8b) is positive. If kol is a universal quantifier, no matter what scope it takes in (8b) and under any semantics of questions of which we are aware, such a response is not predicted.

We have seen that in UE contexts kol behaves like a universal quantifier and yet that in DE contexts it is problematic to think of it in such terms. We have shown from questions that a solution in terms of a wide scope universal won’t explain the data. However, if one were to assume that kol has the truth-conditions of an existential quantifier, its behavior in interrogatives and DE contexts would straightforwardly follow.

In the next section, we put forward our proposal, which is based on this assumption and an adoption of a mechanism of strengthening. We claim that such an analysis explains kol’s interpretation in DE and modal contexts, and furthermore, that it derives kol’s universal import in UE episodic contexts.

4. Proposal: strengthened existential

4.1. Assumptions

4.1.1. Exhaustification

Exhaustification, an operation of grammatical strengthening, has been proposed for explaining phenomena like Scalar Implicatures, Free Choice inferences and Polarity Sensitivity (Krifka (1995); Chierchia (2006, 2013); Fox (2007), a.o.).

An exhaustivity operator is a covert counterpart of only which takes two arguments: a proposition (the PREJACENT) and a set of alternatives, and returns the prejacent conjoined with the negation of all alternatives that are non-weaker than the prejacent.

To force the exhaustivity operator to negate only a proper subset of the non-weaker alternatives, in order to avoid contradictions, we follow Fox (2007) in defining the exhaustivity operator EXH in the following way, using the notion of Innocent Excludability (IE). ⁶

\[
\text{EXH}(Alt(p))(w) \Leftrightarrow p(w) \land \forall q \in \text{EXCLUDABLE}(p, Alt(p))[\neg q(w)]
\]

When Alt(p) is the set of alternatives of the prejacent p.

b. \(\text{EXCLUDABLE}(p, Alt(p)) = \bigcap\{Alt(p)' \subseteq Alt(p) : Alt(p)' \text{ is a maximal set in } Alt(p), s.t. \{\neg q : q \in Alt(p)\}' \cup \{p\} \text{ is consistent}\}

⁶See also discussion in section 5.1.
The formula in (9a) reads: the exhaustification of a proposition \( p \) and a set of \(( p \)'s) alternatives \( Alt(p) \) is true in a world \( w \) if and only if that proposition is true in that world and every alternative member in the set of EXCLUDABLE alternatives is false in that world. (9b) reads: the set of EXCLUDABLE alternatives, given a proposition \( p \) and a set of \(( p \)'s) alternatives \( Alt(p) \), equals to the intersection of all maximal sets of alternatives in \( Alt(p) \) whose negation is consistent with the prejacent \( p \).

We further assume, also following Fox (2007), that exhaustification applies recursively until no additional strengthening occurs (that is, until applying EXH any number of times would not provide additional information).

### 4.1.2. The semantics of kol

We propose that \( kol \) has the truth-conditions of a plain existential quantifier:

\[
[kol](P)(Q) \iff \exists x [P(x) \land Q(x)]
\]

(10) 
(for any \( P \) and \( Q \) of type \( < e, t > \))

In accordance with the similarity between any’s and kol’s behavior in DE and FC contexts (section 2), we suggest a solution that utilizes theories of NPIs and FCIs. We thus propose that kol requires to be in the scope of an exhaustivity operator (as in the analysis of Polarity Sensitive Items (PSIs) like any in Chierchia (2006, 2013)).

A second way in which kol is like PSIs is, we submit, in that it introduces alternatives that cannot be pruned (i.e. neglected; see Chierchia (2013) and Ivlieva (2013)). The assumptions above mean that kol’s alternatives, when excludable, will always be negated by the exhaustivity operator it requires.

The set of alternatives associated with kol contains its DOMIN alternatives. The set of domain alternatives of the prejacent contains propositions that differ from it only in having a domain of quantification which is a subset of the domain in the prejacent.

\[
Alt([kol](P)(Q)) = \{ \exists x \in D'[P(x) \land Q(x)] : D' \subseteq P \}
\]

(11) 
A crucial part of our proposal is that kol’s set of alternatives, unlike in the case of many PSIs, does not include a SCALAR alternative, namely the universal quantifier.
Intuitively, keeping the scalar (i.e., universal) alternative out, would save it from being negated by EXH. In this way, we can have a chance to get a universal meaning for kol at the end of the computation. The discussion in what follows provides an argument for the claim that lacking a scalar alternative is not implausible, based on conjunctive strengthening of disjunctions.

4.1.3. Disjunctions with conjunctive meaning

Model-theoretically, existential quantification can be put in terms of disjunction, and universal quantification – in terms of conjunction (at least over finite domains). Since we propose that kol is an existential quantifier, let us build on this parallelism with disjunction and mention three other cases in which strengthening disjunctive constructions leads to conjunctive (universal) interpretations.

It has been argued that sentences with disjunctive constructions can sometimes get conjunctive interpretations. First, a familiar case is that of Free Choice disjunctions:

\[(13)\] You are allowed to eat ice cream or cake.
   a. \(\sim\) You are allowed to eat ice cream.
   b. \(\sim\) You are allowed to eat cake.

The inferences in (13a)-(13b) correspond to the two disjuncts in (13), which is surprising given that an expression of the form \(\diamond(a \lor b)\) is expected to have a meaning weaker than \((\diamond a) \land (\diamond b)\), namely that of \((\diamond a) \lor (\diamond b)\). The proposal in Fox (2007) is that disjunction can get grammatically strengthened into conjunction if some existential operator (allowed in (13)) takes scope over the disjunction and under two exhaustivity operators.

In addition, it has been argued that even simple unmodalized sentences with disjunctive constructions sometimes also end up with a conjunctive meaning. Singh et al. (2012) report that children reject sentences of the form in (14a) if the statement in (14b) is false.

\[(14)\] a. The monkey is holding a flower or a book.
   b. The monkey is holding a flower and a book.

This is taken to be evidential for arguing that children actually interpret (14a) as adults would interpret (14b).
Finally, Meyer (2011) discusses examples such as (15), in which both inferences in (15a)-(15b) are present, in spite of (15) being of the form of a disjunction.

(15)  Bernadette must be rich or else she wouldn’t own a Porsche.
     a.  ⇔ Bernadette is rich.
     b.  ⇔ If Bernadette wasn’t rich, she wouldn’t own a Porsche.

In both cases it has been proposed that the observed conjunctive interpretations result from strengthening (i.e., exhaustifying) disjunctions whose set of alternatives lacks scalar (i.e., conjunctive) alternatives. Similarly, we propose that kol is an existential quantifier that lacks scalar (i.e., universal) alternatives and thus may get strengthened to receive a universal meaning.

4.2. Application

4.2.1. U-kol as a strengthened existential

How can the assumptions we made explain the different interpretations of kol in different environments as we have seen in our data? In what follows we present a brief derivation for every such environment.

The most problematic case, given our assumption that kol bears the semantics of an existential quantifier, is that of U-kol. Specifically, how can an existential quantifier have a universal import in upward entailing environments? The derivation in (16) shows how it happens, according to the proposed analysis.

The simplified LF in (16) is the relevant representation of the sentence in (2) based on the assumption that the EXH operator occurs as many times as needed for adding more information. In this case, even though applying EXH to the prejacent once will not give us more information, applying it twice would. Applying it more than twice will be again uninformative, so the relevant LF based on our assumption has two EXH operators as in (16).

(16)  \[ \text{EXH EXH kol boy arrived} \]
     a.  \[ D = \{yossi, john\} \]
     b.  \[ a := \text{yossi arrived}; b := \text{john arrived} \]
     c.  \[ \left[ \text{kol boy arrived} \right] = \exists x [ \text{boy}(x) \land \text{arrived}(x)] \equiv a \lor b \]
     d.  \[ \text{Alt}\left(\left[ \text{kol boy arrived} \right]\right) = \{a \lor b, a, b\} \]
     e.  \[ \text{EXH}_{\text{Alt}(a \lor b)}[a \lor b] = a \lor b \]
     f.  \[ \text{Alt}(\text{EXH}_{\text{Alt}(a \lor b)}[a \lor b]) \]
First, for expository reasons, assume a toy model of two boys, Yossi and John, as in (16a). The relevant sentences for deriving the alternatives, $a$ and $b$, are defined in (16b).

The semantics of the prejacent of (the low) EXH is shown in (16c) and is equivalent to $a \lor b$ in our toy model due to the equivalence between disjunction and existential quantification. The set of alternatives for (16c) is in (16d): the prejacent itself, which is $a \lor b$, and the domain alternatives *kol* introduces, $a$ and $b$. Note that crucially the scalar alternative $a \land \neg b$ is absent from this set, in accordance with our assumption that *kol* does not introduce scalar alternatives.

The result of applying EXH once with respect to the set of alternatives in (16d) is in (16e) (the set of alternatives appears in subscript). Since no alternative is excludable, the output of applying EXH equals to its input – the prejacent.

However, the set of alternatives of this very sentence, namely of EXH *kol* boy arrived ((16e)) is different from the one in (16d); this set is provided in (16f). Here the alternatives are identical to (16e), except for the domain of quantification which is a subset of our D in (16a). This identity is the reason why the EXH in each of the alternatives in (16f) operates with respect to the set Alt($a \lor b$), that is, the one in (16d). The set in (16f) thus turns out to contain the original sentence ($a \lor b$), and in addition, ‘only $a’ ($a \land \neg b$), and ‘only $b’ ($b \land \neg a$).

Applying EXH for the second time, this time with respect to the set of alternatives in (16f), yields (16g). The derived meaning is, roughly, $a$ or $b$, and not only $a$, and not only $b$, which is equivalent to $a \land b$. We have started with a disjunctive assertion, equivalent to an existential one, and ended up with a conjunctive meaning, that is – a universal meaning. This is due to our assumptions: (i) that *kol* is an existential quantifier, (ii) that it is obligatorily exhaustified, and (iii) that it introduces domain alternatives but not scalar alternatives.

4.2.2. Deriving NPI-*kol*

To explain the data of NPI-*kol* we only have to show that exhaustification does not do any harm to the assertion, since assuming *kol* is an existential quantifier and keeping surface structure would straightforwardly yield the desired meaning.
In DE-environments no alternatives of the prejacent are non-weaker (i.e., all are entailed), since negation over an existential quantifier constitutes the strongest member on the scale. Because of that, no strengthening occurs and \textit{kol} remains existential.

(17) is the LF of (3). Here applying EXH once would suffice because applying it more times will have no additional effect. The truth-conditions of the basic statement with no EXH are in (17a) (assuming again a toy model, with a domain containing two entities). The set of alternatives is shown in (17b), and the result of applying EXH with respect to that set of alternatives is in (17c).

\[
\text{(17)} \quad \text{EXH \ NEG \ was.caused \ kol \ damage} \\
\text{a.} \quad \text{NEG \ was.caused \ kol \ damage} \equiv \neg (a \lor b) \\
\text{b.} \quad \text{Alt}(\text{NEG \ was.caused \ kol \ damage}) = \{\neg (a \lor b), \neg a, \neg b\} \\
\text{c.} \quad \text{EXH}_{\text{Alt}(\neg(a \lor b))}[\neg(a \lor b)] = \neg(a \lor b)
\]

4.2.3. Deriving FC-\textit{kol}

The analysis suggested here for FC-\textit{kol} is almost identical to that of Fox (2007) on Free Choice inferences: disjunctive items could be strengthened without contradiction to conjunctions when in the scope of an existential operator. The derivation in (18) is very similar to the one in (16) and goes along the same lines.

\[
\text{(18)} \quad \text{EXH \ EXH \ yossi \ may \ eat \ kol \ cookie} \\
\text{a.} \quad D = \{\text{cookie}_1, \text{cookie}_2\} \\
\text{b.} \quad a := \text{yossi \ eats \ cookie}_1; \quad b := \text{yossi \ eats \ cookie}_2 \\
\text{c.} \quad \text{[yossi \ may \ eat \ kol \ cookie]} \equiv \diamond(a \lor b) \\
\text{d.} \quad \text{Alt}(\text{yossi \ may \ eat \ kol \ cookie}) = \{\diamond(a \lor b), \diamond a, \diamond b\} \\
\text{e.} \quad \text{EXH}_{\text{Alt}(\diamond(a \lor b))}[\diamond(a \lor b)] = \diamond(a \lor b) \\
\text{f.} \quad \text{Alt}(\text{EXH}_{\text{Alt}(\diamond(a \lor b))}[\diamond(a \lor b)]) = \{\diamond(a \lor b), (\diamond a) \land \neg(\diamond b), (\diamond b) \land \neg(\diamond a)\} \\
\text{g.} \quad \text{EXH}_{\text{Alt}(\text{EXH}_{\text{Alt}(\diamond(a \lor b))}[\diamond(a \lor b)])}[\text{EXH}_{\text{Alt}(\diamond(a \lor b))}[\diamond(a \lor b)]] \\
= \diamond(a \lor b) \land \neg((\diamond a) \land \neg(\diamond b)) \land \neg((\diamond b) \land \neg(\diamond a)) \\
= \diamond(a \lor b) \land ((\diamond a) \leftrightarrow (\diamond b)) \\
= (\diamond a) \land (\diamond b)
\]

In light of the computation in (18), the following example may seem puzzling:

\[
\text{(19)} \quad \text{ata} \quad \text{yaxol \ lavo} \quad \text{kol \ yom} \\
\text{you may \ to.come \ kol \ day}
\]
a. You may come any day.
b. You may come every day.

In line with what we saw in example (6), the reading in (19a) represents the inference that the addressee is free to choose whatever day(s) on which he comes. However, prima facie it might seem that (19) has yet another interpretation, (19b), according to which the addressee can come on each and every day. This interpretation would be problematic in light of our discussion of the FC-
kol data, suggesting that kol in modal contexts does pattern like every.

One way to go is to assume that (19b) is a reading of (19), different from (19a) in being the result of applying EXH under the modal: may EXH EXH you come kol day, resulting in \[ \Diamond > \forall \], that is, the every/U-
kol reading. (19a) would then be analyzed as EXH EXH may you come kol day, yielding the any-meaning similar to FC-
kol in (18).

However, another possibility is to maintain a single representation of (19), namely EXH EXH may you come kol day. Note that differently from Fox (2007)'s analysis, since in the current analysis kol lacks scalar alternatives, the scalar implicature that \[ \neg \Diamond (a \land b) \] is not predicted to arise in such cases, as can be seen in the computation in (18). This prediction may get some evidence from examples like (19), if we take (19b) to not be a distinct reading of (19), but merely truth-conditionally compatible with FC-
kol’s strengthened meaning.

If so, what seems to be two different readings of (19) is not the result of a true ambiguity but rather two context-determined options which are derived from the same truth-conditions. The reason for the absence of the every reading from sentences such as (6) would be our world knowledge which suggests that it is not likely that we are allowed to eat all of the cookies; that is, it is a true pragmatic inference.

5. Discussion

5.1. Embedding in a general theory of PSIs – presuppositional exhaustification

A few crucial assumptions made here are couched in a general theory of polarity sensitivity, following Krifka (1995); Chierchia (2006, 2013); mainly, the assumption that there are lexical elements which have to be in the scope of an exhaustivity operator, e.g., English any, which is a basic assumption that brings about the ungrammaticality of such elements in UE environments.

However, assuming Innocent Excludability, as in (9), won’t derive contradictions for items like any in UE environments, contradictions which are crucial in explaining the distribution of such items within the theories mentioned above. We would like to argue that there is a way to reconcile the general theory of polarity sensitivity with Innocent Excludability and by that to implement our analysis under its broad wings.
As discussed in Fox (2007), defining the exhaustivity operator without IE leads to some inevitable contradictions, which are unwanted on empirical grounds. For example, if the prejacent is of the form $\alpha \lor \beta$, then the set of alternatives includes the prejacent and $\alpha \land \beta$, $\alpha$, and $\beta$. Apart from the prejacent itself, each of the alternatives is logically stronger: they asymmetrically entail the prejacent. Therefore, the prediction would be that $\text{EXH}[(\alpha \lor \beta)]$ entails $(\alpha \lor \beta) \land (\neg \alpha) \land (\neg \beta) \land (\neg (\alpha \land \beta))$, which is a contradiction, and also does not correlate with the observation that in sentences such as *Sue ate cake or ice-cream*, an implicature that *Sue didn’t eat both* is the only one that arises.

Therefore, unless one is to make some additional assumptions, IE is a crucial notion for theories of exhaustification. Our goal would be then to keep $\text{EXH}$’s definition as in (9), i.e., with IE, and to find an alternative way to rule-out the ungrammatical sentences which the general theory of PSIs explains by deriving contradictions.

An idea on which a solution could be based is to add a presupposition to the exhaustivity operator, as in (20). In this we follow Danny Fox (p.c.) and modify a suggestion discussed by Chierchia (2013).

\[
\text{Presuppositional exhaustivity operator (revised version of Chierchia (2013, p. 186))}: \\
\text{EXH}_{p, \text{Alt}(p)}(p) = \\
\begin{cases} 
\text{EXH}_{E, \text{Alt}(p)}(p) & \text{if for every } q \in \text{Alt}(p) : \\
\text{Undefined otherwise} 
\end{cases}
\]

The presupposition in (20) reads as follows: the exhaustivity operator over a prejacent $p$ with respect to the set of alternatives of $p$ operates with innocent excludability as defined in (9) if for every member $q$ in the set of alternatives $\text{Alt}(p)$, applying $\text{EXH}$ twice would entail either that $q$ is true or that $q$ is false. Otherwise, applying $\text{EXH}$ would be undefined.\(^7\) In other words, the presupposition is that the process of exhaustification must give the complete answer to the question provided by the set of alternatives of the prejacent.

A further important assumption here is that there is an underlying difference between alternatives of elements which require to be in the scope of $\text{EXH}$ and alternatives of elements which don’t; the former are unprunable, that is, they cannot be omitted from the set of alternatives on which $\text{EXH}$ operates, whilst the latter can. We thus predict that for every alternative introduced by a Polarity Sensitive Item such as *any*, or *kol* in our analysis, exhaustification must determine its truth-value,\(^7\)

\(^7\)Note that this is not meant to present two different kinds of $\text{EXH}$ operators. What appears here as $\text{EXH}_{p, \text{Alt}(p)}$ is the operator used everywhere, and it is defined the way we defined $\text{EXH}$ in (9) ($\text{EXH}_{E, \text{Alt}(p)}$ here) if it satisfies the presupposition and is undefined otherwise.
but exhaustification over other elements can leave some alternatives without determining their truth-value due to the possibility to omit them from the set of alternatives.

Such a requirement predicts items like any to be bad in episodic UE environments, since exhaustification cannot determine the value of the domain alternatives without excluding them in a way that would violate IE. It also predicts the grammaticality of any in possibility contexts since applying EXH twice would entail the truth of the domain alternatives (Fox (2007)), thus satisfying the presupposition. We can thus retain the benefits of theories that have been made for polarity sensitivity, alongside the benefits of IE as used in our proposal on kol.

5.2. Previous proposals

Some researchers have suggested analyses to account for the distribution of kol. Let us briefly discuss two of them: Levy (2008) and Tonciulescu (2011).

5.2.1. Levy (2008): ambiguity approach

Levy (2008) argues that NPI-kol and FC-kol are existential quantifiers, while U-kol must be given a universal semantics. Therefore, according to her, U-kol is a universal quantifier which is a counterpart of every, while NPI-kol and FC-kol are (roughly) a counterpart of any.

This analysis reflects the intuitions we discussed in section 2, according to which kol’s NPI- and FCI-uses would benefit from a theory that states that they have existential semantics. However, in addition to the need to claim that there are two different lexical entries for kol that such a proposal raises, an analysis along these lines has to assume that they differ also in their distributional properties. U-kol would be an ordinary universal quantifier, while NPI-FC-kol would be sensitive to polarity. This account would need to explain why U-kol is not available in (3)-(5) by stipulating some ad-hoc distributional rule.

Contrarily, we propose that a unified account is possible, if kol is taken to be an existential quantifier, with no need for assuming different lexical entries and consequently no need to assume a principled difference in distribution.

5.2.2. Tonciulescu (2011): universal indefinite

Tonciulescu (2011) suggests an analysis based on Menéndez-Benito (2005)’s analysis for Free Choice any. Menéndez-Benito (2005) deals with FCIs like English any and its Spanish counterpart...
cualquier(a). She proposes (following Kratzer and Shimoyama (2002)’s alternative semantics) that any is a variable which introduces alternatives under Hamblin semantics, and has to associate with a sentential universal quantifier. Combined with an exclusivity operator similar to EXH defined above, the result is a contradiction in UE episodic contexts, but Free Choice in possibility contexts.

Tonciulescu (2011) argues that kol is a pronoun just like any in this theory, denoting a set of individual alternatives and agreeing with a (propositional) universal quantifier. In her analysis, even U-kol in UE episodic contexts such as (1)-(2) needs to involve (possibility) modality in order to explain its grammaticality in UE episodic contexts.

However, this modality is empirically unjustified, since the cases of U-kol in (1)-(2) don’t seem to have any modal flavor. In the analysis proposed here, the cases of U-kol are not assumed to involve any kind of modality.

5.3. Open issues

We would like to briefly mention several matters that pertain to kol’s distribution, and especially U-kol’s distribution, and which need to be dealt with.

First, throughout the paper we have been discussing cases of kol taking an indefinite singular NP. It is important to note that when kol combines with a (mainly plural) definite restrictor NP, it is unambiguously universal. Consider the following example, in which, unlike in (3) above, the presence of negation does not prevent kol from being universal.

(21) yosi (lo) PagaS et kol ha-yeladim
yosi (NEG) met ACC kol the-children
(It is not the case that) Yossi met all the children.

A possible direction to explain such data is to assume that the semantics of the definite article ha is such that applying it on a plural noun results in a singleton set, over which kol then quantifies. That is, in (21) kol quantifies over the maximal member in the set of (sum-individuals that are) children. This maximal member will be a sum of all the children, and thus it does not matter if kol remains existential (e.g., in a DE environment) or gets strengthened into a universal, it will have a universal import.

A different path to take is to stipulate that somehow due to definiteness, there is a requirement according to which EXH must occur low, locally above kol that takes a definite NP. This way, whenever kol’s restrictor is definite, it will be locally exhaustified and thus strengthened into a universal quantifier, even in DE context.
Aside from sketching these possibilities, we have to leave the question of deciding on their empirical and theoretical consequences for future research.

An additional issue that one should note is that U-\textit{kol} sometimes seems to be available (to some speakers) in DE contexts. This calls for an explanation due to the observation that scalar implicatures usually disappear in DE contexts. In the grammatical view of scalar implicatures, this is potentially a testimony of an LF that lacks EXH. Under the proposal made in this paper, not having EXH under a DE operator means that \textit{kol} is predicted to remain existential, but as noted above, it does seem to get strengthened into a universal in these environments in some cases.\footnote{An argument against this objection was brought to our attention by Salvador Mascarenhas, who also provided the following two examples. The argument establishes that there is evidence for the presence of EXH in DE environments, drawn from the presence of Free Choice inferences in such environments. E.g., in the following two examples, the disjunctive sentence embedded in a DE environment shows FC inferences.}

A possible solution would be that for these speakers, \textit{kol} is focused in these cases. Assuming that focused elements require to be in the immediate scope of EXH, this would result in the observed U-\textit{kol} readings in DE environments. This remains an empirical question for future research.

Moreover, certain factors interfere with how easy it is to get existential interpretations for \textit{kol}. More specifically, NPI-\textit{kol} seems to prefer ‘abstract’ restrictors, which do not denote predicates of concrete, physical entities. For example, \textit{kol} in a sentence like \textit{NEG arrived kol response} is more likely to be acceptable than \textit{NEG arrived kol boy}. This is an issue we have nothing particularly intelligent to say about.

Finally, a relevant observation to make is that speakers tend to relate cases of NPI-\textit{kol} to a higher register than that to which they relate U-\textit{kol} and FC-\textit{kol}. It seems that in the lower, ordinary register, there is a preference to use other, dedicated NPIs.\footnote{This point was made by Kamp (1973) to argue against a Gricean account of FC.}

Together with a possible competition account that could build on such preferences, a possible explanation to the register difference may draw on an important difference between NPI-\textit{kol} on the one hand, and U-\textit{kol} and FC-\textit{kol} on the other hand, as it arises from our proposal. That is to say, the fact that in order to derive the latter two, exhaustification applies and results in something that differs from the prejacent, on the truth-conditional level, while in the case of NPI-\textit{kol}, exhaustification must apply due to the requirement imposed by \textit{kol}, as we argue, but has no truth-conditional effect; the exaustified proposition is equivalent to the prejacent. Thus, exhaustion, in the case of NPI-\textit{kol}, is vacuous. One can claim that some condition that applies at the ordinary speech register requires exhaustification to be non-vacuous. If this is the case, then the excess in applying

\begin{enumerate}[a.]
  \item If I am allowed to eat an apple or a pear, then I have a choice.
  \item Am I allowed to eat an apple or a pear?
\end{enumerate}

\footnote{See discussion in Levy (2008); Tonciulescu (2011).}
EXH vacuously would be taken to be related to a non-ordinary register.

6. Conclusion

We have presented data showing that Hebrew *kol*, which is traditionally considered a universal quantifier, is in fact an existential as is evident in questions ((8b)). Our analysis is that the universal import of *kol* is only a derivative of it being an existential that:

1. Must undergo exhaustification.
2. Introduces domain alternatives and lacks a scalar alternative.

We claimed that this is in line with different phenomena of disjunctions with conjunctive meanings for which analyses in similar terms have been suggested. Finally, we sketched a possible way for embedding our analysis in a general theory of PSIs while maintaining the notion of Innocent Excludability.

References


Unembedded Indirect Discourse
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Abstract. This paper contributes to two debates: (i) the debate about whether or not ancient Greek has Free Indirect Discourse (FID), and (ii) the debate about how we should analyze FID semantically. We do this by showing that there is a distinction between FID and what we call Unembedded Indirect Discourse (UID). The semantic analysis that we develop for the latter shows that the two phenomena, though superficially similar, are semantically fundamentally different. We conclude that UID would have been more deserving of the title ‘free indirect discourse’ than the more quotative and direct discourse-like narrative technique that is now confusingly called so.¹

Keywords: speech reports, Free Indirect Discourse, ancient Greek, subjunctive, oblique optative.

1. Introduction

There are conspicuously diverging opinions about whether or not ancient Greek has Free Indirect Discourse. In narratology and classical studies we find several authors express the view that the style can be traced back to ancient Greek, for instance in the Handbook of Narratology:

   FID, though already present in ancient Greek and Latin literature and in biblical narrative, would not be identified until the last decades of the 19th century. [McHale 2009]

On the other hand, there is a common view that Free Indirect Discourse is a more recent invention:

   The claim that instances of the style can be found in Greek and Latin finds little credence … and no plausible examples have been proffered to support this claim. [Banfield 1982: 228]

Quite independently there has been considerable debate within formal semantics about how best to analyze Free Indirect Discourse. In particular there is an ongoing debate between, for instance, proponents of theories in terms of double context dependence (Schlenker, 2004; Eckardt, 2012);² monstrous indirect discourse (Sharvit, 2008); and (mixed) quotation (Maier, 2012).

We want to contribute to both debates by introducing a distinction between Free Indirect Discourse (FID) and what we call Unembedded Indirect Discourse (UID). More specifically, in this paper we (i) describe the phenomenon of UID as distinct from FID in ancient Greek, and (ii) propose

¹We thank Dag Haug, Kjell Johan Sæbø, Rob van der Sandt, Peter de Swart, Sammie Tarenskeen, Bob van Tiel, Jan-Wouter Zwart, and the audiences of Sinn und Bedeutung 2013 and INSEMP for their useful suggestions. The research for this paper is supported by the Netherlands Organization for Scientific Research (NWO), Veni grant 275-20-025 (Corien Bary), and by the EU under FP7, ERC Starting Grants 263890-BLEND (Emar Maier) and 338421-PERSPECTIVE (Corien Bary).

²Going back to ideas of Banfield (1982).
an analysis based on Fabricius-Hansen and Sæbø’s (2004) presuppositional analysis of a similar phenomenon in German. We conclude that failure to recognize the distinction between FID and UID may have contributed to (a) an overestimation of the occurrence of FID in older texts, and (b) the classification of FID as a kind of indirect discourse.

2. Unembedded Indirect Discourse in ancient Greek

In ancient Greek indirect discourse, a verb of saying can take as its complement

a. a regular indicative finite *that*-clause;
b. a finite *that*-clause with the verb in a special mood, called the optative;  
c. an infinitival clause.

In (1) we see (constructed) examples of each, all reporting the utterance γράφω grapheo ‘I am writing’:

(1) a. ἔλεξεν ὅτι γράφει
    *elexen hoti graphei*
    he-said that he-is-writing
b. ἔλεξεν ὅτι γράφοι
    *elexen hoti graphoi*
    he-said that he-is-writing-*OPT*
c. ἔφη γράφειν
    *ephê graphein*
    he-said to-write

Ad (1a): ancient Greek is a non-Sequence-of-Tense language. Hence the present tense in the complement (retained from the original utterance without modification). Ad (1b): the use of the optative in speech reports is called the *oblique optative*. It is subjunctive-like in the sense that in other languages, such as German, we often find the subjunctive mood (Konjunktiv in German) used in similar ways. Ad (1c): in such infinitival constructions, ancient Greek does not express the subject of the complement’s main verb if it is the same as that of the matrix verb, as in (1c). If it is not the same, it uses accusative case. So literally ‘he-said her to-write’ translates as ‘he said that she was writing’. This construction is called the *accusative-with-infinitive* construction, AcI (Accusativus cum Infinitivo) for short.

Interestingly, when an author wants to report a longer discourse indirectly, he can continue to use the latter two indirectness markings (oblique optative or AcI) for several syntactically independent sentences, i.e. main clauses not embedded under verbs of saying. We see this for example in (2):\(^4\)

\(^3\)To avoid confusion: apart from the optative, ancient Greek also has a mood that is traditionally called the *sub-junctive*. That mood is not related to speech reports and will not be discussed here.

\(^4\)Throughout this paper we use the following conventions: verbs of saying are marked with bold face; infinitives are underlined (the accusatives belonging to these infinitives are not marked); optatives are double underlined; and we
‘The Persian learned men say that the Phoenicians were the cause of the dispute. These (they say) came to our seas from the sea which is called Red, and having settled in the country which they still occupy, at once began to make long voyages. Among other places to which they carried Egyptian and Assyrian merchandise, they came to Argos, which was at that time preeminent in every way among the people of what is now called Hellas. The Phoenicians came to Argos, and set out their cargo. On the fifth or sixth day after their arrival, when their wares were almost all sold, many women came to the shore and among them especially the daughter of the king, whose name was Io (according to Persians and Greeks alike), the daughter of Inachus. As these stood about the stern of the ship bargaining for the wares they liked, the Phoenicians incited one another to set upon them. Most of the women escaped: Io and others were seized and thrown into the ship, which then sailed away for Egypt. In this way, the Persians say (and not as the Greeks), was how Io came to Egypt, and this, according to them, was the first wrong that was done.’

This whole passage is an Acl report of what the Persians said.\(^5\) Verbs of saying occur only twice: once at the beginning (\(\phiαι\) \(\phiασι\) ‘said’) and once at the very end (\(\lambda\epsilonγο\upsilon\upsilon\) \(\lambda\epsilonγουσι\) ‘said’). The infinitive in the first sentence, \(\gammaε\nu\epsilon\sigma\thetaαι\) \(\gammaε\nu\epsilon\sigma\thetaαι\) ‘to be’ depends on the former syntactically, as we would expect. But then this infinitival construction is continued for several sentences, without the verb of saying being repeated.\(^6\) The infinitive in these sentences still indicates that we have to do with a report of what the Persians said, but syntactically it does not depend on a verb of saying use double spacing to highlight other elements of the example.

\(^5\)The fact that not all English finite verb forms are underlined may give the impression that in the Greek text there is an alternation between infinitival and finite verb forms. All the verbs that are not underlined in Greek, however, are either participles or finite forms in clauses subordinated to the Acl construction.

\(^6\)‘They say’ is added in the second line of the English translation to make clear that the report is continued, it is absent in the Greek text.
anymore.\(^7\)

In fact, even the initial, overt indirect speech embedding is not necessary: an implicit or parenthetical say may suffice (cf. Cooper 1974). (3) is an example where the saying is expressed only parenthetically:

(3) Τόπο δὲ μεγάλεος τῆς πόλιος, ὃς λέγεται ὑπὸ τῶν ταύτης οἰκημέονος, τῶν περὶ τὰ ἔσχατα τῆς πόλιος ἡλικίων τοὺς τὸ μέσον οἰκέοντας τῶν Βαβυλωνίων οὐ καθόλου ἡλικίως, ἀλλὰ (τυγεῖν γὰρ σηκώεις ὄρθην) ἀρρεύειν τε τούτων τὸν χρόνον καὶ ἐν εὐπαθείᾳ εἶναι, ἐς ὃ δὴ καὶ τὸ κάρτα ἐπούθεντο.

Hdt. 1.191 ‘because of the great size of the city, the inhabitants of the middle part did not know that those in the outer parts of it were overcome; all this time (since there happened to be a festival) they were dancing and enjoying themselves, until they learned the truth only too well.’

The Aci construction does not depend on the verb of saying λέγει legetai syntactically, since that verb occurs in a parenthetical construction. Nevertheless, the Aci does indicate that we have to do with a speech report.

In (4) the saying is only implicit:

(4) τῶν μὲν δὴ πρωτέρων ἐπερέσβευε Ἀρτοβαζάνης, τῶν δὲ ἐπιγενομένων Ξέρξης. Ἐόντες δὲ μηρὸς οὐ τῆς αὐτῆς ἐστασιάζον, ὡς ἐπερεσβαζόντες τὸ παντὸς τοῦ γόνου καὶ ὧτι νομίζομεν ἐμὲ πρὸς πάντων ἀνθρώπων τὸν πρεσβύτατον τὴν ἀρχὴν ἔχειν. Ξέρξης δὲ τῆς ἀντίστοις ἐμὲ πρὸς πάντων τὸν πρεσβύτατον τὴν ἀρχὴν ἔχειν, ξέρξης δὲ ὡς ἀντίστοις τις παῖς ἐμὲ τῆς Κῦρου θυγατρός καὶ ὧτι Κῦρος ἐμὲ ὡς πτησάμενος τούτος Πέρσης τὴν ἔλευθερην.

Hdt. 7.2 ‘Artobazanes was the oldest of the earlier sons, Xerxes of the later; and as sons of different mothers they were rivals. Artobazanes (pleaded that he) was the oldest of all Darius’ offspring and that it was everywhere customary that the eldest should rule; Xerxes (argued that he) was the son of Cyrus’ daughter Atossa and that it was Cyrus who had won the Persians their freedom.’

Here the optative is the only formal indicator that we have to do with a report (‘pleaded that he’ is added twice in the English translation to indicate the reportive status).

We coin the phenomenon illustrated in (2), (3), and (4) Unembedded Indirect Discourse. It shares some remarkable characteristics with the narrative technique called FID, of which (5) is a canonical example:

(5) Tomorrow was Monday, Monday the beginning of another school week.

Both report modes

\(^{7}\text{One of the reasons why it cannot be one long sentence is the presence of the word γὰρ gar in the second line, which always introduces a main clause.}\)
(i) are reportive: in (5) the story protagonist’s thought or speech is reported
(ii) are syntactically unembedded: a verb of saying is absent or given only parenthetically
(iii) have pronouns and tenses behave as in indirect discourse: in (5) the past tense of was corresponds to what an indirect discourse report (6a) rather than a direct discourse report (6b) would be like.

(6)  
a. He realized that the next day was Monday
b. He thought: ‘Tomorrow is Monday.’

These similarities raise the question whether we have to do with FID here. In other words, is UID a form of FID?

In order to answer that question, we need to get a clearer picture of what distinguishes FID from indirect discourse. We see the difference between the two with various classes of linguistic expressions. Table 1 gives an overview.

<table>
<thead>
<tr>
<th></th>
<th>FID</th>
<th>indirect discourse</th>
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</thead>
<tbody>
<tr>
<td>non-pronominal indexicals</td>
<td>always protagonist-oriented</td>
<td>always narrator-oriented</td>
</tr>
<tr>
<td>attitudinal particles</td>
<td>always protagonist-oriented</td>
<td>??</td>
</tr>
<tr>
<td>exclamatives</td>
<td>can occur</td>
<td>impossible</td>
</tr>
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</table>

Table 1: FID versus indirect discourse

Although pronouns and tenses in FID behave as in indirect discourse, all other indexical expressions behave differently. While, for example, the indexical adverb tomorrow in (5) is interpreted from the perspective of the character or protagonist in the story, such a protagonist-oriented reading is impossible in indirect discourse where such indexical expressions are to be interpreted from the perspective of the actual speaker or narrator (hence the change to the next day in (6a) in order to report the same content).

As for attitudinal particles (such as German doch, ja, wohl), it seems that more work needs to be done before anything decisive can be said about their behavior in both constructions. But Eckardt’s (2012) work on particles in FID suggests that in that construction they are protagonist-oriented.

Finally, exclamatives like hurray can occur in FID but not in indirect discourse.

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8 Such differences have been listed by many linguists and narratologists, among whom, for example Banfield (1982) and Schlenker (2004).
9 This list is not exhaustive. Other differences that have been mentioned in the literature are, for example, the presence of direct questions and vocatives.
It turns out that if we look at the UID cases in ancient Greek, none of the indicators that point into the direction of FID is found there.\(^{10}\) To the contrary, we do find indicators that point into the direction of indirect discourse. We see this, for example, when we look at definite descriptions. Definite descriptions in FID are protagonist-oriented (i.e. interpreted from the perspective of the reported speaker), whereas in indirect discourse they can be both protagonist-oriented and narrator-oriented (interpreted from the perspective of the actual speaker). (7) is an indirect discourse example:

(7) Oedipus believed that his mother was not his mother.

This sentence in principle has two readings. A non-sensical protagonist-oriented or de dicto reading in which Oedipus believes something like ‘My mother is not my mother’ (he believes in a contradiction), and a narrator-oriented or de re reading in which Oedipus believes of someone who the narrator refers to as his mother – Oedipus himself may think about this person in terms of e.g. Iocaste rather than my mother – that this person is not his mother.

By contrast, (8), the equivalent in FID, only has the contradictory protagonist-oriented reading:

(8) His mother was not his mother, Oedipus believed.

<table>
<thead>
<tr>
<th>FID</th>
<th>indirect discourse</th>
</tr>
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<tbody>
<tr>
<td>definite descriptions</td>
<td>always protagonist-oriented</td>
</tr>
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</table>

Table 2: FID versus indirect discourse (continued)

In other words, narrator-oriented readings of definite descriptions tell us that we have to do with indirect discourse rather than FID. And indeed, such readings are available for the UID cases in ancient Greek, showing that UID is not a form of FID. (9) is an example:

(9) Σκούθαι μὲν ὅσα ὑπὲρ σφέων τε αὐτῶν καὶ τῆς χώρης τῆς κατύπερθε λέγουσι, Ἑλλήνων δὲ οἱ τὸν Πόντον οἰκεόντες ὁδέ. Ἡρακλέα ἐλαχύμοντα τὰς Γηρυώνεω βοῶς ἀπεκέφαλι ἐς γῆν ταύτην ἐσούσαν ἐρήμην, ἤτοι οὐ δὲ Σκούθαι νέμονται. Γηρυώνεω δὲ οὐκέτι ἔζω τοῦ Πόντου, κατοικομένοι τῆ Ἑλληνικῆς ἔγο ράσι Κρήτα νησίον, τὴν πρὸς Γηρυώνεων στῆλεον ἐπὶ τῷ Ὀκεανῷ. Ἡδτ. 4.8

‘This is what the Scythians say about themselves and the country north of them, but the Greeks tell the story as follows: Heracles, driving the cattle of Geryones, came to this land, which was then desolate, but is now inhabited by the Scythians. Geryones lived west of the Pontus, settled in the island that the Greeks call Erytheia, on the shore of Ocean near Gadira, outside the pillars of Heracles.’

\(^{10}\)Herodotus is the most prominent user of this construction. Cooper (1974) has selected the occurrences in his work (many of which are quite long) and this formed our corpus, supplemented with examples in grammars and other secondary literature.
In (9) it is clear that the phrase *the island that the Greeks call Erytheia* originates from Herodotus rather than from the Greeks whose speech he is reporting (who probably simply said *Erytheia* or maybe *the island we call Erytheia*).\footnote{Similarly, it seems that many of the proper names in UID would be pronouns rather than proper names in FID. It is however hard to compare the two in this respect since the use of proper names in FID needs further investigation.}

To conclude, whereas FID patterns with direct discourse in many respects, we see that the cases of UID are really cases of indirect discourse, albeit indirect discourse that is not syntactically embedded, a class of speech reports that, as far as we know, has not been recognized as such before in the semantic literature. We will discuss the position of this construction within the taxonomy of reported speech and thought in the conclusion.

Having shown that UID is a kind of indirect discourse, in the next section we will give it a semantic analysis in which it is treated accordingly.

### 3. The Reportive Subjunctive as a presupposition trigger

To provide a semantic analysis of the phenomenon of unembedded indirect discourse in ancient Greek, we borrow from an existing analysis of a remarkably similar phenomenon in German, the so-called Reportive Subjunctive (also known in German linguistics as the *Indirektheitskonjunktiv* or *Konjunktiv der indirekten Rede*). We start by introducing this German subjunctive mood, and then present an analysis based on Fabricius-Hansen and Sæbø’s (2004) idea that this mood morphology triggers a presupposition. We then apply this analysis to the Greek oblique optative, and finally extend it to the AcI.

#### 3.1. The reportive subjunctive in German

The Reportive Subjunctive is a special use of the German subjunctive mood that occurs in complements of indirect discourse reports (Jäger, 1971). We will not be concerned with any other uses of the German subjunctive, e.g. in conditionals, or the differences between the two distinct forms usually referred to as Konjunktiv I and Konjunktiv II. We will also ignore differences between verb-second and verb-final complements, and questions about exactly which classes of verbs other than verba dicendi may license this subjunctive in their complements.

Our starting point then is the observation that German, like ancient Greek, has a morphologically realized mood that is licensed by an indirect discourse construction. Here’s an example from Fabricius-Hansen and Sæbø (2004):

\[(10) \text{Er behauptete, dass jemand das Auto angefahren habe} \]

\[he \text{ claimed that somebody the car on-driven have.subj} \]
‘He claimed that somebody had driven into the car’

Moreover, this extra marking of the indirect discourse construction is optional and semantically superfluous. According to Fabricius-Hansen and Sæbø (2004), there is no semantic difference between (10) and the variant with embedded indicative:

(11) Er behauptete, dass jemand das Auto angefahren hat

To explain such data, Schlenker (2003) proposes to analyze the reportive subjunctive as a logophoric mood, i.e., what we see in (10) is the phonological realization of a possible world variable decorated with a logophoricity feature that forces it to be bound by the reporting verb. However, just like the Greek oblique optative, the reportive subjunctive can occur in independent main clauses, as UID, we hypothesize. This may be as a “continuation” of an earlier, overtly embedded indirect discourse:

(12) Er sagte, sie sei schön. Sie habe grüne Augen
    He said she be.subj beautiful. She have.subj green eyes
    ‘He said she was beautiful. She had green eyes, he said.’

The first sentence is a standard indirect discourse (in verb second form), featuring the (semantically superfluous) reportive subjunctive. This sentence would mean the same in verb final form (with complementizer dass ‘that’), and with indicative instead of subjunctive mood. The second sentence is an unembedded, syntactically independent main clause. In the indicative it would simply mean that she has green eyes, but the subjunctive forces a reportive reading, viz., he (also) said that she had green eyes.

For examples like (12), a Schlenker-style analysis would have to invoke a mechanism of modal subordination. But given that subjunctive marked unembedded indirect discourses can also occur (both in German and in Greek) without any introductory embedded indirect discourse, this turns into positing covert saying verbs. We propose a less ad hoc solution: it is the subjunctive morphology itself that contributes the reportive interpretation. The main difficulty then becomes the formulation of a uniform, compositional semantics of the reportive subjunctive morpheme that (i) turns an entire clause into a report, but (ii) dissolves if the clause in question is overtly embedded. We propose such an interpretation in terms of van der Sandt’s (1992) presupposition-as-anaphora theory in DRT. Our principal inspiration is the similarly uniform and presuppositional account by Fabricius-Hansen and Sæbø (2004), which we modify in various (technical) respects.

3.2. A presuppositional semantics for the reportive subjunctive

Syntactically we assume that mood takes scope over the entire clause at LF, i.e., the mood morpheme on the verb corresponds to a sentential operator, Subj, at LF.
(13)  a. PF: Sie habe grüne Augen
     b. LF: [S Subj [S[NP she] [VP have green eyes] ] ]

Without a Subj the verb would be spelled out as indicative. After describing in some detail the semantics of Subj we will return to Greek. The idea will then be that in a Greek finite clause, as in German, Subj surfaces on the main verb as an mood morpheme, the optative. Finally, to describe the reportive interpretations of independent AclS, we’ll assume that in an infinitive main verb, Subj cannot be spelled out overtly.

Semantically, the challenge is now first to define the semantic contribution of Subj in such a way that the three utterances in (14) come out equivalent. (We are switching to an easier, and purely abstract example, merely for ease of presentation.)

(14) Mary was complaining about the meeting.
     a. [Subj [somebody left]]
     b. She said that [somebody left]
     c. She said that [Subj [somebody left]]

All three mean simply that Mary said that someone left (the meeting set up in the context). We define the contribution of Subj in a fairly conservative extension of DRT with presuppositions, lambdas and higher-order intensional predicates and discourse referents.

As usual in DRT, we describe this semantic contribution at the representational DRS level. The model-theoretic interpretation of DRSs is entirely straightforward and hence uninteresting. In the theory of presupposition-as-anaphora, interpretation is a two-stage process (not counting model-theoretic interpretation). The first stage is the translation from a syntactic LF to a preliminary (higher-order, intensional) DRS (PrelDRS). The difference between PrelDRSs and final, output DRSs is that presuppositions are represented in situ in a PrelDRS. Hence, the PrelDRS construction stage can (and should) be spelled out compositionally. The second stage consists in merging the PrelDRS with the context and resolving any presuppositions. This typically involves moving presupposed content around, and, for instance, enriching the context by accommodation, as dictated by pragmatic principles. This resolution stage eventually results in an updated output DRS, which will serve as input context for the interpretation of the next sentence.

So the clause under the scope of Subj in (14a) will be assigned the following preliminary DRS, based on the logical representations of its constituents someone and left. Given that the sentence does not contain presupposition triggers (we’re disregarding the past tense), this would be its final output DRS as well. As for notation, we will suppress types (as well as syntactic structure and category labels), and use $T(\ )$ for the translation from LF to the logical PrelDRS language.

(15) $T(\text{somewhody})=\lambda x_{et} \left[ \begin{array}{c} x \\ X(x) \end{array} \right]$

$T(\text{left})=\text{leave}_{et}$
Adding the `Subj` operator turns this DRS into a largely presuppositional structure:

\[
\mathbb{T}(\text{somebody left}) = \begin{bmatrix}
    x \\
    \text{leave}(x)
\end{bmatrix}
\]

The at issue contribution in (16) is only a propositional variable (type \(st\), a function from possible worlds to \(\{0, 1\}\)). The dashed box represents the unresolved presuppositional content. Strictly speaking there are two existential presuppositions here: (i) we’re presupposing the existence of a proposition \(p\), which is presupposed to be the proposition that someone left; and (ii) we presuppose the existence of a source \(x\), someone who said that \(p\) (i.e., \(\text{say}(x,p)\) means that \(x\) stands in the indirect-discourse-saying-relation to proposition \(p\)). As usual in the theory of presupposition-as-anaphora, we see that the presupposition binds the at issue variable, that is, what the at issue \(p\) is will be determined by presupposition resolution.

On a technical note: it may be tempting to formulate the contribution of `Subj` as a single lambda term (as did Fabricius-Hansen and Sæbø 2004), but this won’t work because, for \(\xi\) a variable of type \(t\), and \(\alpha\) a DRS (also of type \(t\)), \((\lambda\xi.\xi}(\alpha)\) does not denote the same proposition as \(\wedge\alpha\). So we’re stuck with adding a primitive construction rule for `Subj`, akin to (and reducible to, if desired) Heim and Kratzer’s (1998) *intensional functional application* rule.

Now, consider first the case where `[Subj [somebody left]]` as translated in (16) is used as an independent sentence, i.e. the UID case in (14a). In that case, the compositional translation phase for the sentence is over so we move on to stage two, adding the PrelDRS to the context and looking for antecedents to bind our two presuppositions to:

(17) Mary was complaining about the meeting. Subj [ somebody left ]
Before we go on resolving the two presuppositions, note that there is something unusual about this PrelDRS. DRS conditions are supposed to be statements, expressions of facts and relations between discourse referents and/or subDRSs – in Montagovian terms, conditions should be expressions of type \( t \). But the condition \( p \) in (17) is of type \( st \), which doesn’t really make sense as a condition. Now, the reason this at issue \( p \) is there in the first place is because we want to be able to embed the subjunctive clause under a saying verb, as we will see in detail shortly. There are a number of potential remedies for this situation. Fabricius-Hansen and Sæbø (2004) effectively redefine the merge operation (\( \oplus \)) to delete conditions of type \( st \) in the main DRS. A more drastic alternative would be to simply give up the idea of defining a uniform contribution for the subjunctive in embedded and free sentences, and thus undermine the ideal of a compositional PrelDRS translation. For now we follow Fabricius-Hansen and Sæbø, and leave an independent motivation of this stipulation for future research.12 In other words, the result of the modified merge operation is (18):

We now look for an antecedent speaker \( (y) \) and an antecedent proposition \( (p) \), or else accommodate. We can bind the source \( y \) in a context where it’s clear who is reported to be speaking. These

\[ m \]
\[ \text{complain}(m) \]
\[ p \rightarrow y \]
\[ \text{say}(y,p) \]
\[ p=x \]
\[ \text{leave}(x) \]

\[ m \]
\[ \text{complain}(m) \]
\[ p \rightarrow y \]
\[ \text{say}(y,p) \]
\[ p=x \]
\[ \text{leave}(x) \]

12 At Sinn und Bedeutung 18, Todor Koev suggested that maybe it’s not so bad to leave the \( st \) proposition \( p \) (i.e. the proposition that somebody left) floating around in the main DRS context. Arguably, it could be pragmatically reinterpreted as indicating that \( p \) is an issue. In other words, we pragmatically turn \( p \) into the statement ‘it is an issue whether \( p \) is actually true’ \((p \sim \circ \text{false} \circ p)\). Note that the more straightforward transformation, from \( p \) to the statement ‘\( p \) is true’ \((p \sim \circ \text{true} \circ p)\) makes too strong predictions – it doesn’t follow from the subjunctive UID statement in (14a) that someone actually left. It remains to be checked whether the suggested weaker implication, that it is an issue whether someone left, is generally valid.
are precisely the contexts where we typically find UIDs: stretches of reported discourse, clearly attributed to some salient contextual source, either implicitly or by a preceding canonical indirect (or direct) discourse. In this case, we just learned that Mary was complaining, so she is a salient speech act source for \( y \) to bind to: \( m = y \).

Next, to bind \( p \) we would need a salient propositional discourse referent in the main DRS universe. Moreover, this antecedent proposition would have to be the proposition that somebody left, as specified by the final presuppositional content condition. There is no explicit antecedent to bind to, but it is easily accommodated. In fact, assuming the existence of a proposition that is (equal to) the proposition that someone left is completely costless, in the sense that it doesn’t add any information to the common ground. It is an a priori given that every possible proposition “exists” (which says nothing about whether or not it is true). In addition to this “free” accommodation, we then only need to accommodate the remaining condition, \( \text{say}(y, p) \), i.e. we’re accommodating that \( y \) – or rather \( m \), its previously established antecedent – said that \( p \).

In this way we get the correct final output representation: i.e., the contextually salient source (Mary) said that someone left.

To show that this semantics, without any further modification, also works for the case where the subjunctive clause is overtly embedded, i.e. (14c), we add the following standard lexical entries for indirect discourse. We’re assuming, again, the two-place relation \( \text{say} \) (of type \( (st)et \)), and we analyze the complementizer as a vacuous operator, i.e. an identity function of type \( (st)st \):

\[
T(\text{said})=\lambda q.s.t.\lambda z.\text{say}(z, q) \quad T(\text{that})=\lambda q.s.t. q
\]

To interpret an indicative complement we need, again, something like Heim and Kratzer (1998) intensional functional application rule. We will assume a rule that says: if we want to feed a type \( t \) argument, in this case a DRS, to a function that takes only \( st \), simply add an \( ^\wedge \) to lift the type of the argument. We can now combine all the lexical items above to get a proper, compositional PrelDRS representation for (14b), the overt indicative report:

\[
[\text{Mary [said [that [somebody left]]]}] \quad [\equiv(14b)]
\]
Since there are no presuppositions, adding this PrelDRS to the context comes down to adding the global condition $\text{complain}(m)$. Comparing this with the output derived above we see that an overt indicative report indeed comes out equivalent to an unembedded subjunctive main clause.

On to the embedded subjunctive, (14c). Based on its LF and our lexical translation rules we get the following PrelDRS:

\[
\begin{array}{c|c}
  m & \\
  \text{say}(y,\wedge x) & \text{leave}(x) \\
\end{array}
\]

\[
\text{Sincetherearenopresuppositions, addingthisPrelDRStothecontextcomesdowntoaddingthe}
\]
\[
\text{globalcondition} \quad \text{complain}(m). \text{Comparingthiswiththeoutputderivedabovewe}
\]
\[
\text{seethatanover}
\]
\[
\text{tindicativereportindeedcomesoutequivalenttoanunembedded}
\]
\[
\text{subjunctivemainclause.}
\]

On to the embedded subjunctive, (14c). Based on its LF and our lexical translation rules we get the following PrelDRS:

\[
\text{(21) \quad [Mary [said [that } \text{[Subj[somebody left]]]]]}
\]

\[
\begin{array}{c|c}
  m & \\
  \text{say}(m, p) & \\
  y & \\
  \text{say}(y, p) & \\
  p = \wedge x & \text{leave}(x) \\
\end{array}
\]

\[
\text{We add it to the context, and look for antecedents for } y \text{ and } p. \text{ As before, } y \text{ will be bound to Mary,}
\]
\[
\text{the known speech act source from the context, and } p \text{ will be accommodated, mostly for free (given}
\]
\[
\text{the a priori existence of the proposition that someone left). At that point we can further clean up the}
\]
\[
\text{representation by removing a superfluous occurrence of } \text{say}(m, p), \text{ and eliminating the variable } p
\]
\[
\text{for readability:}
\]

\[
\begin{array}{c|c}
  m & \\
  \text{complain}(m) & \\
  \text{say}(m, p) & \\
  y & \\
  \text{say}(y, p) & \\
  p = \wedge x & \text{leave}(x) \\
\end{array}
\]

\[
\text{So, with only a minor tweak to the merge operation (remove non-} \ell \text{ conditions), we captured the}
\]
\[
\text{contribution of the subjunctive morpheme (corresponding to Konjunktiv in German and optative}
\]
\[
\text{in Greek) in such a way that we can predict the key data, viz. the equivalence of overt indicative}
\]
\[
\text{reports, overt subjunctive reports and independent main clause subjunctive. Apart from the merge}
\]
operation, we have relied only on standard DRT and presupposition theory. In particular, our PrelDRS were constructed fully compositionally, and uniformly on the basis of a single Subj operator.

Our analysis, designed for the German Indirektheitskonjunktiv, applies to the ancient Greek oblique optatives out of the box. Both phenomena show the same reportive subjunctive behavior: when embedded in a report they add nothing to the truth conditions, but when they occur in unembedded main clause they turn a simple assertion $\varphi$ into a semantically indirect report, $x$ said that $\varphi$, in which the source, $x$ is to be determined anaphorically. We can sum up our analysis of the reportive subjunctive (in German and Greek) as follows:

(22)  
\[
\begin{align*}
&\text{a. } \text{LF: } \ldots [S \text{ Subj } S[NP \text{ someone } ] [V P \text{ left } ]] \\
&\text{b. } \text{PF: } \text{ Subj } \leadsto \text{ optative/Konjunktiv morphology on the main verb} \\
&\text{c. } \text{compositional semantics: } T(\text{Subj } \varphi) = \\
&\begin{array}{|c|c|}
& p = \land T(\varphi) \\
& \text{say}(y,p) \\
& \text{post} y \\
& \land p \\
\end{array}
\]

3.3. The AcI at the syntax–semantics interface

We’ve analyzed the optative variant of UID in ancient Greek by interpreting the optative mood marker generally as a presupposition trigger. But what about the AcI marked cases of UID? There is no analogue in German, or, as far as we are aware, in any modern Romance or Germanic language. We will analyze Greek unembedded Acs as potentially harboring the same Subj, but then not overtly realized. This means that we have to treat Acs in Greek as syntactically on a par with (dependent or independent) clauses. Note that ancient Greek differs in this regard from many other European languages, where infinitival complements are generally more like VPs, or in any case cannot stand alone as independent main clauses. We turn to the peculiar morphosyntactic properties of the ancient Greek infinitive to explain how this exceptional behavior.

An infinitive is of course non-finite, meaning that it lacks agreement. But the classical Greek infinitive differs in one important respect from its modern Romance and Germanic counterpart: although it does not inflect for person and number, it does inflect for tense (future vs. non-future). Hence, Spyropoulos (2005; 2007) proposes that the ancient Greek infinitive comes with a “defective T” (marking tense but not person), but a T nonetheless. Ancient Greek infinitival complements therefore are somewhere in between the more familiar modern infinitives, which can never have overt subjects, and full finite clauses. In particular, unlike modern infinitives, which need their (covert) subjects to be controlled by a matrix argument, ancient Greek infinitival clauses can occur on their own, as unembedded main clauses.

13On a few points our formalization is more conservative than that of Fabricius-Hansen and Sæbø (2004).
This then is the reason why infinitival UID is syntactically possible in ancient Greek, but not in, say, German. The defective T hypothesis also explains why the overt infinitival subject is always in the accusative. Nominative case is usually assumed to be licensed specifically by agreement features in T, so that’s out. Ferraresi and Goldbach (2003) argue, for Latin, where they discuss some similar AcI/UID-like constructions,\textsuperscript{14} that the accusative is simply the unmarked case that gets plugged in by default here. According to Spyropoulos, it’s the covert complementizer in the infinitival clause that, for reasons that go beyond the scope of this paper, assigns accusative case. For our current purposes it doesn’t really matter where the accusative comes from. The most important thing is that infinitives have a defective T which allows them to have an overt, uncontrolled subject, and form a genuine CP that can be embedded under a saying verb, or occur on its own.

To explain why unembedded AcIs in ancient Greek are interpreted reportatively, i.e. as UID, we posit that infinitival clauses, like regular, finite CPs, can be modified by our presupposition-triggering \texttt{Subj} operator.\textsuperscript{15} For morphological reasons, this \texttt{Subj} however doesn’t get spelled out overtly on an infinitive main verb in ancient Greek. There just happens to be no optative infinitive form.

In sum, we predict the unembedded AcI whose LF and PF are schematically represented in English below to be semantically equivalent to the earlier three report variants from 3.2, i.e., the unembedded subjunctive, the embedded indicative, and the embedded subjunctive:

\begin{enumerate}
\item a. LF: [S \texttt{Subj} [S[NP\texttt{someone}] [VP\texttt{leave.inf}]]]
\item b. PF: Someone.acc to leave
\item c. interpretation: she said that someone left
\end{enumerate}

### 3.4.Generic reporting

With our semantics of UID fully spelled out, we can turn to some actual text and check concrete predictions. For instance, the proposed presuppositional interpretation of \texttt{Subj} predicts that we need to find in the context an antecedent source for the report. But what if the context doesn’t offer a concrete, salient, and plausible source? According to the theory of presupposition-as-anaphora, we first look for a suitable antecedent, but if we don’t find one, we accommodate. In the case of our example UID, we had a context where Mary was complaining, so we derived that she was likely the one who said that someone left. In an empty context, all we’d conclude would be that there was a source who said that someone left.

In other words, the concrete prediction of our theory is that a UID \( \varphi \) in a context without a salient

\textsuperscript{14}Further research on UID in Latin remains to be carried out. In any case, Latin patterns with Greek in having a rich, near-finite infinitive (with similarly defective T), and in having an AcI construction that can occur unembedded.

\textsuperscript{15}It’s not clear if (and if so, why) unembedded AcIs must contain a \texttt{Subj}, or whether embedded AcIs also contain one.
speech act source, is interpreted as a kind of generic report, or hearsay: *it is said that* \( \varphi \), or *allegedly* \( \varphi \).

We can check this in our ancient Greek corpus. Consider the following passage from Herodotus.

(24) Ἀλατώνας δὲ αὐτὸν οἱ Πέρσαι ἔγαγον παρὰ Κῦρον. Ὅ δὲ συννόησας πυρήνι μεγάλην ἀνεβίβασε ἐπὶ αὐτὴν τὸν Κροίσον τὸ ἐν πέδησαι δεδημένον καὶ δὲ ἑπτά Λυδικὸν παρ’ αὐτὸν παῖδας, ἐν νόμῳ ἔχουν εἴτε δὴ ἀκορεθίαν ταῦτα καταγιένθε εἴτε δὲ, εἴτε καὶ εὔχην επιτελέσαν θέλων, εἴτε καὶ τυφόμενον τὸν Κροίσον εἶναι θεοσεβής τούτῳ εἶνεκεν ἀνεβίβασε ἐπὶ τὴν πυρήνι, βουλόμενος εἴδειν εἰ τὶς μὲν δαιμόνοις φύσεται τοῦ μὴ ζώοντα κατακαυθῆσαι. Τὸν μὲν δὲ ποιέειν ταῦτα. Τῷ δὲ Κῦροι ἐστεωτὶ ἐπὶ τῆς πυρῆς ἑσπερείν, καὶ περὶ ἐν κακῷ ἕντοι ἴσοντα τοῦ Κροίσου καὶ τοῦ Σόλωνος, ὡς οἱ εἴ ς τὸν θεὸν εἰρήμενον, τὸ μηδὲν εἶναι τῶν ζωόντων ὀλιγιαν. Ὅς δὲ ἄρα μὲν προσστῆσαι τοῦτο, ἀνενεκαμένον τε καὶ ἀναστέναξάντα ἐπὶ μᾶλλθης σημαίινοι ἐνύσπασως Σόλωνι. Καὶ τὸν Κῦρον ἀκούσαντα κελεῦσαν τοὺς ἔρμηνες ἐπειρεῖσθαι τὸν Κροίσον τίνα τοῦτον ἔπικαλέσω, καὶ τοὺς προσελθόντας ἐπειρωτὶν. Κροίσον δὲ τέως μὲν σιγήν ἔχειν εἰρωτόμενον, μετὰ δὲ, ὡς ἡναγκάζετο, εἰπεῖν . . .

Hdt. 1.86

‘The Persians took him and brought him to Cyrus, who erected a pyre and mounted Croesus atop it, bound in chains, with twice seven sons of the Lydians beside him. Cyrus may have intended to sacrifice him as a victory-offering to some god, or he may have wished to fulfill a vow, or perhaps he had heard that Croesus was pious and put him atop the pyre to find out if some divinity would deliver him from being burned alive. So Cyrus did this. As Croesus stood on the pyre, even though he was in such a wretched position it occurred to him that Solon had spoken with god’s help when he had said that no one among the living is fortunate. When this occurred to him, he heaved a deep sigh and groaned aloud after long silence, calling out three times the name “Solon.” Cyrus heard and ordered the interpreters to ask Croesus who he was invoking. They approached and asked, but Croesus kept quiet at their questioning, until finally they forced him and he said . . .’

After a series of finite forms, Herodotus switches to unembedded infinitives (underlined). Assuming that these come with a *Subj* at LF, they trigger reportive presuppositions. Apparently, Herodotus wants to mark the fact that he didn’t get this information first hand. But it is not at all clear in the context who told Herodotus all this. We thus predict a hearsay interpretation: *it is said that* (or: *I’ve been told that*) he did the following. *Allegedly, as Croesus stood on the pyre . . . it occurred to him . . . .

Given the lack of native speakers, it is not trivial to prove that this is indeed the intended reading of the passage, but it does at least offer an initially plausible explanation for the occurrence of these AcIs. Further research is required to thoroughly check this and other predictions.

4. Conclusion: The position of UID in the taxonomy of speech and thought reports

Inspired by the Greek data, we want to argue for the following picture:
We have argued that within the class of indirect speech and thought reports a distinction is to be made between embedded and unembedded ones (parallel to a distinction within the class of direct discourse reports into framed and unframed ones). Furthermore, we have shown that unembedded indirect discourse is not to be confused with what is traditionally called “free indirect discourse”. The latter name is misleading for the construction it is used for since it suggests that that is indirect discourse that is free (i.e. syntactically unembedded). FID – to keep using the standard terminology – is free, but it is not indirect discourse. UID, by contrast, is indirect discourse that is free and hence would be more deserving of that title. We believe that recognizing the class of unembedded indirect discourse also helps us obtain a clearer picture of what FID is semantically, viz. something that should not be treated as a kind of indirect discourse.

It is important to see that the point we are making is not (just) terminological. Of course, we can invent a term that covers both FID and UID. ‘Not purely direct, unembedded speech/thought reports’ would capture both. Or one could propose to stretch the use of the term “free indirect discourse” so as to include not only what is traditionally called so, but also the phenomenon of unembedded indirect discourse. However, what we hope to have shown in this paper is that the resulting group does not form a semantically homogeneous class. To the contrary, the two are fundamentally different: FID is quotational/direct-ish, whereas UID is intentional/indirect-ish.

Let’s now return to the question of the existence of FID in ancient Greek raised at the very beginning of this paper. We clearly have not proven that FID does not exist in this language (it is quite difficult to prove that something does not exist in a dead language). But the fact that we have never seen clear examples of this technique suggests to us that it does not exist. This suggestion is easily falsifiable: if only an ancient Greek example is found that is reportive without being syntactically embedded and which furthermore has an exclamative and an indexical temporal adverb like ἐχθές ‘yesterday’ that has a protagonist-oriented reading, we would happily acknowledge the existence of FID in this language. We think that the burden of the proof is with the scholars who claim that it exists.

We suspect that the existence of UID in ancient Greek may in some cases have contributed to the

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16Most (if not all) unembedded ones in ancient Greek are speech rather than thought reports.
impression that the superficially similar and misleadingly named stylistic device FID is present in this language. What we have shown in this paper is that on a closer look the two are fundamentally different phenomena.

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Minimizers in conditional threats and promises

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Abstract. Minimizer NPIs are famously licensed in conditional threats, but not promises. In this paper I show that this content-sensitivity is pragmatically motivated, independent of NPI licensing: minimizers are licensed in all types of conditionals. However, in most contexts it is not in the speaker’s best interest (and therefore irrational) to use a minimizer when making a promise, rendering such promises odd.

Keywords: Minimizer NPIs, conditionals, threats, promises, game theory.

1. Introduction

Many studies of negative polarity items (NPIs) focus on any and ever and their equivalents in other languages. In this paper, I focus on minimizer NPIs like drink a drop, lift a finger and make a peep. In particular, I discuss their distribution in conditionals: minimizers are licensed in ‘neutral’ conditionals and conditional threats as in (1) and (2), but they are usually odd in conditional promises as in (3).¹

(1) a. If John drinks a drop, I will be very surprised. NEUTRAL
    b. If Alex lifts a finger, Lee will be happy.
    c. If Jesse makes a peep, Kim will lose the bet.

(2) a. If John drinks a drop, I will punch him. THREAT
    b. If Alex lifts a finger to help Mary, I will make him rue the day.
    c. If Jesse makes a peep, I will tear his head off.

(3) a. ??If John drinks a drop, I will kiss him. PROMISE
    b. ??If Alex lifts a finger, I will cook him dinner.
    c. ??If Jesse makes a peep, I will pay him $5,000.

This observation is not new; in fact it has been around since Lakoff (1969), but it has remained a puzzle for existing theories of NPI licensing. I propose a pragmatic solution to the puzzle in this paper: I show that it is often irrational for the speaker to use a minimizer when making a promise. This, rather than an inability of promises to license minimizers, is what causes sentences like (3)

¹I would like to thank the audience of Sinn und Bedeutung 18, and I would also like to thank Ryan Bochnak, Gennaro Chierchia, Regine Eckardt, Kai von Fintel, Itamar Francez and Sabine Iatridou for helpful and constructive comments on earlier versions of this paper.

²A brief note on terminology: I use the term neutral conditional to differentiate between conditionals which merely state a causal (or relevance) relationship between antecedent and consequent, and those which express a promise or a threat.
to be odd.

While the data presented in this paper focuses on hypothetical conditionals, it is important to note that the same generalizations hold for relevance conditionals. The mechanism I propose below also works for relevance conditionals. (I am agnostic as to whether we can assume the same semantics for hypothetical and relevance conditionals (cf. Franke 2009 who proposes to give them the same syntax and semantics, and Iatridou 1991 who assumes a different syntax and semantics).) Consider the following examples adapted from Csipak (2010).

(4) a. Wenn Alex einen Funken Verstand hat, das Angebot ist super!
   if Alex a spark intelligence has that offer is great
   ‘If Alex has a spark of intelligence, that is a great offer.’
   NEUTRAL

   b. Wenn du einen Ton sagst, ich habe eine Pistole.
   if you one tone say I have a gun
   ‘If you make a peep, I have a gun.’
   THREAT

   c. ??Wenn du einen Tropfen trinken willst, ich habe Bier in der Küche
   intended: if you want to drink a drop, I have beer in the kitchen
   PROMISE

The remainder of the paper is organized as follows: in section two, I present the relevant conditional data and introduce the two main strands of theories of NPI licensing; showing that neither can account for the puzzle of conditional promises. In section three, I give a game-theoretic rendering of threats and promises. Section four shows how a game-theoretic approach to threats and promises can explain why minimizers are good in threats, but odd in promises. Section five concludes the paper.

2. NPI licensing

What makes NPIs special is that they can only occur in special environments – for example under n-words like no one (as in (5a)), but not in standard ‘positive’ assertions (as in (5b)).

(5) a. No one has ever heard of minimizers.

   b. ??Alex has ever heard of minimizers.

It is well-known that not all NPIs are licensed under all licensers – while so-called ‘weak’ NPIs like any and ever are licensed under a large number of licensers (such as clausemate negation, clausemate negation, self-negation, etc.),

I use ?? to indicate that a particular sentence is odd, and I do not distinguish between ungrammaticality, infelicity or being odd for other reasons.
comparatives, the antecedents of conditionals, the scope of *only*, *in weeks* are only licensed in a small subset of these licensers (they are licensed in clausemate negation, for example, but not in the antecedent of a conditional).

Consider the well-behaved weak NPI *ever* and strong NPI *in weeks* and their licensing behaviour in conditionals. Note that while *ever* is acceptable in all three types of conditionals (in (6)), *in weeks* is not acceptable in any of them (seen in (7)). But crucially they behave uniformly across different types of conditionals.

(6)  
   a. If John *ever* drinks alcohol, I will be surprised.  \text{NEUTRAL}  
   b. If John *ever* drinks alcohol, I will punch him.  \text{THREAT}  
   c. If John *ever* drinks alcohol, I will kiss him.  \text{PROMISE}  

(7)  
   a. *?*If John drinks alcohol *in weeks*, I will be surprised.  \text{NEUTRAL}  
   b. *?*If John drinks alcohol *in weeks*, I will punch him.  \text{THREAT}  
   c. *?*If John drinks alcohol *in weeks*, I will kiss him.  \text{PROMISE}  

We can say that the antecedent of a conditional is a licenser for weak NPIs like *ever*, but not for strong NPIs like *in weeks*. Now remember the pattern we observed for the minimizers *drink a drop, lift a finger and make a peep*, seen in (1), (2), and (3). It differs from both the pattern of weak NPIs and that of strong NPIs: minimizers are acceptable in neutral conditionals and threats, but odd in promises. This poses a problem – it seems we can neither claim that minimizers are licensed in the antecedents of conditionals, nor that they are not. In other words, minimizers like *drink a drop* are content-sensitive: whether they are licensed or not depends on the content of the conditional.

In order to understand what is going on, we first need to take a closer look at what minimizers actually are. They are NPIs that denote the (minimal) endpoint of some contextually salient scale. For example *drink a drop* is the smallest amount a person can drink; *lift a finger* is the smallest amount a person can help; *make a peep* is the smallest amount a person can draw attention to themselves; etc. There is no consensus over whether they generally count as ‘weak’ or ‘strong’: while Krifka (1995) and Chierchia (2013) argue that they are emphatic and therefore strong, Gajewski (2008) and Hoeksema (2002) show that their distribution is wider than that of strong NPIs like *in weeks*, which suggests that they are more similar to weak NPIs.

In the remainder of this section, I present the two main strands of NPI licensing theories: a syntactic-semantic one following Ladusaw (1979) who suggests that NPIs need to occur in the scope of a downward-entailing operator in order to be licensed, and a pragmatic one following Fauconnier (1975). On this view, NPIs give rise to alternatives and must be more informative than their alternatives in the context they occur in.
2.1. Downward-Entailingness

One of the two broad categories of NPI licensing theories is a syntactic-semantic one: NPIs must occur in the scope of a licensing operator. Different accounts differ as to what the nature of this operator is and how exactly the mechanism works, but they share the common move in the analysis that the NPI needs to occur in the operator’s scope. I show that this move it what is problematic for the conditional data, and therefore I do not go into detail about what the different implementations of the syntactic-semantic account are. I briefly introduce the original proposal by Ladusaw and three modifications.

Ladusaw (1979) proposes that NPIs are licensed in the scope of a downward-entailing operator. Downward-entailing operators are operators under which the entailment between sets and their subsets is reversed (being a part of a subset entails being part of its superset, and under a downward-entailing operator being part of the superset entails being part of the subset). This proposal accounts for NPIs being licensed under a surprisingly wide number of contexts – clausemate negation is downward-entailing, but so is the scope of *few* and a number of other contexts which are not ‘negative’ in any obvious way.

\[(8)\] \[f\text{ is downward-entailing iff} \quad X \subseteq Y \Rightarrow f(Y) \subseteq f(X)\]

\[(9)\] a. broccoli \subseteq vegetables
b. Alex doesn’t like vegetables. \subseteq
   Alex doesn’t like broccoli.
c. Few people like vegetables. \subseteq
   Few people like broccoli.

\[(10)\] a. √ Alex doesn’t like any vegetables.
b. √ Few people like any vegetables.

Note that downward-entailingness is a logical property of operators like *few*: either the operator has it, or not. Being downward-entailing does not depend on factors like context or, as needed to solve the conditional puzzle, *content*.

Several improvements have been proposed to fine-tune Ladusaw’s original account. For example, Zwarts (1998) attempts to explain the difference between weak NPIs like *ever* and strong NPIs like *in weeks* in terms of an additional licensing property: some downward-entailing operators have an additional logical property, anti-additivity. These operators are ‘stronger’ licensors: strong NPIs need to occur in the scope of an operator that is anti-additive, not just downward-entailing.
A different problem has been tackled by von Fintel (1999): some operators which license NPIs are not straightforwardly downward-entailing. But von Fintel shows that these are Strawson-downward-entailing – once the presuppositions of the ‘entailed’ proposition are fulfilled, it is in fact entailed.

In a series of works, Giannakidou (cf. e.g. Giannakidou 1998, Giannakidou 2006, Giannakidou 2010) develops a different syntactic-semantic licensing mechanism. The property she proposes is responsible for NPI licensing is (non-)veridicality:

\[(11) \text{An operator } F \text{ is veridical iff } F(p) \text{ entails or presupposes that } p \text{ is true in some individual’s epistemic model; otherwise } F \text{ is nonveridical.} \] (Giannakidou 2006: 589)

All of these improvements on Ladusaw’s origial theory maintain the basic premise that NPIs have to appear in the scope of an operator which has a certain logical property. Once an operator is established to possess that property, and a given NPI is established to be licensed in its scope, nothing in these theories predicts the kind of content-sensitivity observed in (1) – (3). Since minimizers are acceptable in the antecedent of a neutral conditional (cf. (1)), syntactic-semantic theories of NPI licensing predict them to be licensed in all antecedents of conditionals, regardless of whether these express a neutral relation between antecedent and consequent, or a promise or a threat.

2.2. Pragmatic scales

The second major category of NPI licensing theories aims to explain NPI licensing pragmatically: following a proposal by Fauconnier (1975), there have been a number of proposals that assume that NPIs trigger alternatives on a contextually salient scale (cf. e.g. Krifka 1995, Eckardt 2005, Chierchia 2013). The core idea common to all of these proposals is that an NPI denotes the endpoint of a scale, and that by using the NPI, the speaker is making a stronger statement than by using an alternative value from the relevant scale (often the ‘strength’ of assertions is measured in terms of entailment\(^4\)).

Consider for example the minimizer drink a drop. The relevant scale is one of amounts of (alcoholic) beverages someone consumes. Both Eckardt (2005) and Chierchia (2013) paraphrase the meaning of drink a drop as ‘drinking an amount so small that it does not count/is impossible to drink only that much and no more’; the minimal endpoint of the scale of drinking. Below is a Chierchia-style lexical entry for the minimizer drink a drop.

\(^4\)van Rooij (2003) discusses how entropy and relevance can be used to measure ‘strength’ in questions.
Consider a context where there is a party tonight, and it is well-known that Alex does not like alcohol. In such a context, a speaker can express her beliefs about whether Alex will drink or not by using a conditional.

(13) a. If Alex drinks a drop at the party I will be very surprised.

The conditional containing the minimizer *drink a drop* entails the one containing the alternative *drink two beers*; this means that the first is a ‘stronger’ proposition in the relevant sense. According to the pragmatic theories of NPI licensing, the minimizer should therefore be licensed here (which in fact it is, cf. (13a)).

Note that there is nothing in the pragmatic theories of NPI licensing which would predict content-sensitivity. As long as the proposition containing the minimizer is ‘stronger’ than its alternatives, NPIs are predicted to be licensed, independently of the content.

I have shown that both main theories of NPI licensing cannot predict that minimizers are sensitive to content when they occur in the antecedent of a conditional. I will now discuss some game-theoretic insights into the nature of threats and promises before I use these insights for explaining the content-sensitivity of minimizers.

3. Psycholinguistic and game-theoretic insights into threats and promises

Game theory models the decisions and preferences of agents who are interacting with each other. Each agent has preferences about the outcome of the interaction, and game theory is a good way to model at each point of the interaction which utterance promises the greatest payoff for the speaker (i.e. comes closest to her preferred outcome).

Both promises and threats are used in order to bring about certain behaviours of the addressee (Searle 1998), and both are often expressed in conditional form. Game theorists have attempted to describe when a promise or a threat is *effective*; that is when a situation in which a promise or threat was uttered is resolved in such a way that the speaker (and ideally the hearer as well) gets what she wants. Three key components are necessary: both promises and threats need to be *credible, beneficial* and *efficacious* (see below; cf. Klein and O’Flaherty 1993). If one of these is
missing, the threat or promise cannot be uttered felicitously.

But there is also a striking difference between threats and promises: they affect the speaker’s public commitments in different ways. While the speaker is not entering in a commitment when making a threat, she does when making a promise. Both the hearer and the public can demand that she honour her promise, but they cannot in the same way demand that she deal a punishment (cf. Schelling 1960, Searle and Vanderveken 1985 and experimental evidence in Verbrugge et al. 2004). From a game-theoretic perspective, we can describe this pattern (obligation to pay a reward that is part of a promise, but no obligation attached to a threat) as saying that for the speaker threats are cheap; promises are costly.

Before presenting my analysis for minimizers in threats and promises, I introduce some game-theoretic insights on the notions of benefit and efficacy which illustrate what makes a promise or a threat effective (i.e., induces the hearer to show the behaviour desired by the speaker). I ignore the question of when a promise or a threat is credible, which is a separate issue. I simply assume that the speaker’s threats and promises are credible – she is taken to be in a position where she can pay the promised reward or deal the threatened punishment.\(^5\)

Consider first the case of promises. When is a promise effective? Both speaker and hearer must get what they want. From the point of view of the speaker, getting the addressee to show the desired behaviour must be worth more than paying the reward (this makes the promise beneficial to the speaker). From the point of view of the hearer, getting the reward must be worth more than showing the desired behaviour (this makes the promise efficacious for the hearer). The table below models the preferences of the speaker and the hearer. Doing something that does not benefit oneself directly is modeled by a negative value (the ‘cost’ one has), whereas getting something one wants is modeled by a positive value.

Consider a scenario where the speaker wants to tease the hearer. Clamato is a tomato-flavoured beverage which contains clam broth; something that the hearer may not drink voluntarily. The speaker can make the promise in (14), which we can model as in the table below. The values assigned in the cells are supposed to illustrate the agents’ costs and benefits. We consider the exchange to be a one-off, i.e. we ignore any previous interactions the interlocutors may be aware of which might complicate the model, and we also ignore the possibility of any future interactions.

(14) If you drink this Clamato, I will cook you dinner.

\(^5\)For experimental work on what makes promises and threats credible, see Lopez-Rousseau et al. (2011) and references therein.
In this example, for the speaker the benefit of watching the hearer drink Clamato is high enough to offset the cost of making dinner, and the hearer’s efficacy of getting dinner also offsets the cost of drinking Clamato. Because the promise is beneficial for the speaker, it is rational for her to utter it.

Now consider a threat. In order to induce a hearer to show the desired behaviour, it must be more attractive for him to avoid punishment than to behave against the speaker’s wishes. The speaker herself has little to no cost since she is not obligated to do anything (remember that threats are cheap). Therefore, any threat is beneficial for the speaker; whether it will be effective in bringing about the desired hearer behaviour is only a question of whether it is credible and efficacious. We consider a threat to be efficacious if the pleasure drawn from going against the speaker’s wishes (in the example below, getting drunk) is lower than the ‘cost’ associated with being punished.

(15) If you get drunk, you have to sleep on the couch.

<table>
<thead>
<tr>
<th></th>
<th>drunk</th>
<th>couch</th>
</tr>
</thead>
<tbody>
<tr>
<td>speaker cost</td>
<td>–</td>
<td>0</td>
</tr>
<tr>
<td>speaker benefit</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td><strong>speaker net gain:</strong></td>
<td><strong>0</strong></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>drunk</th>
<th>couch</th>
</tr>
</thead>
<tbody>
<tr>
<td>hearer cost</td>
<td>–</td>
<td>-8</td>
</tr>
<tr>
<td>hearer pleasure</td>
<td>5</td>
<td>–</td>
</tr>
<tr>
<td><strong>hearer net gain:</strong></td>
<td><strong>-3</strong></td>
<td></td>
</tr>
</tbody>
</table>

There are two important things to note here: first, the hearer has a ‘negative’ gain. The pleasure of getting drunk is lower than the discomfort of having to sleep on the couch. This means it is efficacious for the hearer to comply with the speaker’s wishes. Modeling the speaker’s benefits is more difficult. Note first that the speaker has no costs (threats are cheap). The benefit comes about indirectly: since the speaker does not want the hearer to get drunk, we need to consider the conditional strengthening of the threat.

(16) If you don’t get drunk, you don’t have to sleep on the couch.

Here, the corresponding table easily models the speaker’s benefit.

<table>
<thead>
<tr>
<th></th>
<th>not drunk</th>
<th>not couch</th>
</tr>
</thead>
<tbody>
<tr>
<td>speaker cost</td>
<td>–</td>
<td>0</td>
</tr>
<tr>
<td>speaker benefit</td>
<td>8</td>
<td>–</td>
</tr>
<tr>
<td><strong>speaker net gain:</strong></td>
<td><strong>8</strong></td>
<td></td>
</tr>
</tbody>
</table>
Notice again that there is no associated cost for the speaker: not forcing the hearer to sleep on the couch is ‘free’. Making the move from the conditional threat to the conditionally strengthened threat has been shown experimentally to occur regularly in discourse (cf. Fillenbaum 1976 and more recently Guerini and Castelfranchi 2006).

In this section I have shown that for promises to be beneficial to the speaker, they need to be ‘cost-effective’. Threats, on the other hand, are free for the speaker, which means they are always beneficial.

4. The analysis

I propose that the reason why minimizer NPIs are acceptable in conditional threats, but not promises, has nothing to do with their licensing. In principle they are perfectly licensed in the antecedents of all conditionals, regardless of content – just as both theories of NPI licensing discussed above predict for weak NPIs. The reason that they are often odd in promises is because it is often irrational for the speaker to make a promise that contains a minimizer.

4.1. Threats

Remember the pragmatic theory of NPI licensing which analyzes minimizers as giving rise to alternatives on a contextually salient scale, with the minimizer itself denoting the endpoint of that scale. In the case of drink a drop, this is a scale of amounts of (alcoholic) beverages consumed. Drinking a drop is the minimal endpoint, with alternatives like drinking a glass or a bottle. When a minimizer is used in the antecedent of a conditional, the speaker is making the strongest possible threat; threats containing alternative values of the scale are entailed. Consider the following scenario: the speaker does not like it when the hearer drinks alcohol because he is the designated driver. She can felicitously express a threat containing a minimizer.

(17) a. If you drink a drop of wine tonight, you have to sleep on the couch. ⊆
   b. If you drink a bottle of wine tonight, you have to sleep on the couch.

<table>
<thead>
<tr>
<th></th>
<th>drink a drop</th>
<th>couch</th>
</tr>
</thead>
<tbody>
<tr>
<td>speaker cost</td>
<td>–</td>
<td>0</td>
</tr>
<tr>
<td>speaker benefit</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td><strong>speaker net gain:</strong></td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>drink a drop</th>
<th>couch</th>
</tr>
</thead>
<tbody>
<tr>
<td>speaker cost</td>
<td>–</td>
<td>0</td>
</tr>
<tr>
<td>speaker benefit</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td><strong>speaker net gain:</strong></td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>drink a drop</th>
<th>couch</th>
</tr>
</thead>
<tbody>
<tr>
<td>hearer cost</td>
<td>–</td>
<td>-8</td>
</tr>
<tr>
<td>hearer efficacy</td>
<td>2</td>
<td>–</td>
</tr>
<tr>
<td><strong>hearer net gain:</strong></td>
<td>-6</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>drink a bottle</th>
<th>couch</th>
</tr>
</thead>
<tbody>
<tr>
<td>speaker cost</td>
<td>–</td>
<td>0</td>
</tr>
<tr>
<td>speaker benefit</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td><strong>speaker net gain:</strong></td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>drink a drop</th>
<th>couch</th>
</tr>
</thead>
<tbody>
<tr>
<td>hearer cost</td>
<td>–</td>
<td>-8</td>
</tr>
<tr>
<td>hearer efficacy</td>
<td>2</td>
<td>–</td>
</tr>
<tr>
<td><strong>hearer net gain:</strong></td>
<td>-6</td>
<td></td>
</tr>
</tbody>
</table>
Like in the threat discussed in the previous section (cf. (15)), the hearer faces negative consequences if he chooses to drink alcohol: the pleasure of drinking (regardless of the amount) does not offset the cost of sleeping on the couch. Therefore it is efficacious for the hearer to behave according to the speaker’s wishes. As before, both threats are free of cost for the speaker. As before, it is easier to see the benefit for the speaker by looking at the conditionally strengthened threat.

(18) a. If you don’t drink a drop of wine tonight, you don’t have to sleep on the couch.
b. If you don’t drink a bottle of wine tonight, you don’t have to sleep on the couch.

<table>
<thead>
<tr>
<th></th>
<th>not drink a drop</th>
<th>not couch</th>
</tr>
</thead>
<tbody>
<tr>
<td>speaker cost</td>
<td>–</td>
<td>0</td>
</tr>
<tr>
<td>speaker benefit</td>
<td>4</td>
<td>–</td>
</tr>
</tbody>
</table>

**Speaker net gain:** 4

<table>
<thead>
<tr>
<th></th>
<th>not drink a bottle</th>
<th>not couch</th>
</tr>
</thead>
<tbody>
<tr>
<td>speaker cost</td>
<td>–</td>
<td>0</td>
</tr>
<tr>
<td>speaker benefit</td>
<td>4</td>
<td>–</td>
</tr>
</tbody>
</table>

**Speaker net gain:** 4

There are two important things to note: first, threats are cheap! Both conditionally strengthened threats are beneficial for the speaker. The second important observation is that the speaker’s benefit does not change depending on how much the hearer doesn’t drink. Whichever element of the scale the speaker picks as the threshold is the one the hearer may not cross. Note that there are some values that the speaker should not pick if she wishes to behave rationally: if she knows that the hearer starts snoring if he drinks more than two glasses of wine, choosing a threshold of one bottle (more than two glasses) yields a threat which is not beneficial to the speaker: the hearer can comply with the terms of the threat and still create an outcome which is not beneficial to the speaker (i.e. by drinking three glasses, and then snoring). But a threat that is beneficial for the speaker at two glasses has the same benefit as the threat *If you drink one glass of wine tonight, you have to sleep on the couch*, and in fact any alternative amount that is lower than the threshold of two glasses, including a drop. Since the minimizer picks out the lowest element on the scale of drinking, by uttering (17a) the speaker makes the strongest possible threat.

Because threats are cheap for the speaker and they yield the same benefit (as long as they remain below the crucial threshold), it is rational for her to simply make the strongest threat possible.\(^6\)

\(^6\)I am ignoring two issues here: one is the potential benefit she may derive from first making a strong threat and then being generous and forgiving the hearer for drinking a small amount. The second issue is one of credibility: depending on how draconic a punishment the speaker threatens to deal out, the hearer may believe that if the punishment is disproportionate for the offense, the speaker will not follow through (Lopez-Rousseau et al. 2011).
4.2. Promises

While it is rational for a speaker to make the strongest possible threat, the opposite is true for a promise: promises are costly for the speaker. As soon as the speaker utters a promise, she is socially obligated to pay a reward if the hearer shows the behaviour specified in the antecedent. Therefore, in order to make a promise that is rational to make, the speaker needs to make sure that the costs she faces are offset by what she gains. Since a minimizer picks out the endpoint of the scale, the hearer only has to show a minimal amount of the behaviour the speaker wants to reward. In most cases, this is not enough for the speaker to make the promise beneficial to her.

Consider the following scenario. The speaker wants to tease the hearer, who does not like seafood, and dares him to drink some Clamato. If he manages to drink a substantial amount, for example one glass, she is willing to cook him dinner. However, making dinner involves a lot of effort (which is costly for the speaker), which means that the speaker does not want to reward the hearer for only drinking a spoonful or less.

\[
\begin{array}{c|c|c}
\text{drink a drop} & \text{dinner} \\
\text{speaker cost} & - & -5 \\
\text{speaker benefit} & 1 & - \\
\hline
\text{speaker net gain:} & -4 \\
\end{array}
\quad
\begin{array}{c|c|c}
\text{drink a drop} & \text{dinner} \\
\text{hearer cost} & -1 & - \\
\text{hearer efficacy} & - & 6 \\
\hline
\text{hearer net gain:} & 5 \\
\end{array}
\]

\[
\begin{array}{c|c|c}
\text{drink a glass} & \text{dinner} \\
\text{speaker cost} & - & -5 \\
\text{speaker benefit} & 6 & - \\
\hline
\text{speaker net gain:} & 1 \\
\end{array}
\quad
\begin{array}{c|c|c}
\text{drink a glass} & \text{glass} \\
\text{hearer cost} & -3 & - \\
\text{hearer efficacy} & - & 6 \\
\hline
\text{hearer net gain:} & 3 \\
\end{array}
\]

Using the minimizer in this context and making the strongest possible promise now works against the wishes of the speaker: by making the stronger promise, she is obligated to pay a reward even in situations where the promise is not beneficial to her. She does not want to reward the hearer for drinking only a small amount of Clamato. Uttering a promise which promises a reward for drinking very little Clamato is not beneficial for the speaker – it commits her to paying the reward as long as the hearer drinks an amount past the threshold indicated in the promise. Using a minimizer which picks the endpoint of the scale is therefore irrational.

So far I have shown that it is rational for the speaker to use minimizers in threats: using a minimizer makes the threat as strong as possible, and since threats do not cost the speaker anything, she can
just make the strongest possible threat (even if she may not plan to enforce the punishment for an offense at the low end of the scale). Promises, on the other hand, are costly for the speaker. Therefore it is often irrational to use a minimizer and making the strongest possible promise, because then the speaker is committed to paying a reward even if the hearer only does a very minimal amount. This is what causes minimizers to be odd in conditional promises.

4.3. Desperate promises

Notice that nothing in the analysis presented above leads to the conclusion that minimizers are not – semantically or pragmatically – licensed in promises. This means that we should find contexts in which minimizers do occur in conditional promises. These should be contexts where it is rational for the speaker to make the strongest possible promise (which is usually not a rational move).

We do indeed find these special circumstances. When the context supports that the speaker is in fact acting rationally when making a promise that is as strong as possible (often for rhetorical effect), minimizers are perfectly acceptable.

Consider the following scenario. A team of advertisers has an important meeting with a client. Alex is notoriously shy and resents public speaking, but Alex’s boss believes that Alex is so charming that even the tiniest contribution from him will sway the clients. Ideally (for Alex’s boss), Alex should give the entire presentation. But as long as he opens his mouth at all, his charm will still work. In such a context, there is a salient scale Alex say a word; …; Alex present the campaign; … with corresponding conditional promises. It is then perfectly rational for Alex’s boss to use a promise containing a minimizer (‘say a word’). And the minimizer is in fact licensed, see (21).

(20) If you present the new campaign, I will give you a gigantic bonus.
(21) ✓ If you say a word, I will give you a gigantic bonus.

<table>
<thead>
<tr>
<th></th>
<th>present</th>
<th>giant bonus</th>
</tr>
</thead>
<tbody>
<tr>
<td>speaker cost</td>
<td>–</td>
<td>-5</td>
</tr>
<tr>
<td>speaker benefit</td>
<td>16</td>
<td>–</td>
</tr>
</tbody>
</table>

**speaker net gain: 1**

<table>
<thead>
<tr>
<th></th>
<th>say a word</th>
<th>giant bonus</th>
</tr>
</thead>
<tbody>
<tr>
<td>speaker cost</td>
<td>–</td>
<td>-5</td>
</tr>
<tr>
<td>speaker benefit</td>
<td>10</td>
<td>–</td>
</tr>
</tbody>
</table>

**speaker net gain: 5**

<table>
<thead>
<tr>
<th></th>
<th>present</th>
<th>giant bonus</th>
</tr>
</thead>
<tbody>
<tr>
<td>hearer cost</td>
<td>-8</td>
<td>–</td>
</tr>
<tr>
<td>hearer efficacy</td>
<td>–</td>
<td>6</td>
</tr>
</tbody>
</table>

**hearer net gain: -2**

<table>
<thead>
<tr>
<th></th>
<th>say a word</th>
<th>giant bonus</th>
</tr>
</thead>
<tbody>
<tr>
<td>hearer cost</td>
<td>-1</td>
<td>–</td>
</tr>
<tr>
<td>hearer efficacy</td>
<td>–</td>
<td>6</td>
</tr>
</tbody>
</table>

**hearer net gain: 5**

Note that in this context, both promises are beneficial for the speaker: even if the hearer only per-
forms the smallest possible action (‘say a word’), the resulting benefit for the speaker is big enough to offset the cost of paying a giant bonus. For the hearer, on the other hand, the promise without the minimizer is not efficacious. He dislikes giving presentations so much that even the promise of a giant bonus does not offset the cost of having to give a presentation. The promise *If you give the presentation, I will give you a giant bonus* is therefore beneficial for the speaker without being efficacious for the hearer – and therefore, it is not effective. The hearer will most likely not act according to the speaker’s wishes. Using a minimizer in a promise heightens the efficacy for the hearer: the promise containing a minimizer makes it worthwhile for the hearer to contribute to the presentation; the promise is more likely to be effective than the non-minimizer alternative. Therefore it is a rational move in this context to make the strongest possible promise, and the minimizer is licensed.

This type of context is not typical; this is why minimizers in promises often appear odd. Making a ‘desperate’ promise of this kind creates a rhetorical effect similar to the one described in van Rooij (2003) for minimizers in questions.

5. Conclusion

I have shown that minimizer NPIs are licensed in the antecedents of conditionals, regardless of whether these are neutral conditionals, threats, or promises. The reason why threats and neutral conditionals can host minimizers more easily than promises has to do with the meaning minimizers have and the function they play in the discourse: they pick out the endpoint of a scale and thus make the proposition they occur in stronger than its alternatives. It is rational for speakers to make strong threats since they have nothing to lose; threats are cheap for the speaker. Therefore minimizers are perfectly acceptable there. On the other hand, making a promise as strong as possible is generally not a rational discourse move since it means that the speaker is socially obligated to pay the promised reward already for a very small action on the part of the hearer. This often leads to the promise not being beneficial to the speaker. I have shown in the previous section that there are (rare) contexts in which even a very small action on the part of the hearer makes it worthwhile for the speaker to pay the reward. In these cases, the promise is beneficial for the speaker; making the promise is a rational discourse move, and the minimizer is licensed.

In sum, we need to explain the content-sensitivity of minimizers in conditional threats and promises not in terms of a condition on their licensing but in terms of an additional pragmatic reasoning mechanism. We can model it game-theoretically as the contrast between making a rational or an irrational discourse move. In order for minimizers to occur felicitously, they need to be licensed (via syntactic-semantic or pragmatic licensing), as they are in the antecedent of a conditional. But a second condition also needs to be satisfied: the utterance containing the minimizer must create only the kinds of commitments for the speaker that are beneficial to her.
References


**Vertical representation of quantifier domains**

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**Abstract.** We show via American Sign Language (ASL) productions of singular indefinites, plural pronouns, and negative quantifiers that ASL can use space to convey set size and quantifier domain restriction, and moreover, that sets are interpreted as increasingly larger as they are signed higher in space. Such overt markings of domain size are more than simply emphatic, participating in adverbial quantifier binding and exhibiting more systematicity than emphasis in English. We discuss our findings in light of previous research on the semantic use of sign height in ASL, and speculate on the origin of such a strategy in sign languages.

**Keywords:** Quantifiers, domain restriction, sign language, ASL, discourse referents, space.

**1. Introduction**

One well-known problem at the interface of semantics and pragmatics is the issue of quantifier domain restriction: how does the formal semantic component of grammar interact with contexts to sufficiently restrict the domain for the quantificational phrase “every student” in (1) such that it need not be the case that every single student in the world attended and enjoyed a lecture for (1) to be true (Barwise and Cooper 1981, von Fintel 1994; Szabo and Stanley 2000, a.o.)?

(1) Every student enjoyed the lecture.

There is one (unlikely) interpretation of (1) in which every student in the entire world enjoyed the lecture. Another very plausible interpretation of (1) can be paraphrased as *Every student who went to the lecture enjoyed the lecture* or even *Every student that is relevant in our discourse now enjoyed the lecture*. Importantly, there is a strong intuition that there are indeed contexts in which (1) is true while there are simultaneously students who have no opinions on the lecture, as long as such students are not part of the (somehow restricted) domain for the universal quantifier every. In (1) in English, there is no explicit marking of the restriction of the domain of the quantifier every, while other languages may mark the domain more explicitly (Etxeberria and Giannakidou to appear, and earlier work). In this paper, we focus on domain restriction in American Sign Language (ASL), showing that the restriction of quantifier domains can be marked overtly by signing quantifiers in the location of their domain, and that intermediate levels of domain widening can be signaled by signing a quantifier increasingly higher in space.

In the remainder of section 1 we discuss some background on quantifiers and plurals in ASL, present new data, and sketch our proposal. Section 2 provides detailed examples using a variety of quantifiers and pronouns in ASL. Section 3 presents our proposal that height is linked to large set sizes that can be used as quantifier domains and presents further supporting arguments. Section 4 discusses other uses and possible origins of height in ASL, while section 5 concludes.
ASL is notable from the semantic/pragmatic point of view for using *spatial loci*, or locations in a horizontal signing plane perpendicular to the signers body, that unambiguously keep track of discourse referents. For example, in (2a) the sign for John (JOHN: capital letters of the rough English gloss will be used to transcribe a sign) is signed in location $a$ (here, the signer’s ipsilateral side), while BOB is signed in location $b$ (the signer’s contralateral side). An indexical point (IX) functions here as a pronoun, such that if the signer points to location $a$ (IX$_a$) the sentence is interpreted as ‘John is smart’, while an indexical point to the other location (IX$_b$) would have been interpreted as ‘Bob is smart’. Loci are not required in contexts without pronouns (2b), but are nevertheless frequently used in ASL, especially in multi-clause discourses.

(2)  
\begin{tabular}{l}
\textbf{a.} JOHN$_a$ LIKE BOB$_b$. IX$_a$ SMART.  \\
\textquoteleft John likes Bob. He (John) is smart.'  \\
\textbf{b.} JOHN LIKE BOB.  \\
\textquoteleft John likes Bob.'
\end{tabular}

Loci can be placed anywhere in the low horizontal plane, so there are theoretically an infinite number of loci, and therefore an infinite number of pronominal assignments, and so relatively stable assignments. This contrasts with English, which is limited to essentially “he,” “she,” and “it”, so that each pronoun must frequently be re-assigned throughout a discourse.

A similar pattern is found for plural sets, which may also be assigned loci that are marked for plurality. In (3a), the bare noun STUDENT is followed by a plural pronoun (plural-marked because the indexical point makes an arc movement) around location $a$, while TEACHER is followed by the same indexical arc around location $b$, and both are interpreted as plurals. The plural-marked loci can participate in anaphoric relationships just like singulars, so that IX-arc$_a$ in (3a) refers to the students, but if it had been traced near location $b$ it would refer to the teachers. Like singulars, loci are also optional for plural marked entities, but without them the (grammatical) bare noun phrases are unmarked for definiteness or number (3b).

(3)  
\begin{tabular}{l}
\textbf{a.} STUDENT IX-arc$_a$ LIKE TEACHER IX-arc$_b$. IX-arc$_a$ SMART.  \\
\textquoteleft The students like the teachers. They (the students) are smart.'  \\
\textbf{b.} STUDENT LIKE TEACHER.  \\
\textquoteleft Some/the student(s) like some/the teacher(s).'</n\end{tabular}

Schlenker et al. (2013) describe how plural sets in sign languages retain information about the geometry of the sets that they refer to, so that if one arc is properly contained within another arc, then the sets referenced by the first set must be a proper subset of the latter (4)(Figure 1).

(4)  
\textbf{STUDENT IX-arc$_{ab}$ SMART. GIRL IX-arc$_a$ HAPPY.}  \\
\textquoteleft The students are all smart. The girls (a subset of the students) are happy.'
More intriguingly, they show that the complement of the subset can be referred to in ASL by pointing to the space contained by the larger arc but excluded by the smaller (5a); this kind of “complement anaphora” is not available in English (5b), but sign languages seem to take unique advantage of the iconic properties of these sets to refer to as-yet unmentioned discourse referents that become salient in the discourse due to the geometry of two mentioned referents.

(5)  
   a. STUDENT IX-arc\textsubscript{ab} SMART. GIRL IX-arc\textsubscript{a} HAPPY. IX-arc\textsubscript{b} NOT HAPPY.  
   ‘The students are all smart. The girls (a subset of the students) are happy, but the rest (the boys) are not happy.’
   b. #The students are smart. Of them, the girls are happy but they are not.  
   (where “they” is interpreted as the students who are not girls)

Schlenker et al. restrict their discussion to subset/superset relationships where at least one subset and the superset are both explicitly located in space through IX-arcs (the green and yellow arcs in Figure 1). As a jumping-off point for our own discussion in this paper of domain marking in ASL, we note that the same subset-superset geometry can be extended to a single set and its complement even with implicit marking of the superset (blue arcs, Figure 2). Consider (6), where the set of students is associated with locus a. In (6a), if IX-arc traces a path over a larger area outside of this location in the same horizontal plane, it is interpreted as the complement set of that original set (“the rest”), as if the whole horizontal plane is understood to be the set containing everyone in the current context. Moreover, a similar IX-arc signed above the horizontal plane containing the original set, with IX-arc pointed upwards, is also interpreted as the complement of the original set, but as if the superset contained many more individuals under consideration, seemingly anyone (not just the individuals already relevant to this context). In other words, IX-arc\textsubscript{LOW,a} (the LOW plane minus what is in locus a) is interpreted as “not the students, but the other ones in our context/discussion”, while IX-arc\textsubscript{HIGH} is interpreted as “not the students, but basically everyone else (irrespective of our context/discussion).”

(6)  
   a. STUDENT IX-arc\textsubscript{a} SMART. IX-arc\textsubscript{LOW,a} NOT.  
   ‘The students, they are smart. The rest are not.’
   b. STUDENT IX-arc\textsubscript{a} SMART. IX-arc\textsubscript{HIGH} NOT.  
   ‘The students, they are smart. Generally, everyone else is not.’
In the remainder of this paper we will argue that this use of vertical (LOW/HIGH) space is a way to implicitly convey set size, and can be used to provide information about the restriction of quantifier domains. So, in (6a) the low, default, horizontal plane represents the current context, while the high plane widens the set of individuals under consideration. We show that this use is systematic across a variety of constructions (not just those indicated through the plural pronoun/demonstrative seen here, but also implicitly through the height of quantifiers), and is actually multi-leveled, so that signing at intermediate heights is interpreted as intermediate sized domains. Because it allows multiple levels, in which increasingly higher levels correspond to increasingly larger sets, we represent the organization of these sets with the abstract “vortex” in Figure 3, with the smallest possible a singleton set (see discussion in section 2.2 on specific indefinites).

![Figure 3. (abstract “vortex” of sets)](image)

In what follows we use this vortex figure to illustrate the semantic effect of signing various quantifiers and a pronoun at different heights. In doing so, we urge the reader to keep in mind that this vortex is abstract and (at this point) seemingly only present in the mind: we are not necessarily claiming that one signs any wider when one signs high, only that when one signs higher, the interpretation is of a larger referenced set.

2. Quantification in ASL and Sign Height

2.1. Quantifier domains in ASL

Quantification has been surprisingly understudied in ASL, particularly the semantic aspects of quantification. Petronio (1995) and Boster (1996) present detailed descriptions at the syntactic/semantic interface of noun phrases in ASL, including quantifiers, but focus on possible word orders within quantified noun phrases. Quer (2012) shows that quantifiers in sign languages can be analyzed using a tri-partite structure, and Schlenker (2011) provides a detailed dynamic account of many binding properties of sign language quantifiers. At the pragmatic level, Davidson (2011) shows that at least one version of ALL and SOME in ASL form a scale for scalar implicatures. Barberà (2012) discusses how in Catalan Sign Language, the domain of a quantifier in ASL can be marked in the low horizontal plane by placing the quantifier in the location of a plural discourse referent that serves as its domain. We have found that a similar spatial modification occurs in ASL. Consider (7a), in which the set of students is associated with locus a. When a quantifier is signed in the same location later in the discourse, the interpretation is that the domain of the quantifier NONE, ONE/SOMEONE, or (fingerspelled) A-L-L is the set of students. Again, the use of loci is not necessary (7b), but like Barberà (2012) we modify our translation slightly to include a partitive construction in (7a) to indicate that the second sentence in (7a) contains information about the domain for the quantifiers, while (7b) does not (it is only available from the greater discourse context).
(7)  

a. MY STUDENT IX-arc, SMART. NONE/ONE/A-L-L, SKIP CLASS.  
   ‘My students, they are smart. None/one/all of them skip(s) class.’

b. MY STUDENT SMART. NONE/ONE/A-L-L SKIP CLASS.  
   ‘My students are smart. None/one/all skip(s) class.’

Schlenker (2011) analyzes quantifiers signed in locations (as in the second sentence of (7a)) as introducing a discourse referent in that locus; clearly more should be done to understand the relationship between domain restriction (involving plural sets) and the creation of discourse referents (which are often marked with singular number). In this paper we focus on domain restriction, especially the use of height to signal relative set size in a variety of constructions.

2.2. Height and Existential Quantifiers

We begin with the use of height to signal domain size for existential quantifiers. The sign we gloss as SOMEONE can be seen in Figure 4, which includes still frames from a video containing the sentences in (8). (Unlike the English word “someone”, the sign we gloss here as SOMEONE is not just used for humans, but can range over inanimate objects just as easily as people.) In Fig. 4a, the quantifier SOMEONE is signed lower than in 4b, and the sentences they correspond to are interpreted with restricted (8a) and wide domains (8b), respectively.

(8)  
   Context: Signer is discussing her friend getting a nanny for her children.

   a. IX, WILL FIND SOMEONE\textsubscript{low}.  
      ‘I will find someone (among the usual group).’

   b. IX, MUST FIND SOMEONE\textsubscript{high}.  
      ‘You need to find someone (anyone)!’

Figure 4.

Previous analyses of the semantics of vertical sign height have focused (exclusively, it seems) on existential quantifiers of precisely this kind, and in particular the very high, circling SOMEONE in Figure 4b. MacLaughlin (1997) describes this sign as a non-specific SOMEONE used for less identifiable references, in contrast to specific indefinites and definites, which she argues must be signed in the low plane. According to Barberà (2012), in Catalan Sign Language high signing space is reserved for non-specific indefinites, while specific indefinites and some discourse-prominent non-specific indefinites are signed in the low plane. We fully agree with these
researchers that the more identifiable, definite, or specific noun phrases are, the more likely they are to be signed in the low plane. However, we suggest that underlying these tendencies in ASL is a general rule for using high space to represent wide set sizes.

Three points in particular lead us to adopt an analysis of set widening to correlate with height in ASL, and not definiteness or specificity. First, as we will see in the following two subsections, pronouns and quantifiers other than existentials can make use of this abstract height system, and we cannot account for their behavior using specificity or definiteness. Second, specificity can actually be modeled under some accounts (see Schwarzschild 2002) as domain narrowing to a singleton set, so having specific indefinites in the lower plane is predicted by our account under that view, where it would simply be a special case of extreme domain narrowing (Jeremy Kuhn, p.c.). Example (9) contains a specific indefinite, and is signed low in space, which can be modeled as a domain size of one. Third, when an existential has a clearly non-specific interpretation, but still a highly restricted domain, in ASL it is signed in a locus a in the low plane, not high (10).

(9) Context: Signer is discussing her friend getting a nanny for her children.
IX, FOUND SOMEONE_{a(LOW)}. IX, WONDERFUL.
‘I found someone, she is wonderful.’

(10) TEAM, NEED VOLUNTEER SOMEONE_{a(LOW)}
‘We need a volunteer (anyone) from the team’.

There is much to say about domain widening and existentials, and we cannot address all of it here. However, we note a few important facts to situate the ASL case with respect to previous research on wide domain indefinites in spoken languages. First, (8b) tends toward an “aggressively indiscriminate” free choice interpretation (Horn 2000), most easily translated with English “someone, anyone!” Second, there does not seem to be any negative polarity behavior associated with SOMEONE signed in the high plane (see Chierchia 2013 for an account of why negative polarity and domain widening frequently occur together).

2.3. Height and Plurals

We next turn back to a somewhat more simple use of height for marking set size in ASL: plural pronouns (IX-arc), which we saw earlier in our introduction. The semantics of the indexical point is still not understood (it is seen sometimes as a definite article, deictic, or pronoun), but we will adopt a very conservative analysis in which IX-arc is simply a plural pronoun that delimits sets (as we saw above), but like quantifiers can make use of vertical height to implicitly signal the size of these sets.

Consider (11). The context for this dialogue is the following: the signer is traveling with his family, and it becomes a late night on the road so he hastily finds a place for them to spend the night. When they awake in the morning, they realize they are staying at a nudist colony, although
the signer and his family are not practicing nudists. As we saw earlier in (6), we see here in (11) that when the context supplies a natural domain (here, the people in a nudist colony), this context set is automatically established in the lower signing space (11a). When the same IX-arc is signed higher in the continued discourse in (11b) with IX-arc or a series of IX-points oriented upwards in high sign space, it applies to people including those outside of the context, seemingly the entire universe. Crucially, a property ascribed to this high set (such as wearing clothes) should apply to nearly everyone except the sets that have already been mentioned (the nudist colony), which is why nudity works well in the example.

(11)  
\textbf{Context: At or discussing a nudist colony}  
\textbf{a. IX-arc}_{\text{LOW/MID}} \text{ NOT WEAR CLOTHES.}  
\text{‘The people at this nudist colony don’t wear clothes.’}  
\textbf{b. IX-arc}_{\text{HIGH}} \text{ WEAR CLOTHES}  
\text{‘They all/People generally wear clothes.’}

There are variations on both signs. In Figure 5a, the signer chose a level somewhere above the very lowest plane, possibly to indicate that the nudist colony is somewhat large and seems like it’s taking up much of the context. However, it clearly contrasts with the high level in 5b, which is interpreted as a much wider set (basically, everyone) compared to the sign in 5a. Other researchers report signers not varying in the level at which they sign IX-arc, but instead having eye gaze directed further upwards for a sentence like (11b) than for (11a). This suggests, first, that there may be variation among signers, but also that this grammatical use of height can perhaps be expressed through a variety of methods, beyond the manual sign for a pronoun or quantifier. Finally, in Fig. 5b this signer used a scattered series of high IX-points instead of an arc, and we leave it to future research to determine the nature (if any) of this difference.

It is also an open question how many exceptions a high plural permits. Clearly it does not seem to be interpreted as a universal, since the nudists are a clear counterexample to a universal in (11). In some cases it may be best to analyze IX-arc as a plural pronoun (“they”), while in others as a definite determiner forcing a “maximal” interpretation on the set (“the people”), and both would be consistent with previous analyses of IX in ASL. It’s also possible that the most natural analysis of the highest signing is as a generic, but we will leave this and other detailed semantics of IX-arc for future research. In closing, however, we note that in all of the examples in section 2.3, IX-arc can be replaced by the fingerspelled sign A-L-L tracing the same arc, and the
interpretation is more strongly universal (e.g. (11b)“everyone wears clothes!”) as we would expect if A-L-L is a universal quantifier like the English word it is clearly related to.

2.4. Height and Negative Quantifiers

The third use of vertical height indicating set size that we focus on in this paper involves the negative quantifier, NONE. Consider (12), where a signer is asked if anyone else in her family is deaf. The same string of manual signs NONE ONLY-ONE can have two interpretations, depending on how high NONE is signed: in low space the signer conveys that no one in her family (e.g. mother, father, brother, sister, cousins) is deaf, while by signing it higher she conveys that not even her ancestors, distant relations, etc. are deaf.

(12)  
Context: Signer is asked if anyone in her family is deaf beside herself. She replies:

a. \text{NONE}_{\text{low}} \text{ONLY-ONE}_1.
   ‘None, only me.’

b. \text{NONE}_{\text{high}} \text{ONLY-ONE}_1.
   ‘None at all, only me (not even, e.g. ancestors, distant relations).’

Figure 6.  
\begin{center}
\begin{tabular}{cc}
\text{a. NONE\text{\textsubscript{LOW}}} & \text{b. NONE\text{\textsubscript{HIGH}}}
\end{tabular}
\end{center}

In section 3 will we present our proposal for the use of domain height as marking quantifier height, and indicate why we think it is more than just the emphasis that sometimes accompanies quantifiers in English (regular “No-one” vs. emphatic “NO-ONE!”).

Before moving on, we note that the use of height to indicate domain size seems to be available to quantificational expressions (section 2.2 and 2.4) and can be referenced by pronouns/deictics (section 2.3), but it cannot be used in the same way with bare noun phrases, which are otherwise very common in ASL. For example, in (13a) the production of the sign DOG high in space might imply that a dog was in a high position (e.g. on a roof, under a purely iconic interpretation), but it will not select a dog from an especially wide set of dogs, or indicate willingness to accept a particularly unusual dog. For that, one must sign DOG followed by the sign SOMEONE seen in section 2.2 (here, glossed as SOMETHING)(13b).
(13) Context: Talking about adopting a pet.
   a. IX₁ WANT DOG<HIGH.
      ‘I want a dog (any kind of dog).’
   b. IX₁ WANT DOG SOMETHING<HIGH.
      ‘I want a dog (any kind of dog).’

3. Height as domain widening

Now that we have seen multiple ways that ASL can make use of sign height to signal set sizes, in this section we present our proposal for the meaning of sign height and for the structure of noun phrases that make use of this height, which we follow with further arguments supporting this proposal.

3.1. Proposal

Our proposal for the syntactic/semantic contribution of high and low loci in ASL is the following. First, we suggest that there exists an ordering of loci according to vertical height: Let $H_n$ be loci in signing space, and $<$, a “vertical” ordering relation among loci: for any $H_j$ and $H_k$, if $H_k$ is physically higher in signing space in the vertical plane (toward to the signer’s head) than $H_j$, then $H_j < v H_k$. In our transcriptions in the examples in this paper, we have been using “HIGH”, “MID” and LOW” to stand for three heights $H$ where $H_{LOW} < H_{MID} < H_{HIGH}$. The ordering corresponds to the subset relation (14).

\[
\begin{align*}
&H_j \\
&H_k
\end{align*}
\]

Figure 7.

(14) Let $S \subset U$ be a set signed in locus $H_j$, and $S' \subset U$ be a set signed in locus $H_k$. If $H_j < v H_k$, then $S \subset S'$.

How is this condition on loci heights and sets related to the compositional structure of the noun phrase? As we briefly mentioned in our introduction, the problem of how or whether to incorporate quantifier domains into the structure of a quantified noun phrase has been the focus of a large body of research in both linguistics and philosophy. In our limited space, we will present a few options for ASL. First, recall from section 2.1 that when a quantifier is signed in a locus that has been assigned to a plural, the interpretation is that the plural set serves as the domain for the quantifier (see (7), repeated below).

(7) MY STUDENT IX-arca SMART. NONEₐ/ONEₐ/A-L-Lₐ SKIP CLASS.
   ‘My students, they are smart. None/one/all of them skip(s) class.’
We might be inclined to say that the quantifier and the domain combine analogously to the partitive construction that we use in the translation. Under this view, signing a quantifier (e.g., NONE) in a plural locus \( a \) is interpreted as “None of the set that is in \( a \)” or here, “None of my students”. Within the generalized quantifier framework (Barwise & Cooper 1981), a quantifier like NONE is of type \( <<e,t>,<e,t>,t>> \), and so should combine with a predicate of type \( <e,t> \), to create a generalized quantifier of type \( <<e,t>,t> \). If the set associated with the locus is the predicate that comes with NONE to form a generalized quantifier, then we might expect that references back to a plural locus should be able to be interpreted as a predicate, which we consider in (15). First, we see in (15a) that signing a name BOB in a location \( a \) associated with the plural set “my students” is only marginally grammatical as a stand-alone sentence (without much context, signers feel that the sentence is incomplete). However, it improves if Bob is contrasted with another person, John (15b). The best way to signal that Bob is a member of the set is to sign his name and use the indexical point in the location of the plural locus (15c). In general, predicates can occur with bare nouns and no copulas to form clauses, so the marginality of (15a) is not due to a general problem of signing names in locations or a lack of copula (15d).

(15) Context: Signer and interlocutor are discussing Bob’s intelligence. The interlocutor doesn’t realize that Bob is actually a student in the signer’s class.
   a. ??MY STUDENT IX-arc\textsubscript{a} SMART. BOB\textsubscript{a}.
      ‘My students, they are smart. Bob is one of them.’
   b. MY STUDENT IX-arc\textsubscript{a} SMART. BOB\textsubscript{a} JOHN\textsubscript{b}.
      ‘My students, they are smart. Bob is one of them. John is not’
   c. MY STUDENT IX-arc\textsubscript{a} SMART. BOB IX\textsubscript{c}.
      ‘My students, they are smart. Bob is one of them.’
   d. MY STUDENT IX-arc\textsubscript{a} SMART. BOB\textsubscript{a} FINE.
      ‘My students, they are smart. Bob (who is not one of them) is just alright/fine.’

As we mentioned earlier, there is debate about the function of IX as a definite determiner or as a deictic (see MacLaughlin 1997 for arguments that (only) a pre-nominal IX conveys definiteness). While a complete discussion of definiteness in ASL is outside of the scope of this paper, we note that IX clearly also has some deictic properties, since it is in fact a point of the index finger to a location in space! As such, we note a similarity with quantified noun phrases in St’a’t’imcets, for which Matthewson (2001) argues that every quantifier must take as its first argument a noun phrase that has combined with a deictic determiner, allowing the (gloss-only) schema in (16a) but not the English-type structure in (16b).

(16) Schema of structures in St’a’t’imcets:
   a. [DP [Q every][D [the/that][N girl]]] [VP laughs]
   b. *[DP [D every][N girl]] [VP laughs]

There has been debate about whether the surface structure in St’a’t’imcets reflects the underlying structure, or whether it should be better analyzed as having an intermediate type-shifting operation in which the DP (“the girl”) is turned into a predicate before combining with the
quantifier (Etxeberria and Giannakidou to appear), and more work will need to be done on ASL to determine how the ASL noun phrase contributes to this debate. We anticipate that this may be complicated: sets associated with loci were only marginal when used as predicates (15), but it’s possible that the quantifier must be present to trigger the type shifting operation. Importantly, there is one major difference between ASL and St’a’imcets when it comes to quantified noun phrases: in ASL, the quantifier can easily combine with a bare noun when loci are not involved, as in (17).

(17)  ALL/ONE/NONE GIRL LIKE MATH.
‘All/one/no girl(s) like(s) math.’

We take from this discussion the possibility that in ASL, a set established in a plural locus can (and maybe must) be interpreted as a complete determiner phrase, and that quantifiers can be co-located with these loci. When the quantifier is located at a plural locus, it is interpreted as if the referent of the DP serves as the domain for the quantifier. How this should best be modeled at LF, and how closely it follows other languages, is a topic for future investigation.

As a very first pass at a proposed structure, let us consider the IX-arc plural pronoun in section 2.3 and example (11), repeated below. These may act as simple pronouns (Figure 8a-b).

(11)  Context: At or discussing a nudist colony
a. IX-arc_LOW/MID NOT WEAR CLOTHES.
   ‘The people at this nudist colony don’t wear clothes.’
   b. IX-arc_HIGH WEAR CLOTHES
   ‘They all/People generally wear clothes.’

Figure 8.  a. Proposed structure(s) for (11a)  b. Proposed structure(s) for (11b)

Since IX-arc in (11a) is produced low, it simply refers to the maximal plural individual in the set made salient by the default context. Whenever IX-arc is produced higher, however, it refers to the maximal plural individual of a set that must be a superset of the default context. In (11b), it is produced quite a bit higher, and so the set that the plural is created from should be a superset that in (11a) with also many intervening levels, pragmatically providing a very wide set.

Let’s also consider a quantificational noun phrase. For (12), repeated from earlier, we propose the structure(s) in Figure 9.
Context: Signer is asked if anyone in her family is deaf beside herself. She replies:

\(a\). \text{NONE}_{\text{low}} [\text{DEAF}]. \text{ONLY-ONE}_1.

‘None [are deaf], only me.’

\(b\). \text{NONE}_{\text{high}} [\text{DEAF}]. \text{ONLY-ONE}_1.

‘None at all [are deaf], only me (not even, e.g. ancestors, distant relations).’

In parentheses we provide optional structure, which we hope to investigate further. Without this structure, we could use a compositional semantics involving choice functions along the lines suggested by Matthewson (2001). If there is an intervening type shift, then the usual semantics for generalized quantifiers can be used, but of course the domain is still provided through the locus in the DP complement. In Fig. 9, the high locus must be a superset of any other set (including the default context set, which is signed in low space), which results in a widened domain for \text{NONE}. Our indefinite example (8) and other quantifiers (including the universal we briefly mentioned in section 2.3) can all participate in the implicit marking of domain sizes in the same way as \text{NONE}. Of course, this kind of analysis assumes that the spell-out process involves spatial combination (e.g. of \text{NONE} with the locus), in addition to linearizing all of the elements, an assumption that probably deserves much more discussion than we can provide here.

3.2. Multi-leveled domain restriction

We have stressed the way that high quantifiers in ASL can use height to overtly convey information about their domains, but there are also some lexical items in spoken languages, like English "any", that appear to overtly signal information about domain size as well (especially a wide domain)(Kadmon and Landman 1993). What we find especially interesting about ASL, that does not seem to be true for English “any,” is that the vertical use of space can express intermediate domain sizes by intermediate placement of the quantifier between low and high planes. Such intermediate levels motivated our multi-level vortex structure presented in Figure 7. Example (18) illustrates this phenomenon using the same family-visits-nudist colony setup that we saw in (11), but now with three hierarchically related sets.
(18) *Context: Signer is discussing a family visit to a nudist colony. [Her family is a subset of people at the nudist colony, who are in turn a subset of people in the world.] She remarks:

a. POSS-1 FAMILY IX-ARC\textsubscript{LOW} WEAR CLOTHES.
   ‘My family, they all wear clothes.’

b. IX-ARC\textsubscript{MID} NOT WEAR CLOTHES.
   ‘They all (at the nudist colony) don’t wear clothes.’

c. IX-ARC\textsubscript{HIGH} WEAR CLOTHES.
   ‘They all (people generally) wear clothes.’

Figure 10. a. IX-arc\textsubscript{LOW} b. IX-arc\textsubscript{MID} c. IX-arc\textsubscript{HIGH}

The number of levels that can be expressed seems to be limited only by the perceptual system; it’s possible to sign a very restricted set (‘our class’) in the lowest space, with successive heights used for the department, the university, the state, the country, and the world. Eye gaze and manual signs usually track together, but given our earlier discussion about the possible ways that the heights can be expressed (potentially only with eye gaze), we expect the same to hold true at multiple levels.

3.3. More than emphasis

While lexical items like *any* in English are seemingly limited to a binary distinction when it comes to signal domain widening (wide v. default), intonational contours in spoken languages could potentially provide the multi-leveled distinction that height does in ASL. Consider the “high” examples from section 2, but now in English with emphasis (19) (note that here the capitalized words are emphatic English words, not ASL signs).

   You need to find SOMEONE, (ANYONE)!

b. *Context: contrasting with a nudist colony*
   EVERYONE/*THEY* wear(s) clothes!

c. *Context: Is anyone in your family deaf?*
   No, NO-ONE is!
The response in (19a) with emphasis (where here we take emphasis to perhaps be focus, and to have increased volume and an exaggerated intonational contour) is felicitous, especially with the indiscriminate “someone, anyone” phrase. However, it’s not clear that this can be signaled at intermediate levels: in (20), the context is a mother talking to a friend and mentions she is looking for a babysitter, but has been having difficulty finding one. The friend can use intonation to express (20a) and (20c), but it’s not clear that (20b) can be distinguished from these using merely different intonation, although it can be expressed with different heights in ASL.

(20) *Capitalization is emphasis, and bold capitalization is extremely emphatic:*

a. There has to be someone available. (The mother hasn’t quite exhausted her list yet)
b. *There has to be SOMEONE available. (There are some other qualified people)*
c. There has to be SOMEONE available. (Regardless of qualification)

Proceeding to (19b), it’s interesting that the translation of the IX-arc here doesn’t work as a stressed 3rd person plural pronoun, which we might expect based on the morphology of IX-arc in ASL. Nevertheless, we can express a widened domain by emphasizing the quantifier EVERYONE, and it might even be possible to contrast two levels of widened domains (21).

(21) a. EVERYONE wears clothes, and EVERYONE has DNA.

If we try the same for the negative quantifier, we can also use emphasis felicitiously, and we might even be able to emphasize it more and more as the possibilities mentioned become increasingly unlikely. For example, in (22) perhaps no one in the speaker’s family is deaf (NO-ONE is Deaf), and even if maybe there is one possible person who is slightly hard-of-hearing they certainly don’t know ASL (NO-ONE knows ASL), and even if possibly, maybe, somebody knew a sign or two they certainly couldn’t interpret (NO-ONE can interpret).

(22) a. NO-ONE is Deaf, and NO-ONE knows ASL, and NO-ONE can interpret.

At this basic level we agree that emphasis can serve to widen domains in English: Rohrbaugh (1997) even suggests that focus is a more reliable marker of domain widening than a lexical item like "any." We also think that signing large sets higher in space in ASL is emphatic. The signer is going outside of the default sign space, which conveys some sort of markedness in ASL. However, we do not conclude from the use of emphasis for domain widening in English, and the emphatic nature of high signs in ASL, that signing quantifiers higher in space is just emphasis. One reason is that the use of vertical space in this way is systematic in ASL—a sign produced higher in space always selects from a larger set, and a sign produced lower in space always makes reference to a smaller set – potentially even a singleton set. In contrast, intonational contours in English do not have this systematicity. For example:

(23) a. *Context: A friend advising a mother on babysitting:*

SOMEONE must be available!

b. *Context: A mother looking at her child suspiciously:*

SOMEONE stole the cookie!
In the English sentences in (23a) and (23b), SOMEONE is emphasized in both, but the domain for (23a) is especially wide, while the domain for (23b) is especially narrow: the mother clearly knows that it is the child. The intonational contour may or may not be different, and if it is different, it’s possible that there is an intonational contour in English that does correspond to the use of height in ASL for domain widening. However, it can’t be just focus/emphasis, since (23b) is clearly marked and emphatic, and does not express a wide domain for the existential quantifier.

3.4. Binding

There is a further piece of data concerning the linguistic status of the use of height in ASL, and its conventionalized use beyond simply “emphasis” as part of an overtly marked set size. Consider the case where a quantifier is embedded under an adverb of quantification as in (24). In a context in which an interlocutor is wondering whether someone at his next party will want mustard, the host can discuss his prediction based on previous parties using the adverb TYPICALLY (signed with an “open 8” handshape moving from the signer’s heart outwards). If he signs SOMEONE\textsubscript{LOW}, the interpretation is that for most typical parties, there exists someone at that party who likes mustard, although it doesn’t have to be the same person from party to party (24a). If, on the other hand, the host signs SOMEONE\textsubscript{HIGH}, the interpretation of the sentence is that for most typical parties, there exists someone out there in the world who likes mustard (24b). This data suggests to us that, first, the use of height to signal domains is not merely deictic, since the restricted domain in (24a) varies with the values of contexts that the adverb ranges over, and second, it seems to be different than intonation in English, where it is difficult, if not impossible, to get the reading in (24b) just by emphasizing “someone”.

(24)  Context: A host throws many parties. In preparing for the upcoming party, a helper asks for advice on what condiments to put out on the table. The host replies:

a. TYPICALLY SOMEONE\textsubscript{LOW} LIKE MUSTARD.
   ‘Usually at the parties, someone likes mustard.’ (maybe a different person each party)

b. TYPICALLY SOMEONE\textsubscript{HIGH} LIKE MUSTARD.
   ‘Usually someone in the world likes mustard.’ (obviously true)

We note that another possible interpretation of (24b) is that the host is very unsure who it is at each party who likes mustard. This interpretation is something like: “Typically, there is someone, I have no idea who, that likes the mustard.” Perhaps not surprisingly given cross-linguistic similarities between unknown indefinites and free choice, the large set size in high space in ASL seems to be able to convey something about the epistemic status of the indefinite, in addition to the size of the domain for various quantifiers.

3.5. Multiple vortices

Finally, in addition to multiple sets stacked upon each other in a single vortex, we have also found that ASL signers can access two different sets of sets. In (25), the signer divides the signing space into a left and right side to correspond to two opposing sides in a war, and accesses
a separate vortex on each side to represent set sizes. A specific general is located on the left side that corresponds to his "side" (allies, etc.) in the war, while his assassin is located on the right side that is associated with the forces opposing the general.

Example (25) is also an example of using the large set size in high space to signal the epistemic status of the indefinite: while the assassin may be specific, he’s very clearly unknown.

4. Other uses of height in ASL and the metaphor of height and set size

So far, we have focused on the specific use of vertical sign height to signal set size in ASL, but we do not want to give the impression that this is the only use of height in ASL. As a natural sign language, ASL uses space in several ways, some more “iconically” than others (where here, we take “iconic” to be either transparent in meaning or motivated in form). Schlenker et al. (2013) discuss two other uses of vertical height in ASL (and French Sign Language, or LSF), both iconic but to different degrees: a signer can direct the indexical point IX towards the upper sign space if the referent is physically high by virtue of being tall; he can also use high sign space if the referent holds a higher social status than the signer or has a place of relative importance to the signer, such as a mother for a child, a doctor for a patient, or a judge for a defendant. Both literal height (how tall one is) and relative social stature (a more abstract, but still motivated use of height) appear to have some of the same presuppositional properties as gender features (Schlenker et al. 2013). Note that (25) cannot be an example of this use of height, as the general has a position of high social status, but is place low in signing space.

Of course, vertical height can come into play in a purely iconic sense as well: IX may be directed upwards if the referent is in a high location, such as at the top of a stairwell or the attic of a house, and high space can be use to locate north when discussing a map, or ancestors when discussing a family tree. We raise this last example of the family tree because it is the only example we have come across in which a smaller set is placed high (the matriarch and patriarch of many generations of a larger family, for example), and a larger set lower (all of the great-great-grandchildren), with middle-sized sets at intermediate levels (great-grandchildren, etc.). Of course, the use of height in such an example is clearly motivated by our usual illustrations of these kind of familial relations in family trees, and is distinct from the more abstract use of height to mark set size.
In this paper, we have emphasized the abstract and grammatical nature of the use of sign height to convey set size in ASL, but this is quite consistent with it having a gestural origin that may have motivated the current form. One indication that this might be the case is that English makes ample use of height as a metaphor for set size, even in the case of “upward” and “downward” entailments (Larry Horn, p.c.), which is just one particular case of describing sets as going “up in size” when they gain members and “down in size” when they lose members, which in turn links (at least finite) cardinalities with a vertically oriented number line (“high” numbers are used for greater numerosities).

5. Conclusions

In this paper we have discussed a previously undescribed phenomenon of using vertical sign height in ASL to convey something about the size of a set. We have argued that ASL can make use of an overt signal of signing a quantifier increasingly higher to indicate increasingly larger domains, and that this can be signaled at not just binary, but intermediate levels that seem to be limited only by the number of different heights that we can perceptually distinguish. Our account has advantages over previous accounts of the semantics of sign height for ASL (MacLaughlin 1997) by modeling the use of height for multiple quantifiers (although it appears that Catalan SL differs from ASL in this regard for strong quantifiers, see Barberà 2012), and in accounting for the use of non-specific indefinites that are signed low when their domains are restricted.

We have also argued that while this use of sign height may be emphatic, it is not reducible to focus or “emphasis.” We expect that the abstract and grammaticalized use of this kind of set size marking is made easier by the visual language mode, although we left open that there may be a use of intonational contours in spoken languages that can do the same. Finally, we situated this use of sign height among other uses of height in ASL and speculated on its origins and the similar metaphor we find in English. We hope that our account has contributed toward a better understanding of quantification in ASL, an area clearly ripe for further investigation.

Finally, as noticed by Partee (1989) and subsequently discussed by many other researchers, the problem of domain restriction extends beyond quantification over individuals to implicit domain restriction of times, situations, etc. Here we have focused on quantification over individuals, but leave open the possibility that this use of height may be used for other types of quantification.

Acknowledgments

We warmly thank everyone who was willing to be filmed for this project, as well as the SLRDG at UConn, Urtzi Etxeberria, Larry Horn, and Jeremy Kuhn for helpful discussion. DG was supported by the National Science Foundation Graduate Research Fellowship under Grant No. DGE-1247393 NSF IGERT Grant 1144399 to the University of Connecticut. Any opinion, findings, and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the National Science Foundation.
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Explaining leftward focus association with \textit{even} but not \textit{only}\textsuperscript{*}

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\textbf{Abstract.} The ability of English VP-\textit{even} but not VP-\textit{only} to associate with a leftward subject (Jackendoff, 1972) has been a long-standing puzzle for the theory of focus association, and runs counter to the generalization that focus-sensitive operators associate with a focused constituent in their scope. Here I argue that such backwards association is illusory. In cases of apparent leftward subject association, \textit{even} is associating with the subject’s predicate-internal lower copy of movement, which is within the scope of \textit{even}. The same configuration with \textit{only} yields an uninterpretable structure, due to independent differences in the semantic contribution of \textit{even} and \textit{only}. I then show that this pattern of association extends to other cases of movement as well: in general, \textit{even} but not \textit{only} is able to associate with material which has moved out of the operator’s scope. Patterns of leftward focus association present a new argument against the scope theory of \textit{even}.

\textbf{Keywords:} Association with Focus, subject association, Copy Theory of movement, \textit{only}, \textit{even} (scale reversal, lexical ambiguity theory, scope theory)

\section{1. Introduction}

Operators such as \textit{only} and \textit{even} are called \textit{focus-sensitive} as the semantic contribution that they make is dependent upon a focused \textit{associate} constituent in the structure. An important goal for the study of such focus-sensitive expressions has been to provide a compositional semantics for the effect of focus. The widely-adopted proposal in Rooth (1985, 1992) has the effect of limiting association to be with material in the operator’s arguments; in particular, in the case of in-situ focus association, the associate must be in the operator’s scope. An important apparent counterexample to this generalization is observed by Jackendoff (1972):

\begin{enumerate}
  \item \textbf{VP-even can associate with leftward subject, but not VP-only:}\textsuperscript{1}
    \begin{enumerate}
      \item A [professor]\textsubscript{F} is \textit{even} at the party.
      \item * A [professor]\textsubscript{F} is \textit{only} at the party.
    \end{enumerate}
\end{enumerate}

I propose that \textit{even} in such cases is actually associating with the subject’s predicate-internal \textit{lower copy of movement}, within the scope of \textit{even}. I adopt the Copy Theory of movement and assume that the “trace” position includes an unpronounced copy of the moved material. There is therefore

\footnote{1}{Here I adopt the common labels “VP-\textit{only}” and “VP-\textit{even}” descriptively. I will assume in derivations later that these operators adjoin to \textit{vP}, a projection with propositional type.}

\footnote{I thank Irene Heim, David Pesetsky, Maziar Toosarvandani, Hadas Kotek, Martin Hackl, Sabine Iatridou, Kai von Fintel, Danny Fox, Noam Chomsky, Chris Tancredi, Rick Nouwen, Isaac Gould, and audiences at Sinn und Bedeutung 18, the GLOW 35 workshop on Association with Focus, the 2014 meeting of the Linguistic Society of America, and MIT for helpful discussion. Errors are mine.}
an instance of the focus-marked constituent “professor” within the scope of even, even though it is part of the copy of the subject which is unpronounced. Even in (1a’) is associating with this material in the lower copy of movement.

(1a’)  
\[ \text{A [professor]}_F \text{ is even} \ [\text{a [professor]}_F \text{ at the party}]. \]

The same configuration (1b’) with only yields an uninterpretable structure, due to independent differences in the semantic contributions of even and only. The crucial difference will be that even’s semantic contribution is a projective inference that does not modify the assertion, whereas only’s semantic contribution modifies the assertion.

(1b’)  
\[ \text{A [professor]}_F \text{ is only} \ [\text{a [professor]}_F \text{ at the party}]. \]

This proposal provides a principled solution to the puzzle of leftward subject association with even but not only (1), while preserving the generalization that focus-sensitive operators associate with material in their scope.\(^2\)

I begin in the next section by reviewing the compositional semantics for focus pioneered by Rooth (1985, 1992) and discussing the subject association puzzle in more detail in section 3. I then present my proposal in section 4. This leads to a new argument for the lexical ambiguity theory of the scale-reversal of even in downward-entailing contexts, and against the scope theory of even, which I present in section 5.

Finally, in section 6, I show that this same logic extends to other movement configurations as well. Even but not only is able to associate with certain kinds of material which has moved out of the operator’s scope, as schematized in (2). This difference can be seen in simple minimal pairs such as the topicalization examples in (3). Previous work on association in this configuration has focused primarily on the behavior of only, and therefore incorrectly concluded that such association is in general not possible (Tancredi, 1990; Aoun and Li, 1993; Beaver and Clark, 2008).

(2)  
\[ \text{Even can associate with material moved out of its scope, but not only:} \]
\[ \alpha_F \ldots [\text{only/}^\prime \text{even} \ldots] \]
\[ (\text{with } \alpha \text{ interpreted as the associate of the operator}) \]

(3)  
\a.  
\[ \text{[Mary]}_F, \text{John even saw } \_\_\_ \text{ at the party}. \]
\b.  
\[ \text{[Mary]}_F, \text{John only saw } \_\_\_ \text{ at the party}. \]

\(^2\)See Krifka (1998) for discussion of related facts regarding also. As Krifka notes there, additive particles are able to associate with the (contrastive) topic of a sentence, in lieu of a focus in their scope. As the mechanisms and basic distribution of association are quite different with additive particles in this way, they will not be discussed here.
2. Background: the semantics of focus

In this section I present a brief introduction to the compositional semantics of focus. I follow Jackendoff (1972) and much subsequent work in modeling the effects of focus by the addition of a formal “F” feature to focused constituents in the narrow syntax. This abstract F-marking can be thought of as a syntactic annotation which mediates between the observed prosodic realization and its semantic consequences.

The semantic effect of focus is to introduce alternatives to the focused constituent into the semantic computation. F-marking of “Bill” in example (4) below thus conjures up other potential alternatives to Bill, based on the current discourse context. Each of these local alternatives then corresponds to alternative propositions, as shown in (4). The meaning of the proposition without the contribution of focus-sensitive operators is called the prejacent.

(4) John met [Bill]F.
   Prejacent proposition: John met Bill
   Focused constituent: Bill
   Alternatives to “Bill”: Mary, Sue...
   Alternative propositions: John met Mary, John met Sue...

Different focus-sensitive operators then quantify over these alternatives in different ways. Horn (1969) analyzes only as presupposing the prejacent proposition and asserting the negation of each other alternative, as exemplified in (5). In contrast, even projects a non-assertive inference that the prejacent proposition is unlikely compared to its alternatives, and asserts its prejacent, as illustrated in (6).3,4

(5) John only met [Bill]F.
   Presupposition: John met Bill.
   Assertion: ¬ (John met Mary) ∧ ¬ (John met Sue) ∧...

(6) John even met [Bill]F.
   ~ inference: ((John met Bill) <shg> (John met Mary)) ∧
               ((John met Bill) <shg> (John met Sue)) ∧...
   Assertion: John met Bill.

The fact that even does not affect the assertive component of an utterance’s meaning—in contrast to only which uses focus alternatives to construct its assertion—will play a crucial role in explaining the difference between even and only later.

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3In this section I take the entire proposition, including its proper name subject, to be within the scope of the focus-sensitive operators VP-only and VP-even. This is for demonstration purposes only. The status of subjects will be discussed in detail in the following section.

4The status of the scalar inference of even has been debated, often described in previous literature as an implicature or a presupposition. Here I will adopt the neutral term “inference” and use the arrow ~-> to indicate this.
Here I adopt *Alternative Semantics*, a common approach to focus semantics put forward by Rooth (1985, 1992). In this approach, focused constituents are interpreted in-situ at LF via a process of *alternative computation*. Just as every syntactic node has an ordinary semantic value, we can similarly compute a node’s *focus semantic value*, which is a set of alternative denotations for the node which we can derive by swapping out any F-marked constituents with their contextually-determined alternatives. Here I represent the focus semantic value of node α as Alternatives(α). This set of alternatives will always include the prejacent, which I will identify with a box.

\[
\text{Alternatives}(vP) = \begin{cases} 
\text{John saw Bill} \\
\text{John saw Mary,}\n\text{John saw Sue}\n\end{cases}
\]

(Box marks prejacent)

A clause-adjoined focus-sensitive operator considers the focus-alternatives of the complement of the operator, thus F-marked constituents outside of that operator’s scope naturally would not contribute to the evaluation of the operator. This principle seems true given the potential F-markings which can be associated with a VP-*only*:

\[
\begin{align*}
\text{(8)} \quad \textbf{VP-only must c-command its associate:} & \quad \text{(Jackendoff, 1972, pp. 248–250)} \\
\text{a.} & \quad \ast [\text{John}]_F \text{ only gave his daughter a new bicycle.} \\
\text{b.} & \quad \text{John only } [\text{gave}]_F \text{ his daughter a new bicycle.} \\
\text{c.} & \quad \text{John only gave } [\text{his}]_F \text{ daughter a new bicycle.} \\
\text{d.} & \quad \text{John only gave his } [\text{daughter}]_F \text{ a new bicycle.} \\
\text{e.} & \quad \text{John only gave his daughter a } [\text{new}]_F \text{ bicycle.} \\
\text{f.} & \quad \text{John only gave his daughter a new } [\text{bicycle}]_F. \\
\end{align*}
\]

However, as Jackendoff (1972) notes, these facts are slightly different with VP-*even*, in that *even* is able to associate leftward with a subject as in case (a). We now consider the puzzle of leftward subject association in detail.

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5See Rooth (1985, 1992) for a formal definition of the focus semantic value denotation function. The model of Alternative Semantics sketched here differs from Rooth’s in that it eschews the ~ focus interpretation operator. Here we are only looking at vp-level focus-sensitive operators, where we may take Rooth’s ~ focus interpretation operator to have adjoined unambiguously to the complement of the focus-sensitive operator.
3. The subject association puzzle

We now consider in detail the ability of English VP-*even* but not VP-*only* to associate with a leftward subject. Jackendoff (1972) originally observed this contrast with the examples in (9). An auxiliary is added in (10) to show that the *even* in question is indeed a VP-*even* and not simply a post-nominal constituent *even*.

(9) **VP-*even* but not VP-*only* can associate with a leftward subject:**

a. * [John]*[^1] *only* gave his daughter a new bicycle. (Jackendoff, 1972, p.250)

b. ✓ [John]*[^2] *even* gave his daughter a new bicycle. (*Ibid*, p.248)

(10) ✓ [John]*[^3] *will even* give his daughter a new bicycle.

Given the compositional semantics for focus introduced in the previous section, the ability of VP-*even* to associate with material outside of its c-command domain as in (9b,10) is surprising. Assuming that vP-adjoining focus operators compute their semantic contribution using the alternatives in their complement, only the choice of F-marking *within* the operator’s complement should contribute to the operator’s semantics.

I propose that *even* in such cases is associating with the subject’s predicate-internal *lower copy of movement*, assuming the vP-internal subject hypothesis. This proposal will be presented in detail in the following section. The importance of the movement chain and its “trace” position for this pattern of association is demonstrated through the following contrast between subjects of raising and control verbs:

(11) **Subject association across raising vs control:**

a. ✓ [professor]*[^4] *seems to even [___ be at the party].

b. * [professor]*[^5] *wants to even [PRO be at the party].

In (11a) the DP containing F-marking, “a professor”, has raised out of the nonfinite embedding, where it originally was below the surface position of *even*. In (11b) “a professor” is base-generated in the matrix subject position as the embedding verb is a control verb, “want”. The ability of *even* to associate with a leftward subject, then, depends on the intended focus associate originating within the scope of *even*.
Having established that the focus associate originating within the scope of *even* is crucial for this pattern of association, we might imagine that *even* associates with a leftward subject by forcing the subject to reconstruct. That is, even though the associate of *even* is not c-commanded by *even* at PF, the relevant DP is interpreted under reconstruction within the scope of *even* at LF.6

\[ (12) \] **One possible approach: reconstruction**

a. PF: \[ \left. \begin{array}{l} \text{DP} \ldots \alpha F \ldots \right\} \ldots \left[ \text{even} \ [ \ldots \leq \ldots ] \right]\right] \\

b. LF: \[ \left[ \text{even} \ [ \leq \text{DP} \ldots \alpha F \ldots ] \leq \ldots \right]\]

However, I argue that this reconstruction approach is untenable. Consider the sentence in (13). Here we are able to interpret this sentence with *even* associating with the predicate “student” in the leftward subject. Crucially, (13) is compatible both with surface scope and inverse scope between the universal subject and negation. The two scopes in (13) show that the possibility of *even* associating with “student” in the subject is independent of the scope of the quantificational subject, and therefore that the association of *even* with material in the leftward subject does not force reconstruction of the subject into its base position.

\[ (13) \] **Subject association with *even* is compatible with different scopes for the subject:**

Every [student]F didn’t *even* come to the party.

a. \( \forall \neg \neg \rightarrow \text{Neg: } \Rightarrow \) No student came.

b. \( \forall \neg \neg \rightarrow \forall \neg \neg \rightarrow \) Not every student came, but some may have.

The reconstruction-based account also suffers from additional complications. For example, negative quantifiers in derived subject positions do not reconstruct in their A-chain (Iatridou and Sichel, 2011, and citations therein). Under the reconstruction view, then, we would predict leftward subject association to be ungrammatical with subjects headed by negative quantifiers, as the subject will be unable to reconstruct into the scope of *even*. However, association in such cases is possible.7

\[ (14) \] ‘No [student]F will *even* come to the party.

Therefore in cases of leftward subject association, *even* must be associating with material in the “trace” position of movement in some way, without forcing reconstruction. In the next section, I present my proposal which uses the Copy Theory of movement and show why this pattern of association is possible with *even* but not only.

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6Such an approach is suggested as a possibility in Kayne (1998, fn. 75).

7See section 5 below for discussion of the interpretation of *even* in downward-entailing contexts such as in (14).
4. Proposal

4.1. Background: the Copy Theory of movement

I will begin by giving some background on the Copy Theory of movement which I adopt. Under the Copy Theory of movement, movement does not replace its target with a new object, a “trace”, but instead simply merges another “copy” of the targeted object elsewhere in the structure (Chomsky, 1993). At PF one copy in each movement chain is chosen for pronunciation: in cases of overt movement, the head of the chain is pronounced while in cases of covert movement, a lower copy is chosen for pronunciation. See Chomsky (1993); Fox (1999); Sauerland (1998) for syntactic arguments for the Copy Theory of movement.

This Copy Theory approach to movement must be reconciled with our understanding of the semantic consequences of movement. Having multiple (coindexed) instances of objects at LF does not compositionally yield the expected truth conditions. Trace positions are crucial in the interpretation of movement, in particular as a variable bound by the predicate abstraction step of movement (Heim and Kratzer, 1998). A solution that has been proposed is to tweak the lower copy at LF in order to interpret these copy-based movement chains. The lower copy is converted into a definite description with the restriction that it be equal to the variable in question through a process of Trace Conversion (Rullmann and Beck, 1998; Fox, 2002).

Consider example (15), which has a quantifier in object position. I assume that the quantificational DP undergoes Quantifier Raising through copying, resulting in a narrow syntax output with a chain of coindexed “every book” DPs. At LF the lower copy of “every book” will undergo Trace Conversion, resulting in the definite description “the book $x$”—formally $\nu y. (y$ is a book and $y = x$).

(15) An example of interpreting copies:

“John read every book.”

a. Quantifier Raising as copying: [every book], John read [every book],

b. LF after Trace Conversion: [every book] $\lambda x$ John read [the book $x$]

With this background on the Copy Theory of movement and the interpretation of copy-chains, we now turn to the cases of apparent leftward subject association, beginning with the grammatical cases with VP-even.

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8I assume that quantifiers (type $\langle e, t \rangle$) in non-subject position must covertly move (Quantifier-Raise) to a position of (extensional) propositional type $t$, in order to resolve a type mismatch. Predicate Abstraction will turn the landing site into the necessary type $\langle e, t \rangle$ expression (see Heim and Kratzer, 1998).
4.2. Even can associate with the lower copy of movement

The core idea of this proposal is that, when a constituent containing F-marking is moved via the Copy Theory, both copies retain their F-marking. In cases where an operator seemingly associates with F-marked material which has moved out of its scope, I propose that the operator is in fact associating with the F-marked predicate in the lower copy of the movement chain, within the operator’s scope. In this section I will demonstrate how this yields a grammatical result when the operator is even.

I will demonstrate this approach using example (16), which is interpreted with even associating with the predicate “professor” in the subject. Because “a professor” was generated in Spec,vP position and then moved to the surface Spec,TP position, there is a lower copy of the subject within the scope of even. After the lower copy undergoes Trace Conversion (TC), we yield the LF representation in (16b). Even associates with the F-marked “professor” in the lower copy.

(16) \( \text{A [professor]} \text{ \text{even} came to the party.} \)
    a. Narrow syntax: \( \text{[A [professor]} \text{ \text{even} [a [professor]} \text{ \text{came to the party}]} \)
    b. LF after TC: \( \text{[A [professor]} \text{ \text{\( \lambda \text{x} \text{even} \text{ [vP \text{the [professor]} \text{ \text{x} came to the party}]} \) came to the party]} \)

The scalar inference introduced by even will be computed based on the ordinary and focus-semantic value of its complement, vP. In a context where the F-marked predicate “professor” contrasts with the predicate “student”, we yield the following alternatives at vP:

(17) Alternatives(vP) = \{ \begin{align*}
& \text{the professor \( \text{x} \) came to the party} \\
& \text{the student \( \text{x} \) came to the party}
\end{align*} \}

We are now ready to evaluate the semantic contribution of even. We note, however, that the propositions in (17) include the free variables \( \text{x} \), because the \( \lambda \)-binder for \( \text{x} \) is not within the scope of even’s evaluation. I propose that these alternative propositions with free variables undergo existential closure. This yields the expected scalar inference of (16), which is satisfied in a context where it is more likely for a student than a professor to come to the party.\(^9\)

(18) Scalar inference of (16):
    \( \leadsto (\exists \text{x}. \text{the professor \( \text{x} \) came to the party}) \prec_{\text{shock}} (\exists \text{x}. \text{the student \( \text{x} \) came to the party}) \)

\(^9\)Here the original quantifier was also existential, but the interpretation of even in such cases with different quantifiers will be discussed in the following section.
As is assumed, the scalar inference of *even* projects without composing with additional material above it. The ordinary semantic value of *vP* will be unchanged by *even* and will continue to compose with material above it, including the higher copy of the quantificational subject “a professor”. This yields the following assertion for the clause:

\[
(19) \quad [(16)] = \exists x. (x \text{ professor } \land (\lambda x. \text{the professor } x \text{ came to the party}) (x)) = \exists x. (x \text{ professor } \land x \text{ came to the party})
\]

Notice that *even* uses the focus-alternatives only for the computation of its projective scalar inference and does not affect the truth-conditions of its assertion at all. The importance of this property of *even* will be made clear when compared to *only*.

4.3. The associate of *only* cannot move out

As noted by Jackendoff (1972), VP-*even* has the ability to associate with F-marking in a leftward subject, but not VP-*only*. In the previous section I proposed that *even* associates with the lower copy of movement in such cases. In this section I show how this same configuration with *only* yields an uninterpretable structure.

I will illustrate this using example (20). As with the previous case with *even*, copying the subject will yield two instances of the F-marked predicate “professor”, with one being in the scope of *only* (20a). Following Trace Conversion, we will have the LF in (20b). In order to evaluate *only*, we compute the ordinary and focus-semantic denotations of the complement of *only*, vP (20c). Here I again assume that the focus-semantic value of the F-marked “professor” is \{professor, student\}.

\[
(20) \quad * \ A [\text{professor}_F] \text{ only came to the party.}
\]

a. Narrow syntax: \[A [\text{professor}_F], \text{only} [a [\text{professor}_F]], \text{came to the party}\]

b. LF after TC: \[A [\text{professor}_F] \lambda x \text{ only } [\text{vP} \ [\text{the professor}_F x \text{ came to the party}] \text{ came to the party}]\]

c. Alternatives(*vP*) = \{the professor \ x \ came to the party, the student \ x \ came to the party\}

Following Horn (1969), the assertion of \[\text{only} \ vP\] is the conjunction of the negations of the non-prejacent alternatives. Here there is only one such alternative, “the student \ x \ came to the party”:

\[
(21) \quad [(\text{only} \ vP)] = \neg(\text{the student } x \text{ came to the party})
\]
This step is the crucial difference between *even* and *only*. Whereas *even* uses the alternatives in its complement only for the computation of its projective scalar inference, *only* uses these alternatives in the computation of its assertive content, which will then compose with material above it. In this case, \( x \) will be bound by the moved quantifier, “a professor”:

\[
(22) \quad [(20)] = \exists x. \, (x \text{ professor} \land \neg (\text{the student } x \text{ came to the party}))
\]

This utterance introduces contradictory requirements on the variable \( x \). Specifically, the explicit restriction of the quantifier “a professor” requires that \( x \) be a professor, but the lower definite description, introduced by Trace Conversion, requires that \( x \) be a student. The predicates “professor” and “student” are disjoint, and therefore these two requirements on \( x \) cannot be satisfied at the same time. I propose that (22) is therefore uninterpretable, making (20) ungrammatical with the intended choice of focus association.

One crucial assumption in the discussion above is that the alternatives, *student* and *professor* in the example above, are disjoint. While the traditional Roothian conception is for alternatives to be contextually salient entities of the same semantic type (in this case, predicates), recent literature has shown that this characterization is too inclusive. Wagner (2005, et seq) proposes that alternatives must form a partition and therefore must be pairwise disjoint. Evidence for this comes from Wagner’s “convertibles” sentences. Wagner notes that the sentence with *only* in (23) does not assert that Mary does not like high-end convertibles, “unless the context is such that it made salient a partition of convertibles into red ones and high-end ones” (Wagner, 2005, p. 249).

\[
(23) \quad \text{Context: Mary’s uncle, who produces high-end convertibles, is coming to her wedding.}
\]

“Mary *only* likes RED convertibles.”

\( \neg \) Mary does not like high-end convertibles.

\( \Rightarrow \) Mary does not like blue convertibles, etc.

The issue observed in the semantic interpretation of (20) will therefore occur generally in any example of attempted leftward subject association with *only*. This proposal derives the difference between VP-*even* and VP-*only* in the (in)ability to associate with a leftward subject, first observed in Jackendoff (1972), from independent differences in the semantic contribution of *even* and *only*.

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10See Katzir (2013) for further discussion of Wagner’s approach and an alternative.

11Note that the possibility of reconstructing the subject into its predicate-internal position, as in (i), does not feed “backwards” subject association with *only* (ii). See Erlewine (in preparation) for discussion.

(i) Every professor didn’t [____ come to the party].

\( \forall > \neg, \neg > \forall \)

\( \neg \forall \land \neg \) LF: Neg [every professor came to the party] (every professor reconstructed into vP-internal position)

(ii) * Every [professor]P will only [____ come to the party].

Intended LF: *only [every [professor]P come to the party]
5. Scale reversal of *even* and an argument for the lexical ambiguity theory

In the previous section I presented my analysis for cases of apparent backwards association of *even* with a leftward subject. In this section I will extend this approach to clauses which include downward-entailing operators. I will show that the interpretation of *even* in such cases can be easily explained by adopting the lexical ambiguity theory of *even* (Rooth, 1985; von Stechow, 1991; Rullmann, 1997; Giannakidou, 2007, a.o.; also called the polarity theory), and then present a new argument against the scope theory of *even* (Karttunen and Peters, 1979; Wilkinson, 1996; Nakanishi, 2012, a.o.).

Karttunen and Peters (1979) observed that the scalar inference introduced by *even* is different in downward-entailing (DE) contexts. Specifically, the direction of the scalar inference seems to be reversed. This is observed with the pair of sentences in (24): *even* in (24a) reflects how relatively unlikely it is for Bill to read Syntactic Structures, whereas *even* in (24b) reflects how likely it is for Bill to read Syntactic Structures. (DE operators are bolded here.)

(24) **The scalar inference of *even* is reversed in a downward-entailing environment:**

a. Bill *even* read [Syntactic Structures]$_F$.
   \[\sim (\text{Bill read Syntactic Structures}) <_{\text{likely}} \text{(Bill read } ...alternatives... >)\]

b. Bill *didn’t even* read [Syntactic Structures]$_F$.
   \[\sim (\text{Bill read Syntactic Structures}) >_{\text{likely}} \text{(Bill read } ...alternatives... >)\]

The lexical ambiguity theory of *even*, first laid out in Rooth (1985), proposes that there are two variants of English *even*, whose distribution depends on their environment. The standard *even* which introduces an inference of the relative *unlikeliness* of the prejacent is a positive polarity item (here *even$_{PP}$*) and there is also a reverse scale *even* (here *even$_{NP}$*) which introduces an inference of the relative *likeliness* of the prejacent and is a negative polarity item.\(^\text{12}\) English VP-*even* is then interpreted in its pronounced position.

I will now show how the lexical theory can account for the behavior of *even* associating with material which has moved outside of its scope, in a downward-entailing context. Let us consider example (25), which involves a raising embedding, in a context where “student” contrasts with “professor”. The sentence is grammatical with the intended association of “student” with *even*, with a scalar inference that it is considered more likely for a student to be to the party than for a professor to be there.

(25) *No [student]$_F$ seems to *even* be at the party.* (cf 11a, 14)

\(^{12}\)The existence of these two types of *evens* is additionally supported by the fact that some languages lexicalize these two items differently. See König (1991); von Stechow (1991); Rullmann (1997) and others for German, Giannakidou (2007) for Greek, Lahiri (2008) for Spanish, etc.
Under my proposal, *even* associates with F-marking in the subject’s lower copy of movement. As the lower copy of movement undergoes Trace Conversion—illustrated in (26b)—its quantificational part is overwritten. *Even* will then associate with the F-marked “student” in “the student *x*” in the complement of *even*. Because *even* is within the scope of a downward-entailing operator “no”, it will be interpreted as *even*NPI. This results in the correct inference in (26c).

13 Interpreting (25) using the lexical ambiguity theory of *even*:

a. Narrow syntax: \([\text{No} [\text{student}]_F]\), seems to *even* \([\text{no} [\text{student}]_F]\), be at the party

b. LF after TC: \([\text{No} [\text{student}]_F] \lambda x \text{ seems to } *even* \([\lambda x [\text{the} [\text{student}]_F x]\text{ be at the party}]\)

c. *even*NPI: \(\sim (\exists x. \text{the student } x \text{ is at the party}) >_{likely} (\exists x. \text{the professor } x \text{ is at the party})\)

If instead *even*PPI is used here, we yield the wrong inference for (25): that it is less likely for a student to come to the party than for a professor to be there:

27 Using *even*PPI for (25) yields an incorrect inference:

\(\sim (\exists x. \text{the student } x \text{ is at the party}) <_{likely} (\exists x. \text{the professor } x \text{ is at the party})\)

I now turn to the alternative theory for the scale-reversing nature of *even* in such environments, called the scope theory of *even*, first proposed by Karttunen and Peters (1979). Under this view, *even* covertly moves to a higher position to take scope over the downward-entailing operator. Including the downward-entailing quantifier in propositions used to construct the scalar inference results in the apparent scale reversal, without the need for multiple homophonous *even* s. I will show that the scope theory is able to account for the interpretation of *even* in (25), but it makes incorrect predictions regarding leftward association with *even*, which ultimately makes it untenable.

Consider the derivation of (25) under the scope theory, illustrated in (28) below. At LF, *even* covertly moves to a position above the downward-entailing operator (28a). Unlike in (26), then, where *even* does not move and only the lower copy of the subject (converted into a definite description) was in the scope of *even*, in (28) the quantificational material of the subject (*no*) is in the scope of *even*.

14 For simplicity, I do not illustrate the raising movement of the subject in (28).

13 I thank Irene Heim for bringing such examples with downward-entailing contexts to my attention and also Martin Hackl for further discussion.
The scalar inference introduced by *even* is then as in (28b), expressing the relative *unlikeliness* that no student seems to be at the party. This can be restated, however, by factoring out the negation, as expressing the relative *likeliness* that some student seems to be at the party. This reflects the scale-reversing behavior due to the presence of the downward-entailing operator. The result in (28b) accords with our intuitions about the felicity of this expression.\(^\text{15}\)

However, the scope theory makes incorrect predictions regarding the distribution of leftward subject association with *even*. The hypothesized covert movement step of *even* in (28) leads us to predict the availability of the parallel covert movement in the control embedding counterpart (29) below. In this LF, the overt F-marked “student” is now within the scope of *even*, and we therefore predict *even* to be able to associate with the predicate “student” in the subject, contrary to fact.

\[
(29) \text{ Scope theory incorrectly predicts similar structures with control to be grammatical:} \\
* \text{No [student]}_F \text{ wants to *even* be at the party.} \\
\text{Expected LF: *even* [no [student]}_F \text{ wants to } \underline{\text{be at the party}]} \\
\text{(cf 11b)}
\]

Note further that the contrast between (28) and (29) cannot be due to the covert movement step of *even* being possible across a raising embedding but not across a control embedding. Under a scope theory of *even*, *even* would have to move in the exact same configuration as in the expected LF for (29) to explain the scalar reversal of *even* in other, grammatical examples with control embeddings:

\[
(30) \text{ ? Noone wants to *even* read the [abstract]}_F \text{ of this terrible paper.} \\
\text{Scope theory LF: *even* [noone wants to } \underline{\text{read the [abstract]}}_F \text{ of this terrible paper]}
\]

The contrast in grammaticality between the raising example (25) and the control example (29) therefore acts as an argument against the scope theory of *even*, as the scope theory is unable to predict this contrast. This contrast is explained by my proposal together with the lexical theory of *even*. Examples with leftward subject association are uniformly interpreted with *even* associating with F-marking in the subject’s lower copy of movement, within the scope of *even*. *Even* is interpreted in its surface position, and the scale reversal of *even* is due to the polarity-sensitivity of *even*. The example with the control structure in (29) is ungrammatical because there is no lower copy of the subject within the scope of *even*.

\(^{15}\)The inference predicted by this view in (28), that it is more likely for a student to seem to be at the party than for a professor to seem to be there, is not identical to what is produced in (26), but they are in the same direction—that is, the relative likelihood of being at the party is positively correlated with the relative likelihood of *seeming* to be there. Judgements regarding these inferences are therefore hard to tease apart.

Note, however, that the scope theory predicts that the scalar inference introduced by “no [student] \(_F\) seems to *even* be at the party” (25) will be equivalent to the inference introduced by “no [student] \(_F\) *even* seems to be at the party”, as their LFs after movement of *even* are predicted to be identical. To the extent that speakers can detect a difference in the felicity conditions of these two utterances and in similar pairs, their difference offers an additional argument for the lexical ambiguity theory, which predicts a difference in the scalar inferences introduced, and against the scope theory of *even*.
6. A broader pattern of leftward association: only even and not only

Thus far in this paper I have focused on the possibility of association with subjects which have A-moved out of the scope of a focus operator, explaining the puzzling contrast between even and only first observed in Jackendoff (1972). In this section I show that this contrast between only and even extends to other forms of movement as well: that is, even can associate with a constituent which has moved out of its scope, but only cannot.

(31) **Even can associate with material moved out of its scope, but not only:** (=2)

\[ \alpha_F \ldots \left[ *only/even \ [ \ldots \ldots \] \right] \]  
(with \( \alpha \) interpreted as the associate of the operator)

We begin with a classic case of A\-movement: wh\-movement. We see in example (32a) that even is able to associate with the restrictor of the fronted wh\-phrase, “president”. In contrast, the same configuration with only in (32b) is ungrammatical with the intended pattern of association.\(^{16}\)

(32) **Even can associate with a moved wh’s restrictor, but not only:**

a.  \( \checkmark \) Which [president]\_\( F \) did you even meet __?

\( \sim \) it is unlikely for you to meet presidents, as opposed to other types of people.

b.  * Which [president]\_\( F \) did you only meet __?

Consider next the case of topicalization. The examples in (33) are repeated from (3) above. Here too we observe a contrast between even and only, where even is able to associate with the proper name Mary moved out of its scope, but only cannot. Example (34) from Kayne (1998) also shows that this pattern of association is possible with even.

(33) **Even can associate with a proper name topicalized out of its scope, but not only:** (=3)

a.  \( \checkmark \) [Mary]\_\( F \), John even saw __ at the party.

b.  * [Mary]\_\( F \), John only saw __ at the party.  

Intended: \( \approx \) speaking of Mary, John saw only [her]\_\( F \) at the party.

(34) [John]\_\( F \), they even consider __ intelligent.  

(Kayne, 1998, fn. 75)

\(^{16}\)Note, however, that focus association with the entire fronted wh\-phrase is not grammatical:

(i)  * [Which president]\_\( F \) did you even meet __?

Intended: Which president x is such that you met x?

\( \sim \) it is unlikely for you to meet x, as opposed to other people.

(ii)  * [Who]\_\( F \) did you even meet __?

Intended: Who x is such that you met x?

\( \sim \) it is unlikely for you to meet x, as opposed to other people.

The generalization is that apparent backwards association by even can only target F-marking in the restrictor of the moved DP, not an entire F-marked DP. Backwards association with proper names, as in (33) below, is possible because proper names are definite descriptions (Elbourne, 2002), as reflected by the cross-linguistically common use of definite determiners with names (Matushansky, 2006, a.o.). See Erlewine (in preparation) for further discussion.
Similar interactions can be observed with covert movement, through the effect of focus association on quantifier scope-taking. I assume that QR, a covert movement operation, is required for the inverse scope (every boy > someone) interpretation in the following baseline example:\footnote{17}

\[
(35) \quad \text{Someone wants to meet every boy in the room.} \\
\text{LF for } \forall > \exists; \ \{\text{every boy} \} \someone \text{ wants } \{\text{PRO meet } \}
\]

The addition of only associating with “boy” has the effect of blocking the inverse scope reading, as discussed in Aoun and Li (1993), building on Tancredi (1990). This is explained by only being unable to associate with “boy” if “every boy” QRs out of only’s scope. However, the scope of every boy is not restricted in the same way when “boy” is associated with even:

\[
(36) \quad \text{Only restricts QR height, but not even:} \\
\quad \text{a. Someone wants to } \text{even meet every } \{\text{boy}\}_E \text{ in the room.} \\
\text{b. Someone wants to } \text{only meet every } \{\text{boy}\}_E \text{ in the room.}
\]

Additional contrasts of this form are presented in detail in Erlewine (in preparation). In all of the cases presented in this section, the pattern of association can be explained with the same logic I presented for leftward subject association in section 4. Even is able to associate with F-marking in the lower copy of movement, within the scope of even. The same configuration with only yields an uninterpretable structure, due to the differing semantics of only.

Previous work looking at focus association with material which has moved out of the operator’s scope (Tancredi, 1990; Aoun and Li, 1993; Beaver and Clark, 2008) has looked primarily at only and has therefore come to the conclusion that association in this configuration is always impossible.\footnote{18} These proposals have the effect of banning all association with the configuration in (31), not just with only. As we have seen in this section, association in precisely this configuration is possible with even, though it is indeed impossible with only. Wholesale bans of focus association in this configuration therefore cannot be maintained.\footnote{19}

\footnote{17}{In particular, note that there is no option for someone to reconstruct into a lower position in order to derive this inverse scope reading, due to the control embedding.}
\footnote{18}{A notable exception is Barbiers (1995), who argues that focus operators can generally associate with trace positions. This is based on movement to the left periphery in Dutch and German, which does allow association in the configuration (31) with both only and even. However, for the English facts described here, the proposal in Barbiers (1995) fails to distinguish between different operators and incorrectly predicts that only can also associate with material which has moved out of its scope. I discuss these facts and the difference between Germanic and English-type languages in Erlewine (in preparation).}
\footnote{19}{Beaver and Clark (2008, chapter 7) explains Tancredi’s (1990) proposed ban on association in this configuration by appealing to the fact that F-marking affects the phonological realization of its bearer and proposing that trace positions therefore cannot contain F-marking. The data and proposal here therefore also constitute an argument against such a general ban on F-marking on unpronounced material.
7. Conclusion

The ability of VP-\textit{even} but not VP-\textit{only} to associate with a leftward subject was first observed in Jackendoff (1972). Under the Alternative Semantics approach to focus semantics (Rooth, 1985, 1992) focus-sensitive operators consider the alternative propositions computed in their complement, and therefore must have an F-marked constituent in their c-command domain. This apparent “backwards” association with a focus associate outside of the scope of the focus operator has therefore been a long-standing puzzle for theories of focus association.

Following the Copy Theory of movement, I propose that \textit{even} is able to associate with F-marked material in the lower copy of a movement chain, inside its scope. Such cases of apparent backwards association with \textit{even} are therefore illusory, and do not counterexemplify the principle that focus-sensitive operators associate with material in their scope. The same configuration with \textit{only} leads to an uninterpretable structure. This difference derives from independent semantic differences between \textit{even} and \textit{only}: \textit{even} uses the alternatives in its complement to introduce a projective inference, while \textit{only} modifies the assertion. I presented evidence for this view from contrasts between raising and control embeddings, and showed that this pattern of association does not rely on reconstruction.

The facts from leftward subject association also form a new argument for the lexical ambiguity theory for \textit{even}’s interpretation in downward-entailing contexts. Under the competing scope theory of \textit{even}, \textit{even} has the ability to move covertly and be interpreted with higher scope, and must do so in order to outscope downward-entailing operators. I showed that the scope theory is unable to account for differences in leftward association between raising and control embeddings, incorrectly predicting leftward association to be possible with control embeddings. I showed how my proposal—together with the lexical ambiguity theory of \textit{even} and the assumption that VP-\textit{even} is interpreted in its surface position—is able to accurately model the distribution of leftward association, while also accurately modeling the scale reversal behavior of \textit{even}.

Finally, I discussed the more general question of focus-sensitive operators associating with material which has moved outside of their scope. Previous work on this question looked primarily at \textit{only}, and suggested a general ban on focus association in such configurations (Tancredi, 1990; Aoun and Li, 1993; Beaver and Clark, 2008). I showed instead that focus association in this configuration is indeed impossible with \textit{only}, but is possible with \textit{even}. I showed that the proposal put forth in this paper for the puzzle of leftward subject association also extends to other movement configurations and is able to explain the distribution patterns of the data.
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Event individuation by objects: Evidence from frequency adjectives
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Abstract. Adverbially-interpreted temporal frequency adjectives (FAs) such as frequent, sporadic, and daily, are usually restricted to modifying event-denoting nominals (e.g. The house underwent frequent cleanings = Frequently, the house underwent cleanings vs. We saw frequent sailors/the frequent sailor ≠ Frequently, we saw sailors/the sailor). In this, they contrast with what Gehrke and McNally (2012) refer to as nontemporal FAs (e.g. odd, cp. The odd sailor strolled by = A sailor strolled by on odd occasions). However, there is a systematic set of exceptions to this generalization, e.g. She wrote frequent letters, which have never been explained. In this paper we provide an analysis of these exceptional cases. Our account points to interesting parallelisms between the construction of interest and Kennedy’s (2012) use of Kratzer’s (1996) Event Identification to account for event measurement via measure expressions on incremental themes. It also situates this use of FAs within the family of semantic incorporation constructions, providing a novel example of how the varied morphosyntactic resources of a language can make it possible to fulfill the pragmatic functions that incorporation constructions serve for a wide variety of propositional contents.

Keywords: semantics, adjectives, semantic incorporation, temporal modifiers, distributivity.

1. Introduction

It has been well known since at least the work of Verkuyl (1972) that in certain cases events can be measured by one or more of their participants, for example, their incremental themes. In this paper we present a case in which something similar happens with event individuation. Specifically, frequency adjectives (FAs), which contribute entailments about the individuation and distribution of objects, can, under the right conditions, indirectly contribute entailments about the individuation and distribution of events those objects participate in.

In Gehrke and McNally (2012) we show that FAs (Bolinger, 1967; Stump, 1981; Larson, 1998; Zimmermann, 2003; Schäfer, 2007; Gehrke and McNally, 2011) fall into two categories, illustrated in (1). Some FAs (e.g. occasional, (1a)), when modifying non-event nouns, systematically allow the so-called adverbial reading, i.e. can be paraphrased as sentence adverbs. Other FAs (e.g. daily, frequent), do not ((1b), see Schäfer 2007).

\[1\] a. The occasional sailor strolled by. = Occasionally, a sailor strolled by.

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\(^1\)This work has been supported by grants FFI2010-15006, FFI2012-34170, and ICI-2010-08581 from the Spanish government, as well as an ICREA Foundation Academia award. We thank the audiences at Sinn und Bedeutung and at the Workshop on Aspect at the Tenth International Tbilisi Symposium on Language, Logic and Computation for helpful comments.
b. A frequent sailor strolled by. \(\neq\) Frequently, a sailor strolled by.

We argue in that paper that the contrast is related to whether the FA expresses strictly temporal distribution (e.g. frequent, daily, some uses of occasional; hereafter, temporal FAs) vs. non-temporal distribution (rare, odd, other uses of occasional; hereafter, non-temporal FAs), a distinction to which we return below.

However, there seem to be exceptions to this generalization (Gehrke and McNally, 2011). FAs like frequent can sometimes have an adverbial reading in combination with non-event nouns in certain argument positions of certain verbs, e.g. with themes of verbs of creation and consumption ((2)). Though we were able to observe that the exception does not hold for incremental theme arguments more generally ((3)), and we identified some other suggestive contrasts, e.g. that in (2b) and (4b) vs. (4a), until now we have had no analysis of these facts.

(2) a. She wrote me frequent letters. = Frequently, she wrote me a letter.
   b. She baked frequent batches of cookies. = Frequently, she baked a batch of cookies.
   c. She drank frequent cups of coffee. = Frequently, she drank a cup of coffee.

(3) a. ??She read frequent books to her mother.
   b. ??She mowed frequent lawns.

(4) a. ??She baked frequent cookies.
   b. She baked frequent cakes.

The goal of this paper is to account for these exceptions. We show that the adverbial reading in these exceptional cases requires that the atomic events described by the VP 1) be uniquely individuated by the (temporal) FA-modified argument, 2) have a uniform, continuous internal structure (in the sense we elaborate on below), and 3) describe stereotypical activities. In addition, the nominal modified by the FA must be plural. We then argue that semantic composition in these cases proceeds via semantic incorporation (McNally, 1995; van Geenhoven, 1995; Chung and Ladusaw, 2003; Farkas and de Swart, 2003, among others), implemented via a generalized version of Chung and Ladusaw’s Restrict rule. Ultimately, the analysis points to interesting parallels between event individuation by temporal FAs and event measurement via incremental themes as analyzed by Kennedy (2012). It also situates this use of FAs within the family of semantic incorporation constructions, providing a novel example of how the varied morphosyntactic resources of a language can make it possible to fulfill the pragmatic functions that incorporation constructions serve for a wide variety of propositional contents.

The paper is structured as follows. Section 2 sharpens the empirical generalizations concerning the
requirements that have to be met in order for the adverbial reading to arise exceptionally with FAs like *daily*, *frequent* etc. in combination with non-event nouns. Section 3 spells out the analysis and situates the construction within the context of semantic incorporation constructions more generally. Finally, section 4 concludes.

2. Sharpening the empirical generalization

In this section, we show that four conditions have to be met in order for a verb phrase to allow a temporal FA with a non-event noun on the adverbial reading. To substantiate our claims about the sorts of examples that are unacceptable, we have carried out searches on the GloWbe web corpus of English available at http://corpus.byu.edu and some complementary searches using Google; the sorts of VPs we mark as infelicitous have failed, except in a few very residual cases to be noted below, to have counterparts in the corpus.²

First, the distribution expressed by the FA has to involve one unique discernible event for each discernible object described by the (singular form of the) nominal. This accounts for one of the contrasts mentioned in the introduction and repeated in (5), as well as for the contrast in (6).

(5)  
   a. ??She baked frequent cookies.  
   b. She baked frequent cakes.  
   c. She baked frequent batches of cookies.  
   d. I smoked frequent cigarettes on the smoke-filled balcony.  
   (books.google.com/books?isbn=0307595323, p. 67)

(6)  
   a. ??He ate frequent peanuts.  
   b. He ate frequent handfuls of peanuts.

The bare plural *cookies* in (5a) does not identify one unique discernible event because one typically bakes more than one cookie at a time. In contrast, the common unit for each baking event involving cakes *is* one cake per event, which is why (5b) is acceptable; the same holds, mutatis mutandis, for (5d). However, if we add a typical unit measure in which cookies are baked, such as *batches* in (5c), the example becomes acceptable: each batch corresponds to a unique discernible baking event. Similarly, in the case of (6), as more than one peanut can be (and often is) eaten simultaneously, the condition of one unique event per discernible object is not satisfied; however, the use of a distinct unit measure such as *handful* ameliorates such examples. More generally, unit measure nominals such as *instance*, *dose*, *sip*, *cup* can improve examples with verbs that would resist adverbially-used temporal FAs in cases where, without the measure nominal, the VP describes an event that involves a plurality or an undelimited mass that impedes an association between a unique discernible event

²Attested examples from this corpus are indicated simply as *GloWbE*; a few others extracted from Google searches are indicated with the corresponding URL.
and discernible object described by the nominal containing the FA ((7)).

(7)  
   
   a. ...distribute your financial resources to purchase frequent doses of lovely things rather than infrequent doses of lovelier things.  \(\text{GloWbE}\) 
      (cp. ??She purchased frequent CDs.)
   
   b. Simple measures such as drinking frequent sips of water...  \(\text{GloWbE}\) 
      (cp. ??They drank frequent beers.)

Other verbs that allow the adverbial reading with these FAs include send and receive in combination with the particular arguments in (8), which again typically involve one unique discernible event for each discernible object.

(8)  
   
   a. Send frequent emails to your professor if something is hard to understand...  \(\text{GloWbE}\)
   b. Please make sure you check your child’s book bag everyday because I do send frequent letters home informing you about upcoming information.  \(\text{http://www.cabarrus.k12.nc.us/cms/lib07/NC01910456/Centricity/Domain/5154/sept.%205-9.doc}\)
   c. ...she has begun receiving frequent messages from doubting pastors...  \(\text{GloWbE}\)
   d. He received frequent letters asking for his prayers...  \(\text{GloWbE}\)

The second generalization we observe is that each event has to have a uniform, temporally continuous internal structure, with little variability within or across events. Otherwise, the examples with FAs are generally infelicitous, as was the case, for instance, in (3), repeated in (9).

(9)  
   
   a. ??She read frequent books to her mother.
   b. ??She mowed frequent lawns.

The examples in (10) illustrate that, even if there is a unique, discernible event for each unique, discernible object, the sentence is not acceptable if this second condition is not met.

(10)  
   
   a. ??He knitted frequent sweaters.
   b. ??She painted frequent pictures of her sister.
   c. ??He played/composed frequent sonatas.
   d. ??She directed/starred in frequent movies.
   e. ??He wrote/read frequent books.  \(\text{(cp. write frequent letters)}\)
   f. ??She ate frequent pizzas.  \(\text{(cp. eat frequent meals, (6b))}\)
   g. ??The child built frequent towers with blocks.
All of the above verbs in combination with the objects in question describe activities that are likely to have non-uniform or temporally discontinuous subparts. This may be due to the fact that the activity itself may develop in a discontinuous way, because it may involve taking breaks (e.g., knitting a sweater, composing a sonata) or repetitions over a particular part of the object (e.g., the examples with movies, playing a sonata, or reading a book). It may also be that the object is unlikely to be uniquely mapped to one event involving the same individual (e.g., eating a pizza is something often done by a group of people). Finally, uniformity may fail because the objects themselves have heterogeneous subparts that may affect the way in which the activity develops, as might be the case, e.g., with build a tower or direct a movie. In contrast, an event of writing a letter or email is much more likely to have simpler internal structure, and the mapping between the object and the development of the activity is more likely to follow a unique (metaphorical) two-dimensional path, e.g., from the beginning to the end of the letter/email.

The third generalization governing the acceptability of the adverbial reading with temporal FAs modifying non-event nominals is that the verb-object combination (the VP) has to name a stereotypical activity. The examples we have seen above all arguably involve stereotypical object-activity pairs (summarized in (11)):

(11) a. cake, (batch of) cookies: bake  
    b. letter: write, receive, send  
    c. e-mail, message: receive, send

In contrast, examples in which the relation between the event and the object described by the FA-modified nominal is not stereotypical sound odd, even though other formulations expressing the intended meaning are perfectly acceptable (contrast (12a,b) and (12c,d)):

(12) a. ??He married periodic heiresses.  
    b. He periodically married an heiress.  
    c. ??She received frequent posters in the mail.  
    d. She frequently received a poster in the mail.

These three generalizations have a pragmatic component to them, and thus it should not be surprising if some counterexamples are found. Nonetheless, our intuitions are quite robustly supported by corpus data. Our Google searches revealed only 1 example each (from clearly native speakers, non-translated English) of mowed frequent lawns and wrote frequent books, apparently contravening the uniformity generalization. Moreover, inspection of these examples showed that they are cases where the activity the VP denotes is being presented as stereotypical of or as characterizing the subject, i.e., they are consistent with the stereotypicality condition in their context of use. Thus, while further research is needed to fully consolidate these three generalizations, we consider them...
sufficiently supported to use them as a basis for an analysis.

The fourth and final generalization is clearly grammatical: the FA-modified nominals have to be plural. The examples become systematically infelicitous if the nominal appears in the singular, and we have not found examples of this sort in Google searches:

(13)  a. ??She baked a frequent cake/a frequent batch of cookies.
     b. ??He ate a frequent handful of nuts.
     c. ??I do send a frequent letter home...
     d. ??...distribute your financial resources to purchase a frequent dose of lovely things
     e. ??He received a frequent letter asking for his prayers.

Finally, we note in passing uses of temporal FA-modified non-event nominals that fall outside the scope of this paper. These examples involve light or support verb constructions and idiom chunks ((14)), as well as property-attributing (rather than possessive or literally locative) uses of have ((15)).

(14)  a. Over the next 80 years Call, who would become one of the more successful commercial photographers in the state, took frequent pictures of the wilderness of Maine.
     b. She undertook frequent responsibilities for the IB Organisation...
      GloWbE
     c. The same can be said about the hundreds of people I once knew or had frequent beers with...
      (cp. ??He drank frequent beers with his friends.)
      http://www.absolutepunk.net/journal.php?do=showentry&e=359172
     d. Keep frequent tabs on offenders...
      GloWbE

(15)  a. If a person has frequent symptoms, would you suggest that they take that preventively every night...
      GloWbE
     b. ...you should realize that the sources you quote have frequent errors about specific US losses...
      GloWbE

In the remainder of the paper, we set aside these cases, which introduce complexities that we cannot explore due to space limitations, and focus on accounting for the properties we have identified for the other cases: unique individuation by the FA-modified argument; uniform, continuous internal structure for the event; description of stereotypical activity; and the fact that the FA-modified noun has to be plural.
3. Analysis


We begin by providing the relevant basic ingredients for the analysis from Gehrke and McNally (2012). As noted above, we argue that FAs fall into two different classes, those that are strictly temporally distributing ((in)frequent, periodic, sporadic, and the fixed frequency adjectives daily, weekly, monthly, etc.; see (16)), and those that involve distribution over some non-temporal domain (occasional, odd, rare; see (17)).

\[ \text{(16) a. The house underwent monthly/frequent/periodic/sporadic cleanings.} \]
\[ \text{b. The house underwent a/the monthly/frequent/periodic/sporadic cleaning.} \]
\[ \text{c. ??A/??The monthly/frequent/periodic/sporadic sailor is 6 feet tall.} \]
\[ \text{d. The reviews were ?monthly/frequent/periodic/sporadic.} \]

\[ \text{(17) a. ??The house underwent odd cleanings.} \quad \text{(on relevant reading)} \]
\[ \text{b. The house underwent ??an/the odd cleaning.} \quad \text{(on relevant reading)} \]
\[ \text{c. ??An/The odd sailor is 6 feet tall.} \]
\[ \text{d. ??The sailor was odd.} \quad \text{(on relevant reading)} \]

As these examples show, nouns modified by temporal FAs can appear in the plural ((16a)), whereas this is not possible with non-temporal FAs ((17a)). Furthermore, in combination with singular nouns, temporal FAs require an indefinite article ((16b)), whereas non-temporal FAs require the definite article ((17b)). The contrast in (16c) vs. (17c), based on an example provided in Stump (1981), illustrates what we mean by distribution over a non-temporal domain, which is only possible with non-temporal FAs: in this case the individuals in question can be temporally co-located as long as they are properly distributed over some other sort of contextually-identified domain (typically space). Finally, temporal but not non-temporal FAs can be used predicatively ((16d) vs. (17d)). In the remainder of this paper, we discuss only the temporal FAs, as these are the ones that

\[ \text{(i) a. The house underwent occasional cleanings.} \]
\[ \text{b. The house underwent an/the occasional cleaning.} \]
\[ \text{c. The occasional sailor is 6 feet tall.} \]
\[ \text{d. The cleaning/??sailor was occasional.} \]

Occasional shows properties of both temporal and non-temporal FAs ((i)); we argue in Gehrke and McNally (2012) that it is ambiguous.

Rare has a predicative use under certain conditions despite meeting the criteria for nontemporal FAs according to the rest of our diagnostics. Fixed frequency temporal FAs such as monthly behave slightly more like relational adjectives than do variable frequency temporal FAs such as sporadic (see McNally and Boleda, 2004, on relational adjectives). The generalizations concerning temporal FAs apply most clearly to the latter. See Gehrke and McNally (2012) for further discussion.
occur in the cases that are the topic of this paper.

In Gehrke and McNally (2012), we propose that temporal FAs are sortally restricted to events, and that they can apply either to event kinds or to pluralities of event tokens (understood as sums of events in an algebraic model, e.g. Link, 1983). Our fourth generalization from the previous section was that non-event nouns modified by FAs generally must be plural, cf. (18).

(18) a. She wrote a frequent/periodic/sporadic letter to her mother.
    b. She wrote frequent/periodic/sporadic letters to her mother.

Hence, we assume that only the plurality-of-event-tokens case is relevant here. Our semantic representation for temporal FAs is very simple: they introduce an intersective predicate of events ((19)).

(19) \([\text{FA}\text{_{temp}}] : \lambda e[\text{FA}\text{_{temp}}(e)]\]

The satisfaction conditions on temporal FAs, stated in (20), provide information about the distribution of a set of events at a given spatiotemporal index. \(\text{FA}\text{_{temp}}\) holds of a plurality argument at an index \(i\) just in case the distribution of the set of atomic parts of that argument at \(i\) is what the FA requires (\textit{distribution} is a function that yields the distribution \(\textit{dist}\) of a set of entities at \(i\), with values like \textit{high}, \textit{low}, \textit{daily}, etc.).

(20) \(\forall e, i[\text{FA}\text{_{temp}}(e) \text{ at } i \leftrightarrow \text{distribution}\{e' : \text{atomic-part-of}(e', e) \text{ at } i\} = \text{dist}]\)

We posit that the FA can combine with the noun via an intersective predicate modification rule. Thus, e.g. \textit{frequent cleanings} denotes a property of pluralities of cleanings whose atomic parts have a high distribution (see Krifka, 1989, for a definition of atomic part):

(21) \[\text{[frequent cleanings]} : \lambda e[\text{cleaning*}(e) \land \text{frequent}(e)]
\quad = \lambda e[\text{cleaning*}(e) \land \text{distribution}\{e' : \text{atomic-part-of}(e', e) \text{ at } i\} = \text{high}]\]

We refer the reader to Gehrke and McNally (2011, 2012) for further discussion and arguments in favor of this analysis. With this semantics in hand, we turn to the analysis of the data that interest us here.

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4The distribution function must guarantee that the members of the set be properly individuable and that the distribution be sufficiently regular (see Stump, 1981; Zimmermann, 2003; Schäfer, 2007, for discussion). As the means by which this is guaranteed is not crucial to our proposal, we will not discuss the options further here.
3.2. The adverbial reading with temporal FAs and non-event nouns

In order to account for the facts in section 2 using the basic semantics for temporal FAs from the previous section, two issues must be dealt with. First, we need to state more precisely the conditions that have to be met in order for the adverbial reading with FAs modifying non-event nouns to be possible at all. Second, we need to solve the sortal mismatch between the temporal FA, which denotes a property of pluralities of events, and the denotation of the noun it combines with, which, in the cases that interest us, is not a property of events.

3.2.1. Atomic Event-Entity Mapping and stereotypicality

To account for the conditions that there be a unique discernible event per discernible object and that the events described must have a uniform, temporally continuous structure, we propose that Atomic Event-Entity Mapping (AEEM), stated in (22), must be satisfied. AEEM requires that there be a 1-to-1 mapping between the atomic parts of the entities in the denotation of the nominal containing the FA and those of the events in the denotation of the verb. Crucially (and perhaps controversially), we consider it necessary for an event to count as truly atomic that it be associated with a single, continuous temporal trace. This condition guarantees that the FA will eventually properly distribute over events.

\[
\forall P[\text{AEEM}(P) \leftrightarrow \forall x, e[P(x, e) \leftrightarrow \exists e', \text{atomic-part-of}(x', x) \exists e', \text{atomic-part-of}(e', e)] \land \\
\forall e', \text{atomic-part-of}(e', e) \exists x', \text{atomic-part-of}(x', x)]]
\]

AEEM accounts for the oddness of sentences for which an argument can easily participate in atomic events in pluralities, such as those in (23):

(23) a. ??She baked frequent cookies.
    b. ??He ate frequent peanuts.
    c. ??They saw frequent sailors.

It also accounts for the fact that adding a description of a unit measure to the FA-modified nominal can make the examples acceptable, as the AEEM can hold between the events and the unit measures in question ((24)).

(24) a. She baked frequent batches of cookies.
    b. He ate frequent handfuls of peanuts.
Furthermore, it accounts for the oddness of sentences where the same atomic entity participates in multiple atomic events, whether because the object can undergo the same eventuality multiple times or because the event in which the entity participates is temporally discontinuous (or both).

(25) a. ??She baked frequent potatoes.
    b. ??She knitted frequent sweaters.
    c. ??She read frequent books.
    d. ??She watched frequent movies.

More generally, this will keep the structure of the events and the objects involved relatively simple and uniform, accounting for the remaining examples in (9) and (10) as well.

In addition to AEEM, there needs to be a condition enforcing the stereotypicality of the event described by the VP. While we are skeptical that it is possible to define a formal condition on stereotypicality, Aguilar Guevara (2013) offers a few recent comments on the notion that we summarize here. According to Aguilar Guevara, stereotypes are conventional beliefs about concepts that are part of the world a community has access to. They are motivated by the regularity and homogeneity with which instances of these concepts occur, and they are often associated with artefacts, which tend to be produced by a particular sort of activity (e.g. baking) or used for a particular purpose (e.g. letters, for communication). Positing a felicity condition on the resulting VP that it describe a stereotypical activity will, as noted, account for the oddness of examples such as those in (26), repeated from above:

(26) a. ??He married periodic heiresses. (cp. He married heiresses periodically.)
    b. ??She received frequent posters. (cp. She received posters frequently.)

There is obviously nothing impossible about marrying heiresses or receiving posters on multiple occasions, and both of these VPs describe eventualities that most likely satisfy AEEM. However, they arguably do not constitute stereotypical activities.

Why there should be a stereotypicality condition on the VPs containing temporal FA-modified non-event nominals, and how exactly it comes into play will emerge in the discussion of the compositional semantics of these VPs, to which we now turn.

3.2.2. The compositional semantics

Recall the fourth generalization we introduced in section 2, namely that the FA-modified nominal must be plural. To this we add an additional observation, namely that the nominal must be a bare
plural in order for the relevant reading to arise:

(27)  
  a. ??She wrote me two/several/many/the frequent letters.
  b. She wrote me those frequent letters. ≠ Frequently, she wrote me those letters.

These facts, together with the stereotypicality condition, lead us to hypothesize that the VPs we are analyzing fall into the family of incorporation constructions. There are various techniques for carrying out incorporation in a semantic sense (McNally, 1995; van Geenhoven, 1995; Chung and Ladusaw, 2003; Farkas and de Swart, 2003; Dayal, 2003, 2011; Espinal and McNally, 2011). What characterizes them all is that the nominal that combines with the verb via incorporation denotes a property, rather than an entity or a quantifier over entities, despite the fact that semantically it corresponds to an entity-type participant in the eventuality denoted by the verb. In other words, in Chung and Ladusaw’s (2003) terms, incorporated nominals restrict, rather than saturate, the verb’s denotation.

For the purposes of illustration, consider Chung and Ladusaw’s (2003) Restrict and Existential Closure (EC) composition rules for incorporation constructions ((28)).

(28)  
  a.  Restrict($\lambda y \lambda x.P(x, y), \lambda z.Q(z)) = \lambda y \lambda x[P(x, y) \wedge Q(y)]
  b.  EC($\lambda y \lambda x.P(x, y)) = \lambda x \exists y. P(x, y)

An example of how this rule would work with the FA modifying an event nominal is given in (29).²

(29)  
  [underwent frequent cleanings]:
  Restrict($\lambda y \lambda e.[\text{undergo}(y, e)], \lambda z_{ev}.[\text{clean}* (z_{ev}) \wedge \text{frequent}(z_{ev})])
  = \lambda y \lambda e.[\text{undergo}(y_{ev}, e) \wedge [\text{clean}* (y_{ev}) \wedge \text{frequent}(y_{ev})]]
  After EC: $\lambda e \exists y_{ev}.[\text{undergo}(y_{ev}, e) \wedge [\text{clean}* (y_{ev}) \wedge \text{frequent}(y_{ev})]]

²There is a further distinction in the literature between incorporation and pseudo-incorporation (Dayal, 2003). Space limitations preclude a discussion of this distinction here, but we note that according to the diagnostics used in Dayal (2003) and Espinal and McNally (2011), the examples we are analyzing would constitute regular semantic incorporation and not pseudo-incorporation. These diagnostics include the fact that the construction involves bare plurals rather than (number-neutral) bare nouns, that the nominal containing the FA systematically licenses the accommodation of a persistent discourse referent, as illustrated in (ia), and that it can be modified by a full range of adjective and relative clause modifiers, as in (ib).

(i)  
  a. She wrote me frequent letters. I have saved them all.
  b. She wrote me frequent, long letters that I really enjoyed.

³Unlike Chung and Ladusaw, we follow Kratzer (1996) in “severing” the external argument from the verb. Thus, the $y$ variable in the example corresponds to the internal argument of the verb. We also add an eventuality argument to the verb’s representation.
For the satisfaction conditions for (29) we posit that for a plurality like that described in (21) to participate in an event, each atom that supports the distribution should participate in a distinct atom of the event described by the verb. Thus, for (29) to be true, there has to be a set of token cleaning events with a distribution that can be described as “frequent”.

We can use the same compositional mechanism for cases involving non-event nominals by adding just one additional and, we would argue, independently motivated ingredient to the analysis. We assume that the property denoted by the FA has exactly the semantics we attributed to it, i.e. it is not attributed to the sort of entity described by the non-event noun itself. Rather, we predicate the FA of an event variable associated with that noun, building on the analyses of sortal mismatches in adjectival modification of nouns in Pustejovsky (1995) and Larson (1998). Our treatment of the noun resembles Pustejovsky’s insofar as we take the event variable we need to be part of its “deeper” semantics, rather than taking the noun to directly denote a relation between entities and events, as Larson does. However, like Larson we assume that this variable must eventually become explicitly visible in the semantic composition process if it is to be targeted for predication. We differ from Pustejovsky in using not qualia structures to introduce this event variable; rather, we introduce it via a contextually-valued relation $R$. The semantic composition of frequent cakes is thus as in (30).

\[(30)\]
\[
\begin{align*}
&\text{a. } [\text{cakes}]: \lambda z \lambda e [\text{cake}^* (z) \land R(z,e)] \\
&\text{b. } [\text{frequent}]: \lambda e [\text{frequent} (e)] \\
&\text{c. } [\text{frequent cakes}]: \lambda z \lambda e [\text{cake}^* (z) \land \text{frequent} (e) \land R(z,e)]
\end{align*}
\]

In order to integrate this relation into the compositional semantics, we take inspiration in Kennedy’s (2012) semantics for combining incremental theme verbs with measure phrases. Kennedy uses Kratzer’s (1996) Event Identification, shown in (31), to combine incremental theme verbs with their themes.\footnote{Kratzer assumes that external arguments do not form part of the semantics of verbs; Kennedy implicitly generalizes this to the internal argument.}

\[(31)\] Event Identification (Kratzer, 1996, p. 122): If $\alpha$ is a constituent with daughters $\beta, \gamma$ such that $[\beta]$ is type $\langle e, t \rangle$, and $[\gamma]$ is type $\langle e, \langle e, t \rangle \rangle$, then $[\alpha] = \lambda x \lambda e [\beta] (e) \land [\gamma] (x)(e)$.

The composition process proposed by Kennedy is illustrated in (32) (NU is a a parameterized measure function that measures things according to ‘natural units’ based on the intension of the noun; cf. Kennedy, 2012, 116).

\[(32)\]
\[
\begin{align*}
&\text{a. } [\text{eat}]: \lambda e [\text{eat} (e)] \\
&\text{b. } [\text{NU}]: \lambda e [\text{NU} (e)]
\end{align*}
\]
b. [ten dumplings]: \( \lambda x \lambda e [\text{dumpling}(x) \land \text{NU}\Delta(\text{dumpling})(x)(e) = 10] \)
c. [eat ten dumplings]: \( \lambda x \lambda e [\text{eat}(e) \land \text{dumpling}(x) \land \text{NU}\Delta(\text{dumpling})(x)(e) = 10] \)

Kennedy’s use of Event Identification in (32) is strikingly similar to Restrict. The only substantive difference is that instead of treating the verb as selecting for ordered arguments, as Chung and Ladusaw do, Kennedy treats the verb as a simple one-place predicate over events. This suggests a natural generalization of Restrict to all arguments ((33); recall that we “sever” the external argument), so that it can identify the entity-type variable in the verb’s denotation (\( y \) in (34a)) with that contributed by the nominal (\( z \) in (34b)). Thus, we end up with the semantics in (34c).

(33) a. Generalized Restrict(\( \lambda y \lambda e. P(y, e), \lambda z \lambda e'. Q(z, e') \)) = \( \lambda y \lambda e [P(y, e) \land Q(y, e)] \)

(34) a. [bake]: \( \lambda y \lambda e. \text{bake}(y, e) \)
b. [frequent cakes]: \( \lambda z \lambda e [\text{cake}^*(z) \land \text{frequent}(e) \land R(z, e)] \)
c. [bake frequent cakes]: \( \lambda y \lambda e [\text{bake}(y, e) \land \text{cake}^*(y) \land \text{frequent}(e) \land R(y, e)] \)

When \( R \) is valued as the thematic role borne by \( y \) in \( e \) and the verb satisfies AEEM, the adverbial reading will arise: The event described in (34c) is a plurality with atomic subevents of baking one cake individuated by the atomic subparts of the plurality described by cakes. The distribution of this plurality of events is described by the FA. If \( R \) is given some other value or the event arguments are not identified, some other interpretation (perhaps as in Sue read a daily newspaper) or anomaly will result.

What we have, in essence, is a generalized operation that allows the nominal to restrict the identity both of the theme participant and the overall event being described. While not formally identical to any previously proposed semantic incorporation operation, it clearly bears the hallmark of incorporation, namely the failure of the nominal to saturate the verb’s internal argument. The fact that the construction belongs to the family of incorporation constructions helps explain the stereotypicality condition, as such conditions are often associated with incorporation. We can implement this condition as a felicity condition on the use of VPs generated by Generalized Restrict.

Though we have taken inspiration in Kennedy’s analysis of measure phrase-modified incremental themes, we should emphasize exactly what the similarity consists in and insist that there is also one important difference. The similarity lies in the fact that information within the nominal about how the participants it picks out are individuated is used to provide information about how the events they participate in are individuated. The difference is that, as far as we know, there is no stereotypicality condition associated with incremental theme constructions involving measure phrases.\(^8\)

\(^8\)It is less clear to us whether one can say that Kennedy’s analysis amounts to an incorporation analysis of the nominal. On the one hand, he treats the nominal as a first-order relation, rather than as quantificational or referential; in this respect, the nominal is similar to incorporated nominals. On the other, since the verb is treated as a simple one-
This leads us to a final, and more general reflection: Why would this use of FAs with non-event nominals require semantic incorporation and the corresponding satisfaction of a stereotypicality condition?

Incorporation constructions are well known to frequently impose “typicality” conditions (see Carlson, 2006, for a review). In this context Carlson (2006, 46) notes:

“There are, logically speaking, a number of different types of restrictions that we might be dealing with, and possibly more than one might be at work at the same time in any given language.”

We suspect that in the case of the use of temporal FAs with non-event nouns, the restriction is related to categorization.9 Our development of this idea builds on observations made in Dowty (2000) about the so-called swarm alternation, illustrated in (35).

(35) a. (Many) bees swarmed in the garden.
   b. The garden swarmed with (*many) bees.

The locative subject variant of the construction in (35b) requires a bare plural complement to the preposition with. Though Dowty did not consider this possibility, it seems highly likely that an incorporation analysis of this PP complement is called for (see Puig-Waldmüller, 2008, for a different sort of construction involving semantic incorporation of a PP complement). Such an analysis would fit well with another fact about the construction in (35b), namely that the VP has to describe ‘perceptually simple’ events with a sufficiently broad distribution over the location. In connection to this, Dowty (2000, 122) observes:

“[Lexical constructions like the swarm construction] denote not just any classes of things or actions, but classes which are relevant for purposes of human activities, e.g. ascribing causation relations and making other generalizations. [... The swarm construction] ascribes an abstract property (expressed by the predicate) to a Location (denoted by the subject NP): the property a place or space has when it is ‘characterized’ by an activity taking place within it – that is, when the extent, intensity, frequency and/or perceptual salience of this activity [...] is sufficient to categorize the Location in a way that is relevant for some purpose in the current discourse.”

place predicate of events, the issue of a choice between restriction vs. saturation does not even arise. While one might reasonably conclude that if there is no possibility of saturation, there must be restriction, it is not entirely obvious to us that this conclusion is correct. Unfortunately we must leave further investigation of this issue for the future.

9Another, somewhat different example of a language-specific restriction on incorporation that is sensitive to categorization can be found in the “potentially characterizing” condition on the use of bare (numberless) nouns in Spanish and Catalan (Espinal and McNally, 2011).
Dowty’s point in this discussion was that the *swarm* alternation was not a strictly syntactic phenomenon, but that it correlated with subtle pragmatic differences that serve a specific communicative purpose. Similar remarks can be made about other sorts of incorporation constructions.

The conditions on the locative subject variant of the *swarm* construction are strikingly reminiscent of the uniformity and stereotypicality conditions on the VPs containing temporal FAs we have discussed in this paper. Imagine that it is the case that there are frequently occurring events of Marta baking batches of cookies during the winter months. Depending on the rhetorical structure of the discourse in which we want to report this information, we might choose to use (36a) or (36b).

\begin{align}
(36) & \quad \text{a. Marta baked frequent batches of cookies.} \\
& \quad \text{b. Frequently, Marta baked batches of cookies.}
\end{align}

However, we also would want to ensure that whether we choose (36a) or (36b), the proposition describes the same basic distribution of eventualities. It is the AEEM that guarantees this semantic equivalence.

Obviously, the choice in (36) is not between two argument alternations for a single verb, but rather between an adjectival vs. adverbial modification strategy. Nonetheless, it is likely that existence of these alternatives facilitates much the same pragmatic distinction as the *swarm* alternation, namely that of presenting a distributed set of eventualities as a property characteristic of the subject vs. as something else, for example, as characteristic of a topic time (Klein, 1994).

The stereotypicality condition for purposes of categorization and similar restrictions of the sort Carlson had in mind are found with various phenomena that are restricted to the VP level. As a rule, when these conditions are associated with a construction, we find alternative competing strategies to describe the activity in question (of the sort in (35) or in (36)) where no such condition applies. These include, for example, constructions involving weak (in)definites (as opposed to strong ones) (Carlson, 2003; Carlson et al., 2006; Aguilar Guevara and Zwarts, 2011), adjectival passives in German (which ‘compete’ with verbal passives) (Gehrke, to appear), so-called P-drop in Greek (which ‘competes’ with full-blown PP structures) (Gehrke and Lekakou, 2013), and the so-called general-factual meaning of the Russian imperfective aspect (which ‘competes’ with the perfective aspect) (Mueller-Reichau, to appear). Mueller-Reichau, for instance, argues that the use of Russian factual imperfectives to refer to a completed event is characterized by a marked information structure which the competing construction with the perfective aspect does not have. All of these constructions point to the importance of understanding the roles that information structure and rhetorical structure play in the choice of one or the other strategy when more than one is available.
4. Conclusions

In this paper, we have addressed a systematic exception to the generalization that temporal FAs have to combine with event nouns in order to allow an adverbial paraphrase. We argued that the adverbial reading in these exceptional cases requires that the events described be uniquely individuated by the FA-modified argument, have a uniform structure, and describe stereotypical activities; it further requires the FA-modified nominal to be plural. We have proposed that semantic composition proceeds via semantic incorporation, implemented via a rule of generalized Restrict. Thus, the facts were easily accommodated, requiring no change in the analysis of temporal FAs that we have independently argued for.

Our analysis points to an important similarity between semantic incorporation and Event Identifi-
cation as used by Kennedy (2012) to account for the way measure phrases in nominals measure out events. In so doing, it reveals something deeply common in the way FAs and measure phrases in nominals effect distribution and measurement, respectively, over events. It also reveals that, alongside already recognized structural resources such as argument alternations and the possibility for representing participants with non-referring expressions, natural language can also avail itself of nominally-embedded temporal expressions to help fulfill the general pragmatic function associated with incorporation.

References


Deriving the Two Readings of English Determiner+Adjective

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Abstract. I distinguish two readings of the English Determiner+Adjective construction, one which refers to individuals who have the property ascribed by the adjective (the creative are intrinsically motivated), and one which refers to the property itself as an abstract mass (the familiar is dangerously wonderful). I present a wealth of new data from Web searches showing that the two readings are grammatically distinct, and both quite productive. To derive these two readings, I take inspiration from the neo-Davidsonian analysis of adjectives from Parsons (1990) and Landman (2000), suggesting that adjectives contain an argument for both an individual and a state – an eventuality with the mereological structure of a mass noun. For the individuated reading, I propose a type-shifter that existentially closes the state argument, leaving a predicate of individuals; for the mass reading, I propose a second type-shifter that existentially closes the individual argument, leaving a predicate of states. When adjectives are analyzed with two hooks – an individual argument and a state argument – both readings of Determiner+Adjective can be derived.

Keywords: adjectives, mass substances, stativity, properties, Determiner+Adjective, predication

1. Introduction

In this paper, I focus on an English construction where a determiner combines with an adjective to serve as a DP:

(1) a. The creative are more likely to be intrinsically (internally) motivated
   b. The familiar is something dangerously wonderful

As Kester (1996), Giannakidou and Stavrou (1999) and Goes (2007) have observed, this construction actually has two readings. (1-a) represents what I’ll call the individuated reading, since it seems to refer to a group of creative individuals. (1-b), on the other hand, exemplifies what I’ll call the mass reading, since it seems to denote familiarity as an abstract concept.

In this paper, I first lay out the empirical properties of both readings, expanding on previous explorations. I show that the conceptual difference between the two readings is also manifested grammatically, in that the individuated reading can be used with count determiners and triggers plural agreement on the verb, whereas the mass reading is used with mass determiners and triggers singular agreement. I also demonstrate that the construction is more productive than previous work.

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1I am grateful to Chris Potts, Dan Lassiter, Cleo Condoravdi, and Beth Levin for their advice on this project. Thanks also to Itamar Francez, Andrew Koontz-Garboden, Rebekah Baglini, Gennaro Chierchia, Louise McNally, and Chris Kennedy for extremely helpful comments and inspiration. Finally, I am indebted to two anonymous reviewers and the audience at SuB18 and at California Universities Semantics and Pragmatics (CUSP 6) for their feedback.
would indicate. It involves many different determiners, not just *the*, and it is quite productive.

Next, I suggest that previous analyses from Kester (1996), Giannakidou and Stavrou (1999), Goes (2007), and Chierchia (1998) do not capture Det+Adjective in its full diversity. Then I propose a semantic analysis in which an Adjective Phrase can combine with one of two type-shifters to derive the two readings of Det+Adjective. To preview, I suggest that adjectives have the denotation in (2), with unsaturated arguments for both an individual and a state (Davidson (1967), Parsons (1990), Landman (2000)), where a state is understood as an atomless join semilattice in the domain of eventualities (Link (1983), Baglini (2014)).

\[
\text{adjective} = \lambda x. \lambda s [s \leq \text{adjective-ness} \land \text{holder}(x, s)]
\]

For example, the adjective *creative* would map an individual and a state to *true* if the state is a subpart of *creative-ness/creativity* and the individual holds that state.

Next, I suggest that a type-shifter can close this state argument, leaving a predicate of individuals who hold that state. This predicate of individuals combines with a determiner to yield the individuated reading. To derive the mass reading, I propose a different type-shifter to close the individual argument and yield a predicate of states of *adjective-ness*, the abstract mass eventuality associated with the adjective. This predicate of states combines with a determiner to yield the individuated reading. This analysis ties the type-shifters to arguments that are already independently motivated in the denotation of an adjective. Thus, we can not only derive both readings of Det+Adjective, but also understand why only these two readings would be available.

I also try to relate this analysis to some broader themes. For example, I am inspired by an interesting pattern identified by Koontz-Garboden and Francez (2013) (henceforth F&KG), Baglini (2013) and Baglini (2014). Citing the classification from Dixon (1982) of property concept (PC) lexemes – words that are commonly lexicalized as adjectives in languages that have adjectives – they identify languages where these lexemes surface as mass nouns. In Ulwa, for example, PC lexemes must combine with a possessive morpheme (*ka*) to be used predicatively:

(3) Yang as-ki-na minisih-ka.
    1SING shirt-1SING dirty-ka
    “My shirt is dirty.” Green (1999) via Koontz-Garboden and Francez (2013), their (26)

In Wolof, predication is also expressed as possession (Baglini (2013), Baglini (2014)). For example, “Awa is strong” is expressed as *Awa has strength*, parallel to *Awa has rice*.
As F&KG and Baglini observe, these PC nouns behave in many ways like mass nouns – just like the mass reading of English Det+Adjective. F&KG thus analyze these PC nouns as “abstract mass substances,” so that for example strength characterizes all portions of this abstract property in an atom-less join semi-lattice (Link (1983)). In contrast, Baglini gives eventualities their own type in the ontology (following Davidson (1967), Parsons (1990), Kratzer (1996), Landman (2000)), and proposes that these PC mass nouns denote a special subtype of eventuality known as states, which behave in quite parallel ways to mass substances.

For both F&KG and Baglini, Property Concept predicates are analyzed to contain two arguments, one for the individual that the predicate is true of, and one for the portion of the abstract mass substance (F&KG) or subpart of the state (Baglini) that the individual possesses. Thus, in different ways, these researchers agree that PC predicates need to contain an additional argument reflecting the property ascribed by the adjective and giving it the lattice-theoretic structure of a mass substance. From my perspective, either of these formulations would work equally well; all that matters is that the adjective contains a second argument with a mass lattice structure. I choose to use the term state because there is already a body of work arguing that English adjectives contain a neo-Davidsonian state argument (e.g. Parsons (1990), Landman (2000)).

In a neo-Davidsonian framework (Davidson (1967), Kratzer (1996)), events have their own type in the ontology, and event-describing verbs contain an event argument in their semantics. For example, kill Caesar would be represented as:

\[
\lambda e \left[ \text{ killing}(e) \land \text{ theme}(Caesar, e) \right]
\]

Events are considered to be a subtype of eventualities, an umbrella term for all sorts of happenings including processes (flutter in the wind), achievements (realize Deirdre was gone), accomplishments (build a house) and states (sit, stand, be happy – Vendler (1967), examples from Kearns (2000)).

In such a framework, it is not clear whether all types of eventualities should have an argument in the semantics, or only some of them. States, in particular, are handled differently by different authors, with Maienborn (2007) saying that one subtype of states has a special state argument argument while the other does not, and Parsons (1990) and Landman (2000) arguing that they all do. In this paper, I use Det+Adjective to weigh in on this debate. If adjectives have argument slots for both individuals and states, it seems plausible that a type-shifter might pick up on either one of these arguments – which is exactly what we need to derive both the individuated
and mass readings of Det+Adjective. In this way, the two readings of Det+Adjective serve as further evidence that adjectives need an additional argument in their denotation.

By weaving in these themes, I hope to not just provide an analysis of this one construction, but also to engage bigger questions about how properties are encoded linguistically.

1.1. Road map

The rest of the paper is structured as follows. In Section 2, I introduce the data on Det+Adjective, highlighting the individuated/mass distinction and showing that both readings are extremely productive. In Section 3, I review previous analyses of Det+Adjective, arguing that more needs to be said to capture the full diversity of the construction. Next, in Section 4, I claim – contrary to much literature – that the construction does not necessarily denote a kind. In Section 5, I characterize states formally, showing how they have the mass behavior needed to derive the mass reading of Det+Adjective. In Section 6, I propose a semantic analysis of both readings of Det+Adjective. Finally, I conclude in Section 7.

2. Empirical domain

In this section, I introduce the data on the English Det+Adjective construction. Using web searches, I have been able to find a wealth of new data which show that Det+Adjective is more productive than previous work might suggest, involving diverse determiners and adjectives.

As a methodological note, all of my data come from Google searches conducted between February 2013 and the time of writing. Generally I search strings in quotes. To cull the relevant readings, I sometimes choose coordinations that I think are likely to occur in the Det+Adj construction (“the rich and the poor”). Other times I include a verb, as in “the familiar is”. I have not included URLs because many of them will be inactive at the time of reading. However, using the methodology I’ve sketched, one should be able to find similar data.

2.1. Conceptual differences between the two readings

Det+Adjective has two, conceptually distinct readings. The individuated reading seems to refer to a group of individuals that have the property ascribed by the adjective. It could often be paraphrased as adjective + people or perhaps adjective + ones or + things, but it crucially could not be paraphrased as adjective + ness or any other nominalizing affix:

(6) The cranky are free to shake their fists and tell her to get off their lawn
Could only be paraphrased as cranky people, NOT crankiness

In contrast, the mass reading seems to refer to the property ascribed by the adjective itself. It could be paraphrased as a nominalized form of the adjective, but it could not be paraphrased as adjective + people/ones/things:

(7) The cute is perhaps the dominant aesthetic category of our late-capitalist times
Could be paraphrased as cuteness, NOT as cute people/ones/things

Also, it is often claimed (e.g. Kester (1996), Chierchia (1998)) that the individuated reading refers only to humans. However, this is not what I have found. For example, in (8-a), the weak and the strong refer to weak and strong insects; in (8-b), the fittest could pick out any sort of evolving organism from foxes to pine trees to slime mold; and in (8-c), the shiny indicates shiny new technological devices.

   b. where fascinating creatures and pioneering scientists reveal how the fittest are made
   c. Latest shiny thing, new tech, doesn’t matter. If you don’t have a goal serving both creator and user, attention is misguided. However, the shiny are distracting for a reason.

I conclude that Det+Adjective need not refer to humans. Rather, this comes about as a pragmatic inference, just as runners generally indicates human athletes but could in a certain context pick out non-humans (e.g. greyhounds are fast runners.)

2.2. Productivity

A given adjective can occur in either the individuated reading or the mass reading. For example, the pretty and the silly can occur in both the individuated and mass readings:

(9) a. Individuated: The pretty are expected to achieve [article about lookism]
b. Mass: The pretty is boring. There must be strength and power.

(10) a. Individuated: Quit talking sense! This is LACurbed [website], where the silly are bashed no matter what!
b. Mass: I think the silly is my favourite part of your books
Of course, some adjectives seem to favor one reading over another; adjectives describing human qualities (e.g. generous, intelligent, married) seem to prefer the individuated reading, whereas adjectives describing abstract concepts (infinite, sublime) seem to prefer the mass reading. But the important point is that the adjective’s lexical entry does not fully determine which readings of Det+Adjective it can participate in.

Det+Adjective is also productive with both gradable and nongradable adjectives on both readings. Above, in (9)–(10) for example, I have shown that gradable adjectives participate in both readings. Below, both readings occur with the nongradable adjectives dead, married and geological:

(11) **Individuated reading**
    a. In Tacloban, the dead are being taken to a mass grave in a public cemetery
    b. the laity and the married are underrepresented in the lists of canonized saints

(12) **Mass reading**
    a. “progress” always seems to go in one direction–toward the dead and the dull.
    b. The form of non-linguistic expression that most closely relates to the geological is painting

2.3. Grammatical differences between the two readings

Next, I demonstrate that this conceptual distinction between the two readings of Det+Adjective is also manifested grammatically. The individuated reading behaves as a plural count noun, triggering plural agreement on the verb and appearing with count determiners, whereas the mass reading works like a mass noun, with singular agreement and mass determiners.

Looking first at verb agreement, we see that the individuated reading has plural agreement whereas the mass reading has singular agreement:

(13) **Individuated reading**
    In truth, the lucky are often no more deserving that anyone else

(14) **Mass reading**
    A lot of the fluffy is gone. This blog has gone from a modge podge of crafts, family, nonsense and special needs to mostly special needs

Turning to determiners, my web searches reveal that Det+Adjective is compatible with a wide
variety of determiners beyond just the. For example, both readings can occur with some (15-a)–(16-a) and possessive determiners (15-b)–(16-b).

(15) **Individuated reading**
   a. Some fired say they are so relieved to be jobless just so they can be done with that school
   b. Give me your tired, your poor/Your huddled masses yearning to breathe free (Emma Lazarus’s poem on the Statue of Liberty)

(16) **Mass reading**
   a. Mix some salty with your sweets
   b. Stop! Your nice is infecting me!

Distinguishing the two readings, the individuated reading appears with determiners that select for count nouns, such as many and few (17-a)–(17-b). These determiners appear with count nouns such as dogs (many/few dogs) but not with mass nouns such as rice (*many/few rice). In contrast, the mass reading appears with determiners that select for mass nouns, such as much and little (18-a)–(18-b). These determiners only occur with mass nouns such as rice (much/little rice) but not with count nouns such as dogs (*much/little dog, on the relevant interpretation of little).

(17) **Individuated reading**
   a. Too Many Rich are Unwilling to Share
   b. How about because few rich are philanthropic?

(18) **Mass reading**
   a. My personal opinion is that too much sweet is bad for you.
   b. A little pretty is just what the doctor ordered!

These data further show that the individuated reading is conceptually plural and count, whereas the mass reading is conceptually mass and grammatically singular.

### 2.4. Modification

Finally, on both readings, Det+Adjective can be modified by degree modifiers ((19-a), (20-a)), other adverbs ((19-b), (20-b)), and adjectives ((19-c)–(20-c)).
(19) **Individuated reading**
   a. The extremely wealthy are shifting their investment strategy away from cash
   b. I for one am actually looking forward to having my benefits cut if it means that the happily unemployed are made to tighten their belt too
   c. the stylish young are reclaiming the necktie as their own

(20) **Mass reading**
   a. the very old is new again
   b. the disgustedly cute is something to be loved
   c. you’re on the upside of the healing and most of the mean nasty is behind you

Although I do not explore the syntax of Det+Adjective in any detail here, I think these facts suggest that Det+Adjective needs to contain a full Adjective Phrase to host the degree modifiers and adverbs (so perhaps it should be called Det+AP). This AP may need to be embedded within an NP to explain why it can also be modified by an adjective. I use the N head to house the type-shifters I propose below. Finally, the whole structure needs to be a DP to explain its syntactic distribution. Thus I assume the following structure:

```
(21) DP
   |   NP
   |       |   AP
|       |       |   A
|       |       |
|       |       |
|       |       |
|   D   |

determiner  N  type-shifter  A

adjective
```

To sum up this section, the Det+Adjective data pattern as follows:
### Grammatical behavior of individuated, mass readings of Det+Adjective

<table>
<thead>
<tr>
<th></th>
<th>Individuated reading</th>
<th>Mass reading</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Intuitive meaning</strong></td>
<td>Individuals the adjective is true of</td>
<td>The property itself</td>
</tr>
<tr>
<td><strong>Productive across determiners?</strong></td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Productive across adjectives?</strong></td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Verb agreement</strong></td>
<td>Plural</td>
<td>Singular</td>
</tr>
<tr>
<td><strong>Determiners</strong></td>
<td>Count, plural</td>
<td>Mass, singular</td>
</tr>
<tr>
<td><strong>Adjective can be degree-modified?</strong></td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Adjective can be modified by adverbs?</strong></td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Adjective can be modified by adjectives?</strong></td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

### 3. Previous analyses

#### 3.1. Kester

Next, I review some previous analyses of the construction. First, Kester (1996) investigates Det+Adjective as part of a broader exploration of how empty categories are licensed in DP. She proposes that inflectional morphology is important for licensing pro, a non-pronounced component of DP. Since English determiners and adjectives do not inflect for gender or number, pro cannot be morphologically licensed and thus can only appear in quite limited contexts, deriving only the individuated reading. In contrast, the richer inflection of Dutch licenses pro in more contexts\(^2\), giving rise to the mass reading of Dutch Det+Adjective.

On Kester’s view, the only null noun in English has the default features [+human +generic +plural]. This is because the impoverished inflection of English does not license null nouns, but the default pro does not need to be licensed. Kester believes that default pro underlies Det+Adjective in English. Thus, she predicts that all instances of English Det+Adjective should refer to pluralities of humans in a generic fashion, as in The rich are different. It is very interesting that more richly inflected languages allow more nouns to be left implicit. However, for English Det+Adjective in particular, it seems that Kester’s system does not predict the full diversity of the construction.

#### 3.2. Giannakidou and Stavrou

Giannakidou and Stavrou (1999) (G&S) bring up Det+Adjective to distinguish it from nominal subdeletion (e.g. You take the blue one and I’ll have the red). They focus on Greek, but discuss English too in comparison.

\(^2\)See McNally and de Swart (2011) for a semantic analysis of several Dutch constructions that are reminiscent of English Det+Adjective.
For Det+Adjective, G&S note both the individuated reading (the blind) and the mass reading (the unknown). However, some of their other claims about the English data conflict with what I have found in my web searches, and some of their findings for Greek do not carry over to English. They argue that Det+Adjective is not fully productive, that it resists modification and faces languagespecific lexical restrictions. In contrast, my data suggests that English Det+Adjective is extremely productive, not resistant to modification, and not subject to any lexical constraints.

Turning to the analysis, G&S analyze Det+Adjective as “a kind-denoting nominalization” (296), using the kind-forming ∩ operator from Chierchia (1998). For example, the blind would denote the kind, BLIND PEOPLE. On their account, ∩ is contributed by the definite determiner (312).

As for the mass reading, G&S say that “reference is made . . . to an abstract concept or idea” (298), and that “the items in this construction, like abstract nouns in general, should best be analyzed as mass nouns” (328). I agree and I try to incorporate this insight into my analysis. Since G&S do not explain how the mass reading is to be derived, I try to build on their analysis in this regard.

3.3. Goes

For Goes (2007), French Det+Adjective is an example of a blurry continuum between lexical categories. Whereas traditional syntax holds that every word in a sentence is labeled with a concrete lexical category – e.g. noun, verb, adjective, preposition – Goes suggests that these categories can be “distorted” or “converted.” According to Goes, distortions are somewhat rigid and stylistically marked, whereas conversions are flexible, productive and unmarked. He proposes many diagnostics to distinguish distortion and conversion.

Goes also notes both the individuated and the mass reading of Det+Adjective for French. According to Goes, the individuated reading of Det+Adjective may represent distortion or conversion depending on how the particular construction patterns with respect to the diagnostics he proposes. The mass reading represents distortion because it passes some of his distortion diagnostics: for example, one cannot say ce triste “this sad” or beaucoup de triste “a lot of sad.”

To sum up, Goes notes both the individuated reading and the mass reading and studies the grammatical behavior of each in great detail. His distinction between distortion and conversion is interesting because it challenges the common assumption that every word fits into exactly one lexical category in any given syntactic context. But since Goes does not provide a compositional account of the semantics, there is room to build on his proposal as well.
3.4. Chierchia

The final analysis I review comes from Chierchia (1998), who considers the individuated reading of Det+Adjective – e.g. the rich – as part of his inquiry into how kinds are formed across languages. He argues that this reading of Det+Adjective denotes a kind, RICH PEOPLE. In his syntactic proposal (394), the adjective modifies a null noun, $\Delta$. $\Delta$ is syntactically plural and count. Semantically, it is “a function that applies to adjectival meanings to return something true of the totality of people having the property ascribed by the adjective,” for example turning rich into a characteristic function of the plural, count totality of rich people.

Having posited this structure, Chierchia returns to the main theme of his paper and asks why the is needed to turn Det+Adjective into a kind when English allows other NPs to be turned into kinds without a determiner, as in Dogs are smart. He concludes that “phonologically null items must somehow be licensed” (395), meaning that they must stand in a special syntactic relationship to some other item to be grammatically well-formed. To license the silent $\Delta$, Chierchia argues that we need the determiner the.

Chierchia’s proposal is attractive because it explicitly guarantees the plural, count behavior of the individuated reading. However, since he does not mention the mass reading, I think we need a more liberal system to derive both readings of Det+Adjective in their full diversity.

To sum up this section, I have presented previous analyses of Det+Adjective and pointed out where I think we can improve. Before I turn to my own analysis, I address a theme that has come up in three of the four analyses I’ve sketched: that Det+Adjective denotes a kind or is somehow inherently generic (Kester (1996), Giannakidou and Stavrou (1999), Chierchia (1998)). In the next section, I explain why I am not convinced by this idea.

4. Kinds

Det+Adjective might seem to denote a kind because it often occurs as a subject to generic predicates – predicates that make general statements, such as extinct or smart, as opposed to episodic statements about concrete happenings, such as be in my yard right now or said hello to me yesterday. However, we also find many examples of the construction with a predicate that does not seem to be kind-selecting:

(22) *Individuated reading*

a. Further up the street, the wealthy shopped, dressed in purples and greens
b. The young cried and clung to their mothers

(23) *Mass reading*
a. The pretty made me do it [buy a lot of stuff at a fabric store]
b. Will probably scrap this [photo] later . . . but the cute made me upload it anyway.

In these contexts, it is not clear that Det+Adjective denotes a kind. Rather, it seems more plausible that Det+Adjective denotes a particular group of individuals with the property in the individuated reading (some particular wealthy people), and a particular portion of the property in the mass reading (some particular instantiation of cuteness).

As further evidence that Det+Adjective is not kind-denoting, we can look to determiners. In English, kinds can be denoted by bare nouns (dogs are intelligent), definite singulars (the dog is intelligent), and – with a slightly different meaning (Lawler (1973), Krifka (2003)) – indefinite singulars (a dog is a mammal). But crucially, kinds cannot be denoted by definite plurals, nor by quantifier DP’s headed by some, many or much, nor by possessives. As we have seen, Det+Adjective can occur with all of these determiners. Since these determiners are not thought to select kinds, it seems that Det+Adjective cannot be inherently kind-denoting.

In light of these data, I argue that Det+Adjective does not necessarily denote a kind. When it does denote a kind, as in the pretty are expected to achieve or the pretty is boring, I suggest that the definite determiner contributes the \( \cap \) operator (which forms a kind) rather than the usual \( \iota \) operator (which simply picks out the unique, maximal, existing individual that the description is true of). This analysis explains how the+Adjective can denote a kind without requiring that Det+Adjective must always do so.

5. States and adjectives

The semantic literature is conflicted over how to analyze adjectives (e.g. Kamp (1975), Klein (1980), Kennedy (1999)). Since gradable adjectives such as tall and expensive depend heavily on context, the main debate focuses on how to capture this context-sensitivity. Here, though, I assume that (gradable and nongradable) adjectives are type \( \langle e, t \rangle \), just for simplicity, and instead focus on a different issue: whether adjectives ought to contain a state argument in their denotation. This idea extends the neo-Davidsonian analysis of events, in which events contain a special argument at logical form, to states (e.g. Parsons (1990)). Endorsing this view, Parsons gives adjetival predication the following logical form:

\[
\exists s [s \text{ is a state of being clever} \land \text{Subj}(s, \text{Brutus}) \land \text{Hold}(s, \text{now})]
\]

The most convincing argument for this analysis (Parsons (1990), Landman (2000)) comes from entailment patterns with modification – based on Davidson’s original arguments for an event variable (Davidson (1967)). As illustrated in (25), a stative predicate with modifiers entails the same
predicate with the order of the modifiers switched ((25-b)) or with one or both of the modifiers dropped ((25-c)–(25-e)).

(25)  
   a. Amanda was happy in Paris on vacation.  
   b. Amanda was happy on vacation in Paris.  
   c. Amanda was happy in Paris.  
   d. Amanda was happy on vacation.  
   e. Amanda was happy.

Unless one posits that happy contains a state argument in its denotation, this inference pattern is difficult to capture. As Landman (2000) discusses in detail, one would have to write meaning postulates to specify that the modifiers can be reordered or eliminated while preserving truth. Moreover, these rules would have to be expanded to capture an arbitrary number of modifiers. Such meaning postulates, Landman points out, are unwieldy and ad hoc.

In contrast, if happy and other statives contain a special state argument, these inferences are captured in a perspicuous manner:

(26)  \[ \exists s[ \text{happiness}(s) \land \text{holder}(Amanda, s) \land \text{in-Paris}(s) \land \text{on-vacation}(s) ] \]

In other words: there is a state of happiness $s$ and Amanda holds $s$ and $s$ is in Paris and $s$ is on vacation. Since conjunction is associative (order doesn’t matter) and entails all of the conjuncts, the inferences in (25) follow.

Zooming out, states – discussed by Aristotle and incorporated into theoretical linguistics by Lakoff (1970) – are one type of eventuality, an umbrella term for any linguistic characterization of something that happens or some way that things are. Whereas other types of eventualities involve endpoints (run a mile) or transitions (realize something), states do not have any inherent endpoint or transition, making them atelic and homogeneous. Moreover, whereas other types of eventualities can happen instantaneously (realize something *for five minutes, win a race *for a minute), states take time: she was happy for ten years. Thus, states are durative.

These ontological and grammatical properties of states are reminiscent of mass nouns. Since we have seen that the mass reading of Det+Adjective functions as a mass noun, this parallel will be important later on. For example, the state of being happy has no inherent beginning or end. In the same way, water has no inherent shape or boundary. Like states, mass nouns display the subinterval property: if x is water, then any subpart of x (down to the molecules) is also water.
To sum up, states are a type of atelic, durative, homogeneous eventuality. To put it formally, states lie in the domain of “mass eventualities” (Baglini (2014)). Mass eventualities have the same algebraic structure as mass nouns – a join semi-lattice without atoms (Link (1983)) – but inhabit the domain of eventualities rather than the domain of individuals.

A state \( S \) is a non-empty set of portions arranged in a join semi-lattice with no bottom element. Subparts of \( S \) are ordered by a relation \( \preceq \), the “part-of” relation. Any two portions of substance can be “fused” to create a larger portion of the substance.

Next, states are homogenous, meaning that they are both divisive and cumulative (Moltmann (1991), Baglini (2014)). \( P \) is divisive if and only if, for all \( x \) and \( y \), if \( P(x) \) is true and \( y \) is a subpart of \( x \), then \( P(y) \) is true (Krifka (1989)). \( P \) is cumulative if and only if, for all \( x \) and \( y \), if \( P \) is true of \( x \) and \( y \), then \( P \) is true of the join of \( x \) and \( y \). Finally, \( P \) is homogeneous if and only if it is divisive and cumulative (Moltmann (1991)).

Characterized in this way, states are given their own type in the ontology (here, type \( s \)). They are one of the basic types used to build adjectival meanings such as:

\[
\text{[happy]} = \lambda x \lambda s [s \preceq \text{happiness} \land \text{holder}(x, s)]
\]

This denotation is slightly different from the one given by Parsons (1990). Parsons would write \( \text{happiness}(s) \) rather than \( s \preceq \text{happiness} \), as I have written here. This is because Parsons does not focus on the algebraic structure of states. On the current picture, \( \text{happiness} \) is not a single entity but a cascade of smaller and smaller portions of the homogenous, static eventuality of \( \text{happiness} \), as reflected by the \( \preceq \) notation.

If states have arbitrarily small portions, then one might object that \( \text{Mary is happy} \) could be considered “true” even if Mary holds only a minuscule subpart of the state of happiness. To handle this context-sensitivity (discussing “portions” rather than “states,” but invoking the same issue), F&KG point out that it is extremely uncooperative, perhaps even false, to claim that one possesses a mass substance when one has too little of it to be relevant for the present purpose (Travis (1989)). To use Travis’s example, it would be uncooperative to offer coffee and then add that \( \text{There’s milk in the refrigerator} \) when there are only a few drops on the shelf. This pragmatic principle ensures that \( \text{Mary is happy} \) will not be a cooperative utterance unless Mary has a contextually significant portion of happiness.

Also, I assume that when \( \text{happy} \) is used predicatively, the state argument is existentially closed at the level of VP, so that \( \text{Mary is happy} \) means that there exists a state of happiness that Mary holds. As discussed above, this will only be a cooperative utterance if this state of happiness is significantly large. However, for Det+Adjective, the state argument need not be existentially closed, as we will see shortly.
Now that I have introduced states both intuitively and formally, I return to the main thread. As we saw earlier, the mass reading of Det+Adjective behaves like a mass noun. States, we have just seen, behave similarly to mass nouns as well. To bring us to English Det+Adjective, I propose in the next section that if we analyze adjectives with a state variable, we can explain both readings of English Det+Adjective using simple type-shifters. We can also shed light on why the individuated and mass readings are both available – because they each target a different argument (the individual e argument for the individuated reading, the state s argument for the mass reading) that is already available in the denotation of the adjective.

6. Analysis

When adjectives are analyzed with an individual argument and a state argument, then either of these two arguments can be closed to yield a predicate of individuals (what we need for the individuated reading) or a predicate of states (what we need for the mass reading). I assume that adjectives have the denotation given in (28-a), where an adjective takes an individual and a state and asserts that the state is a subpart of the abstract mass eventuality associated with the adjective and the individual holds that state. Using this denotation, I propose two type-shifters to yield the two readings of Det+Adjective:

\[
\begin{align*}
\text{a. } & \text{[adjective]} = \lambda x \lambda s [s \preceq \text{adjective-ness } \land \text{holder}(x, s)] \\
\text{b. } & \text{[nom-indiv]} = \lambda A_{(e,(s,t))} \lambda x \exists s A(x)(s) \\
\text{c. } & \text{[nom-mass]} = \lambda A_{(e,(s,t))} \lambda s \exists x A(x)(s)
\end{align*}
\]

To illustrate how the individuated reading is derived, we can consider an example like the creative are more likely to be intrinsically motivated. Since the predicate are more likely to be intrinsically motivated seems like a kind-selecting predicate, we use the kind-forming denotation for the, \( \cap \), as opposed to the object-selecting one, \( \iota \).

First, creative combines with nom-indiv to yield a predicate of individuals for which there exists a state of creativity that the individual possesses (\( \lambda x \exists s [s \preceq \text{creativity } \land \text{holder}(x, s)] \)). This predicate is now type \((e, t)\) and can combine with \( \cap \) like any other predicate of individuals to yield the kind, CREATIVE INDIVIDUALS, associated with that predicate (following Chierchia (1998)). On this derivation, the creative picks out the maximal plurality of creative individuals in any given situation or world, which seems to capture the meaning of this construction. We still need to stipulate that this group of individuals has a cardinality greater than one, since the creative cannot denote a single rich person, and we still need to explain how the semantic plurality of the creative is manifested in plural syntactic agreement. But it seems that the correct meaning has been derived.

This meaning is consistent with the count behavior of the individuated reading. Since a plurality of individuals is grammatically count and plural, we see why the individuated reading goes with count determiners. If we assume that grammatical agreement reflects a noun’s semantic plurality
which I do not have space to justify here – then this analysis would also explain why the plural, count individuated reading triggers plural agreement on the verb.

Turning to the mass reading, we again use the denotation of adjectives given in (28-a), but this time we use the nom-mass type-shifter. To derive the familiar is dangerously wonderful, we again use the kind-creating denotation for the –∩ – as opposed to the object-selecting denotation, ∩, because the predicate seems to be kind-selecting.

Here, we apply nom-mass to familiar. The result is a predicate characterizing all states of familiarity that are held by anyone: \( \lambda s \exists x [ s \leq \text{familiarity} \land \text{holder}(x, s) ] \). This predicate is now a function from states to truth values – type \( \langle s, t \rangle \). If we generalize Chierchia’s \( \cap \) so that it can apply to predicates of states as well as predicates of individuals, we can apply \( \cap \) to this predicate of states of cuteness and arrive at the kind FAMILIARITY, the maximal portion of familiarity in any given situation. Thus, the whole sentence seems to indicate that FAMILIARITY is dangerously wonderful, which seems to be the correct meaning. Moreover, since the familiar is a maximal portion of a mereological mass, we can understand why it has the grammatical behavior of other mass substances.

7. Conclusion

To conclude, I step back to tie together all the themes that I have been integrating into this study of Det+Adjective. In terms of data, my analysis captures the diverse Det+Adjective constructions that I illustrated in Section 2, predicting both readings of Det+Adjective and explaining why they differ grammatically. It correctly predicts that Det+Adjective may occur productively across adjectives and across determiners, and need not denote humans even on the individuated reading. It allows that Det+Adjective can denote a kind (in which case the kind-forming determiner the is used) or not (in which case it occurs with the object-selecting the or any other determiner). Thus, I believe this analysis captures all the data I have presented.

Next, I have tried to relate English Det+Adjective to languages with Property Concept mass nouns, such as Ulwa and Wolof. I have argued that Ulwa and Wolof provide evidence that properties can be conceptualized as abstract masses – in particular, as Baglini claims, in the domain of eventualities – and suggested that English is realizing this same possibility with the mass reading of Det+Adjective. I have used the formal machinery in the work of F&KG and Baglini to specify what states are and how they are structured algebraically, and I have argued that English adjectives have arguments for both individuals and states, but normally existentially closes the state argument, whereas Ulwa/Wolof Property Concept nouns denote states and acquire their individual argument through possessive morphology. Thus all these languages are invoking the same tools in order to express properties and predication.

Finally, I have shown one more advantage to positing state argument in the denotation of an adjective. This move allows us to posit two symmetrical type-shifters for the two readings of English
Det+Adjective. Since each type-shifter closes an argument that is already present, it is easy to see why there are not arbitrarily many adjectival type-shifters, but only the two used in Det+Adjective.

To sum up, this paper has provided a wealth of new data about an interesting, understudied construction. This relatively obscure construction has helped to shed light on some larger issues in semantics, such as how adjectives and eventualities are best represented in logical form, and more broadly, how properties are encoded across languages.

References


Individuating the Abstract
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Abstract. Despite the vast count-mass literature, determining why an abstract noun is countable (arrival) or uncountable (happiness) remains largely unexplored territory. This paper examines several proposals which attempt to derive the countability of deverbal nouns from some aspect of the derivational source, including the well-known hypothesis by Mourelatos (1978) relating countability to aktionsart: nouns derived from states/activities are uncountable, while those derived from accomplishments/achievements are countable. Broad-scale corpus work shows that such hypotheses are not borne out. A second study of abstract nouns from four different semantic domains (bodily states and mental states (sleep), mental properties (intelligence), behavioral properties (kindness) and psych-nouns (irritation, fear)) demonstrates that the noun’s interpretation in a given context determines its countability, in turn influenced by a complex set of factors including lexicalization patterns, ontological contrasts, and world knowledge.

Keywords: abstract nouns, countability, mass, property concepts, aktionsart

1. The challenge of abstract nouns for theories of countability

Despite the vast literature on the count-mass distinction, the exact nature of what guides countability for abstract nouns is currently little understood. Although a wide variety of positions have been taken on which contrasts underlie countability, most theories of countability primarily consider nouns designating concrete entities, such as dog, water, or furniture. Facts about these types of objects are often taken to be important for countability in general—for instance, the ontological contrast between objects and substances, on some accounts, is relevant for the contrast between countable and non-countable nouns, respectively (Link, 1983). Yet, it is unclear how most of these theories can be extended to abstract nouns such as peace or justice. Different researchers have taken different stances as to whether their treatment of the countability of nouns for concrete entities can be extended to abstract entities: Link (1983) sets up a system which is only concerned with concrete objects (and likewise in Grimm (2012) I give a disclaimer at the outset that my analysis only extends to concrete nouns), while Chierchia (1998, 69) claims that his system would extend to abstract terms, yet only devotes a paragraph to it. Despite the meager attention paid to the countability of abstract nouns, it is vital to come to an understanding of these nouns since their behavior frequently goes against the grain of purported generalizations of countability. For instance, abstract nouns often counter-exemplify properties which are, at least in the formal semantics literature, typically taken to be sufficient to distinguish countable and non-countable nouns.

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1This paper has benefited from discussions with Jason Grafmiller, Bryan Leferman, Beth Levin, Louise McNally, and Roberto Zamparelli. I would also like to thank the audiences at Sinn und Bedeutung 18, as well as at the 2012 LSA and at the Faculty of Arts, Masaryk University, Brno, Czech Republic and at the Center for Mind/Brain Sciences, University of Trento, both in November 2013. All errors are my own.
The work of Quine (1960), Cheng (1973), Link (1983), and those following them, all couch their explanations of the countable/non-countable distinction in second-order mereological properties such as atomicity in (1), which distinguishes countable nouns, and cumulative and divisibility, which distinguish non-countable nouns, given in (2) and (3).

(1) $\text{Atomic}(P) = \forall x [P(x) \rightarrow \exists y [y \leq x \land \text{Atomic}(y, P)]]$

(2) $\text{Cumulative}(P) = [P(x) \land P(y) \rightarrow P(x \oplus y)]$

(3) $\text{Divisive}(P) = \forall x [P(x) \rightarrow \forall y [y < x \rightarrow P(y)]]$

All of these properties have wide enough coverage in the domain of concrete objects as well as sufficient intuitive appeal that many researchers continue to countenance their well-known problems. Yet, the application of these properties to abstract nouns gives rise to even more difficulties, since the counter-examples become more plentiful and the intuition behind the application of these properties is often absent for various abstract nouns. For instance, the property atomicity picks out those entities in the world for which no proper part of that entity falls under the same description as the entity itself. Explaining countable nouns as related to atomicity of course performs adequately for cases such as dog. Yet, many strictly countable abstract nouns often do not obey this principle: eventive nouns such as a trip may contain many smaller trips (e.g. a long trip through the Caribbean may contain many short day trips onto different islands) and in the same way a requirement may be comprised of several requirements. Even the choice to use part-structures in the first place, which is entirely natural for representing concrete objects where the parts are straightforward to determine, becomes much less natural for nouns such as resentment or dissent, where it is not clear exactly what the criteria are for determining what constitutes a part.

Abstract nouns fit just as awkwardly with several other claims about the general nature of countability. For instance, many researchers have suggested that nearly all nouns have countable and non-countable uses and have further claimed that flexibility of nominal interpretation to be a hallmark of nominal reference (Pelletier and Schubert, 2004; Borer, 2005; Chierchia, 2010). Yet, unlike the canonical examples where discrete concrete entities may be reinterpreted as substances, as shown in (4-a), many event nouns are very difficult to “grind”, as already noted by Ware (1975) and shown for arrival in (4-b). Further examples are easy to find, such as trick, act, blink, smile, or run.

(4) a. There was dog all over the road.
   b. ??There was arrival all over the airport.

Although data from abstract nouns has not been directly confronted in the countability literature,
several researchers have discussed the countability of deverbal (abstract) nouns and have related the countability of the derived noun to some aspect of the derivational source. In section 2, I examine three hypotheses relating to the countability of deverbal nouns, none of which hold up under closer empirical scrutiny. In section 3, I present several small case studies showing how particular countability contrasts follow from semantic contrasts relevant to the domain at hand, but which are nonetheless distinct from nearly all the semantic contrasts which are typically assumed to underlie countability. The upshot will be that no single, overarching generalization determines countability for abstract nouns. Instead, several more local generalizations tied to semantic domains can be observed to be in effect. This paper will not exhaust the countability contrasts present for abstract nouns, but will hopefully stake out several paths for future research.

2. Derivational approaches

This section discusses three hypotheses that relate the countability of an abstract noun to some facet of its derivational history. I examine (i) whether countability can be derived from the aktionsart of the verbal base, (ii) whether the derivational suffix has a determinate influence on the derived noun’s countability and (iii) whether if a nominalization has arguments, i.e. is a complex event nominal in the sense of Grimshaw (1990), then it is non-countable. The data show that none of the phenomena is fully predictive of a noun’s countability status.

2.1. The Aspectual hypothesis

A large number of authors, such as Mourelatos (1978), Bach (1986), Krifka (1989), Jackendoff (1991), and Brinton (1998) among many others, propose a “cross-categorial” analogy between the categories of verbal aktionsart and nominal countability. All of these theories vary in the exact analogies they make between the verbal and nominal domain, yet they agree on the basic analogy between discrete events (accomplishments and achievements) and count nouns in contrast to activities and states and non-count nouns. This section investigates a strong claim related to the cross-categorial analogy: the aktionsart of a deverbal noun’s derivational source determines the noun’s countability status.

The connection between aspect and countability was first argued for in detail in Mourelatos (1978), which asserts that a strict correspondence between verbal aspect and nominal number can be found in nominalization patterns: “Corresponding to an event predication there is a nominalization equivalent in which the original verb appears as a gerund or deverbative noun (suffixes typically -ion, -ment, -al, -ure) that governs an existential construction of the verb “to be.” If the number of occurrences is specified by an adverb in the original version, the number appears as a cardinal numeral modifying the gerund in the nominalized version. If the number is not specified, the existential construction has the characteristic import of the existential quantifier, “There is at least one...” (p. 425) The examples from Mourelatos (1978, p. 425) below demonstrate the intended
equivalence.

(5) a. Vesuvius erupted three times. ↔ There were three eruptions of Vesuvius.
b. Mary capsized the boat. ↔ There was a capsizing of the boat by Mary.

Mourelatos goes on to argue that such transformations are not possible with process or state predications, as shown in (6). Instead, process and state predications require “mass-quantified transcriptions”, as shown in (7).

(6) a. John hates liars. ↔ There is a hating by John of liars.
b. Helen dominates her husband. ↔ There is a dominating by Helen of her husband.

(7) a. John hates liars. ↔ There is hate by John of liars.
b. Helen dominates her husband. ↔ There is domination by Helen of her husband.

Similarly, Brinton (1998, 37) explicitly puts forth that the aktionsart of a verb determines the countability of any noun derived from it. Verbs designating states and activities derive non-countable nouns (*live > a quantity of/*one living and *run > much/*a running), while verbs designating accomplishments and achievements derive countable nouns (*perform > *a good deal of/*one performance and *arrive > *much/an arrival).

The examples given by the various authors are initially persuasive, yet it remains to be seen whether this hypothesis can be maintained across the lexicon—for such examples only provide evidence for a tiny portion of the larger population of nominalizations. I will use two databases to examine if there is a straightforward relation between aktionsart and countability. First, the CELEX database (Baayen et al., 1993) provides derivational and compositional structure of English words along with syntactic information such as word class and word class-specific subcategorizations. Importantly, CELEX provides a classification of nouns into countable and uncountable, as well as into minor categories such as pluralia tantum and group nouns. Second, the LCS database (Dorr, 2001) contains “Lexical-Conceptual Structures” organized into semantic classes that are a reformulated version of those in Levin (1993), and further contains a classification of verbs in terms of aspectual category (Dorr and Olsen, 1997).

I extracted from the English portion of CELEX the set of deverbal nouns along with all information relating to noun’s derivational history and countability, e.g. for the noun *adoration* I extracted the information that it was derived from the verb *adore* with the suffix *-ation* and was classified as uncountable. I hand-corrected the extracted nouns, as it was necessary to exclude many items, e.g. duplicates (*lender* and *money lender*) or cases such as *combination-lock*, which is listed as derived from *combine*, but which is not a noun relevant to the hypothesis at issue. From the
LCS database, I extracted aspectual information for each predicate. I also excluded all the entries where there was ambiguity in the countability or aspectual classification, setting aside nouns which CELEX classified as both countable and uncountable and predicates which the LCS database classified as having multiple aspectual categories. The final database had 1975 nouns.

Figure 1 displays the relation between countability classification and aktionsart categories for derived nouns in this database. The primary result visible in the figure is that countable interpretations dominated in general, regardless of the aktionsart class of the base verb. This is clearly unexpected under the aspectual hypothesis. Had there been an influence of aktionsart, a greater number of exclusively non-countable nouns than exclusively countable nouns would have been visible for the state and activity categories. Still, a very weak form of the hypothesis was (partially) validated in as much as states have proportionally fewer exclusively countable nouns than, e.g., accomplishments (χ² = 4.9, df = 1, p < 0.05). Overall, the analyses which make a link between aktionsart and countability seem to be pointing out something valid, for as will be discussed in section 3 nouns which refer to states are very often non-countable, but the landscape is much more complicated than a strictly derivational analysis would indicate. This is further complicated in that the hypothesis is silent on the many nouns, around one third of the total in this study, which have both countable and uncountable uses.

2.2. Patterns of deverbalization

Brinton (1998) puts forth a separate claim relating a deverbal noun’s countability status to the means by which it is deverbalized. Brinton (1998) claims that latinate suffixes, such as -age, -al, -ion, -ment, and -ure, preserve the aktionsart of the verbal source. The examples in (8) are reproduced from Brinton (1998, 47) and are intended to demonstrate this claim for the latinate suffixes.

(8) a. State and activity sources: a lot of guidance/*several guidances, some leakage/*many leakages
    b. Accomplishment and achievement sources: a few conquests/*an amount of conquest, an appearance/*much appearance

In contrast to latinate suffixes, Brinton (1998) argues that zero-derived nominalizations consist in primarily countable nouns, and thus that “this deverbalizing device is a means of converting the situation into an event (an accomplishment, achievement or semelfactive) by adding the feature of telicity; this is a shift from mass to count” (p. 49).²

²Brinton (1998) also hypothesizes that -ing does affect the underlying aktionsart, “converting a situation into an activity, of making the situation durative, atelic, and dynamic” (p. 48). My dataset did not allow me to properly test this aspect of her hypothesis.
Figure 1: Distribution of countable and non-countable nouns across aktionsart categories for derived nominals.
The data assembled in section 2.1 did not support a view upon which the countability status of a
noun could be calculated from the aktionsart of the verbal source and the suffix. Quite often, for a
given type of derivational source and a given suffix, one finds conflicting outcomes. For instance,
resent and require are both stative and classified as such in the LCS database, but resentment is
uncountable while requirement is countable.

Table 1 shows the distribution of countable and uncountable nouns in CELEX by suffix. Here, for
completeness, I have included the data for nouns that were considered countable and uncountable.
As can be seen in the table, when considering only pure countable and uncountable classes, many
affixes show strong biases towards one of the two classes. Yet, there is much variation and few
absolutes that can be seen at the level of granularity of this study.

Space prohibits discussion of each suffix, but overall, closer examination showed that the count-
ability preference ultimately follows from the nature of the referent. The clearest pattern in the
data is that -ant, -er and -or, all of which typically produce agent or instrument nominalizations
such as winner, are nearly all exclusively countable. Still, there are exceptions such as thinner, as
in “paint thinner”, which is uncountable due to the fact that it is a liquid.

Turning to zero-derived nouns, Figure 2 shows the distribution of nouns according to countability
classes and aktionsart for zero-derived nouns. The distribution is very similar to that of all nouns
in Figure 1, and so the data does not support a closer association between zero-derived nouns and
countable interpretations than is the general case for derived nouns. Further, there are many nouns
which are both zero-derived and non-countable, such as blame, chatter, dissent, or swagger, which
do not support the hypothesis that zero-derivation results in adding a feature of telicity.

In sum, the pattern of deverbalization did not appear to have a completely determinate effect on
the countability of the derived noun, even if sizable biases were present for particular suffixes as
witnessed by -er or -or.

<table>
<thead>
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<th>-age</th>
<th>-al</th>
<th>-ance</th>
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<th>-er</th>
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<th>-ion</th>
<th>-ment</th>
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<td>8</td>
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<td>41</td>
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<td>5</td>
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<td>12</td>
</tr>
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</table>

Table 1: Distribution of Count and Non-Count Nominalizations by Deverbalizing Suffix
Figure 2: Distribution of countable and non-countable nouns across aktionsart categories for zero-derived nominals
2.3. The ‘Complex Event Nominal’ hypothesis

A very different literature on deverbal nouns sets out yet another hypothesis for deriving the countability of deverbal nouns from their verbal source. Grimshaw (1990) argues nominalizations are ambiguous between different readings, exemplified in (9), reproduced from Alexiadou and Grimshaw (2008). Examination is a complex event nominal (CEN) by virtue of having a “complex event interpretation” (involving participants) in (9-a), while examination in (9-b) is argued to refer to an event without an articulated event structure. In (9-c), examination refers to a physical object, again not possessing event structure, thereby lacking arguments.

(9) a. The examination of the patients took a long time. (CEN-nominal)
    b. The examination took a long time. (Simple Event Nominal)
    c. The examination was on the table. (Result Nominal)

Grimshaw (1990) argues that a cluster of properties distinguishes CEN-nominals from non-CEN-nominals, whether Simple Event Nominals or Result Nominals. One of these properties is number: CEN-nominals purportedly only occur in the singular, i.e. are “mass” nouns, while Simple Event Nominals or Result Nominals do have a singular/plural contrast.

Grimm and McNally (2013) conducted a corpus study on deverbal nominalizations, using the COCA corpus (Davies, 2008), collecting samples of up to 1000 instances of 150 different nouns with CEN-nominal uses. Their results showed that the alleged correspondence between nominalizations with and without arguments and the ability to pluralize was not empirically accurate. First, many CEN-nominals (20%) were observed to occur at least once in the plural. More generally, the presence or absence of an argumental prepositional phrase had no effect on its occurrence in the plural. Nouns with high rates of singular (plural) occurrences when PPs were present also had high rates of singular (plural) occurrences when no PPs were present. For instance, 98% of the occurrences of allegation, both with and without an of-phrase, were singular, while for observation, 46% of the occurrences, with and without an of-phrase, were singular. Grimm and McNally (2013) determine for nearly all the nominalizations considered, there is no significant difference between the number of occurrences in singular and in plural of the CEN-nominal and the number of occurrences in singular and in plural of the non-CEN-nominal. (The only exceptions were application, assessment, and examination—all of which have substantive uses in a non-eventive result reading.) The conclusion of this study is again that no overarching derivational pattern is directly responsible for a deverbal noun’s countability status.

3. Count/non-count contrasts across different lexical semantic classes

The negative results of the preceding section might cause skepticism as to whether systematic principles of countability can be elucidated for abstract nouns. This was the conclusion reached by
Payne and Huddleston (2002) who provide an insightful and wide-ranging discussion of countability, during which they briefly consider the countability of abstract nouns, noting the several types of polysemy. Payne and Huddleston (2002) observe that many abstract nouns are polysemous between an abstract, non-countable interpretation and an eventive, countable interpretation, which they demonstrate with the examples in (10) in contrast to the examples in (11) where the extension to eventive readings does not obtain (Payne and Huddleston, 2002, 337).

(10) a. Considerable injustice was revealed during the enquiry.
    b. Two fundamental injustices were revealed during the enquiry.

(11) a. Serious harm was done to the project’s prospects.
    b. *Two serious harms were done to the project’s prospects.

Payne and Huddleston (2002, 337) conclude that “... this extension is not regular and predictable. Although events in which injustice is instantiated are countable, events in which harm is instantiated are not.” They then claim that the same pattern is observed with deverbal abstract nouns, as in (12) and (13)\(^3\).

(12) a. Full discussion of the land in question is vital.
    b. Two discussions of the land in question took place.

(13) a. Permission is required.
    b. ?Two separate permissions are required.

One may argue that perhaps the comparison set up between injustice and harm is not valid, since they are two very different words for which a number of factors may come into play. Yet, it is possible to find even more acute minimal pairs which make the same point. For instance, although injustice has an eventive countable reading, justice does not, as given in (14).

(14) *Two considerable justices were achieved during the enquiry.

It is difficult to conceive of an a priori reason why justice and injustice should contrast so clearly: both words presumably agree as to the type of meaning conveyed on their non-countable abstract readings. It is unclear on any strictly derivational account why one would allow countable readings but the other not.

\(^3\)Although it is possible to find plural forms of permission, especially in documentation concerning permissions for computer files, these uses are clearly not eventive.
Payne and Huddleston (2002) go on to observe that abstract nouns may also have a “result” sense, and claim that “nouns which denote results ... are generally more countable than those denoting events” (p. 337), which they exemplify with (15).

(15) a. Necessity is the mother of invention. [abstract, non-count]
    b. There were two separate inventions of the light bulb. [event, count]
    c. Edison was honoured for three separate inventions. [result, count]

Again, this may not be a very telling example, for the particular meaning of invention guarantees that it is overwhelmingly used to describe unique events, since entities are (typically) invented only once. If a plausible context is provided, a countable reading is possible, as in (16).

(16) Oftentimes when an inventor in one part of the world begins working with one idea, other inventors simultaneously and independently develop similar ideas. This happened with the inventions of calculus (Leibnitz and Newton) and the electric light bulb (Edison and Swan). (from Automated Lighting: The Art and Science of Moving Light in Theatre, Live Performance and Entertainment by Richard Cadena, via Googlebooks.)

Thus, it remains an open question whether a result sense of an abstract noun, in and of itself, is more countable than an event sense of an abstract noun.

The next sections of this paper examine different shifts in meaning and countability status by examining different lexical semantic domains. I provide three brief case studies based on corpus work of different lexical semantic domains that reveal even more ways in which abstract nouns can be individuated. I argue that the countability of abstract nouns is determined in different ways depending on the lexical semantic domain at issue. When remaining within a particular domain, principled patterns of polysemy emerge. I then provide a sketch of how these patterns can be incorporated into formal semantic systems as appropriate.

For this second set of studies, I examined countability contrasts in four semantic domains: bodily states and mental states (sleep), mental properties (intelligence), behavioral properties (kindness) and psych-nouns (irritation, fear). I selected 10 different nouns for each of the domains. To base the selection of nouns in an independent categorization of nouns, I selected nouns falling under relevant WordNet (Princeton University, 2010) categories, e.g. noun.cognition and noun.feeling. Then for each of the nouns, I examined up to 200 singular and 200 plural occurrences within the COCA corpus, although many nouns had far fewer occurrences. When I did not find any countability contrasts present in the COCA corpus, I then supplemented these searches with Google searches.
Even though these nouns are of quite a different type than typically investigated in the countability literature (viz. dog or water), I have attempted to integrate these observations into a formal treatment which retains the spirit of the traditional analyses. In the following, I assume a standard mereological framework for objects and events (Krifka (1989) inter alia). I also assume, following Krifka (2008), that the plural operator presupposes a discrete set, i.e. a set of non-overlapping individuals.

3.1. Bodily and mental states and their episodic readings

Bodily and mental states, such as sleep, hunger, excitement, alertness, fatigue, rage, drunkeness, etc., primarily display a non-countable use designating a state, as exemplified in (17-a) where it co-occurs with much, a clear trait of non-countability. In (17-b), the plural sleeps is eventive—describing many sleeping events involving the same individual. Accordingly, the ontological contrast between states and events does appear to be relevant for the countability of certain abstract nouns, even if the aktionsart of a derived nominal’s verbal source does not reliably determine the nominal’s countability status as demonstrated in section 2.

(17) a. After much sleep yesterday, everyone is wide awake this morning and in high spirits. (Google)

b. Around the sleeps of a five week old baby, the delicate and dusty songs were recorded anywhere that was far away enough as not to wake her. (Google)

The two uses of sleep in (17) are reminiscent of non-countable substance nouns which also admit of two uses: to designate the substance itself, e.g. much water, or to designate “packages” of the substance, e.g. two waters (see Pelletier and Schubert 2004 and Wiese and Maling 2005 for discussion and references). It is straightforward to give an analogous meaning shift in the domain of states and events, which I will call EPISODIC PACKAGING. I first define the maximal episodic extension of a state s (relative to a property P):

(18) \[
\text{MaxEpisode}(e_{\text{max}}, P) = P(e_{\text{max}}) \land \forall s[P(s) \land \text{Overlap}(s, e_{\text{max}}) \rightarrow s \leq e_{\text{max}}]
\]

Episodic packaging of nominal predicates such as sleep simply restricts the predicate’s domain to maximal episodes, which accordingly results in a domain consisting of non-overlapping entities,

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4Although this analysis follows the standard mereological treatment of the nominal domain, another option would be to use mereotopology as in Grimm (2012). In that treatment, countable predicates require maximally self-connected wholes, which in the present case corresponds to requiring maximal events. Under that treatment, one would not need a separate notion of maximal event, as it comes built-in along with a mereotopological notion of a whole which is taken to underlie countable individuals.
satisfying the presupposition of the plural operator. This coercion appears to be generally available for state-denoting nouns, although often requires substantial context.\(^5\)

In sum, by restricting attention to a particular lexical semantic domain, the ontological contrast between states and events can be seen to be relevant for the non-countable/countable contrast, at least within the domain of bodily and mental states. Crucially, however, the contrast occurs for the same word—even though the noun *sleep* is derived from a stative predicate, under an eventive construal it receives a countable reading. Thus, whether the nouns such as *sleep* are ultimately interpreted as a state or as an event determines their countability status.

### 3.2. Mental and Behavioral Properties: Anchoring in Participants and Events

I now turn to nouns that designate mental properties, such as *intelligence*, *ignorance* or *creativity*, or behavioral properties, such as *kindness* or *honesty*. All of these nouns have a non-countable use designating the property in question (e.g. *Kindness is a virtue*). Yet, the two types of nouns differ in the countability contrasts they permit. The countable reading may be relative either to an event or to a participant, and I will refer to the general process of reifying a property with respect to another individual, whether an event or a participant, as ANCHORING.

Nouns describing mental properties permit PARTICIPANT-ANCHORING, such as *intelligences* which designates intelligence with respect to different individuals. Although such uses are rare, they do occur felicitously as shown in (19)–(21).

19. Please, let’s not insult **both our intelligences** by pretending this is open to question. The desire to provoke a reaction, preferably an over reaction, is glaringly obvious. Seeing this does not require being [Osama Bin Laden]’s secret pen pal. (Google)

20. A young deaf boy is discovered dead. Warrick, Sara, and Grissom handle this case, dealing with **their ignorances** about the deaf community. (Google)

21. We are a mother and daughter team that have decided to put **our creativities** together and make a business that is 100% made in the USA. (Google)

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\(^5\)I note in passing another countability contrast observed for nouns such as *sleep*. The example in (i) is a plural occurrence of *sleep*; however, *sleep* in this sentence doesn’t refer to a particular sleeping event, but rather has a meaning closer to “habitual sleep” which is then further differentiated relative to different individuals. Further research is required to isolate exactly how this reading is related to the other readings of *sleep*.

(i) This disease has ruined **the sleeps of many people**. (Google)
Nouns describing behavioral properties (*kindness*) allow for still different individuation possibilities. These nouns allow **EVENT-ANCHORING** uses in which reference is made to events manifesting the named quality, as shown in (22)-(23).

(22) Still, with a motorcycle she could leave the city on weekends, get away from the **often overbearing kindnesses of her boarding family**, the Harmses. (COCA)

(23) And this in turn permitted **some alarming honesties** to be committed in public. (Christopher Hitchens, *No one left to lie to: the triangulations of William Jefferson Clinton*, via Googlebooks.)

It appears that for a given noun within these noun types, only one type of anchoring is licensed: for mental property nouns, participant-anchored readings were found but not event-anchored readings, while for behavioral property nouns, event-anchored readings were found but not participant-anchoring readings. Which extension is licensed appears to depend on the lexical semantics of the noun type. Nouns which describe behavioral properties are intrinsically related to events. For instance, *kindness* describes a quality of social interactions, which are events. It is sensible that such nouns have an extended use for events which manifest this quality. In contrast, the availability of participant-anchoring appears to be correlated with whether the noun is intrinsically related to participants. For instance, *intelligence* is inalienably possessed, and as such the possessor is already presupposed in the meaning of the noun. If more than one possessor is identified, as is the case in examples (19)–(21), then a countable interpretation can be achieved.

While the referents of the instantiations of the property are intuitively clear, what the bare use refers to is less so. The non-countable use where the noun designates the property in question is reminiscent of a Carlsonian kind (Carlson, 1980), a proper name of a property, as it fulfills at least some of the diagnostics (e.g. *Kindness is rare*). However, it is unclear if properties such as *kindness* or *intelligence* are in every respect like Carlsonian kinds, given the many differences that appear as well—such as the ability for these property terms to occur bare in the singular. It is possible that the two could be related by some more general notion, such as that of a **CONCEPT** (Krifka, 1995), but for the moment I will distinguish the two.6

I now provide a sketch of how to integrate these observations into a formal semantic system. Taking inspiration from Koontz-Garbooden and Francez (2010), who provide a straightforward integration of property concepts into a standard model-theoretic framework, I will take property concepts to denote “primitive properties” which they treat as individuals of type $p$, a subtype of $e$. They define instantiations of the property as $\cup p$, equivalent to $\lambda x[\pi(x, p)]$, the set of entities which possess $p$ (where $\pi$ represents the possession relationship (Barker, 1995)).

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6Some link between these properties and a kind interpretation is necessary, however, given that, for many nouns, a sub-kind interpretation is readily available, e.g. the seven (kinds of) intelligences.
Given these additional distinctions, the countability facts can be accounted for in a natural way. When nouns designate property concepts directly, pluralization fails since the referent of the property concept, the “primitive property”, is unique. Instantiations of properties, however, yield potentially countable sets—but what types of instantiations are permitted is restricted by the lexical semantics of the noun. For intelligence and other inalienably possessed properties, \( \cup p \) realizes the set of participants which possess the property, i.e. \( \lambda x[\pi(x, p)] \) ranges over human individuals. Behavioral properties instead require events which possess the property, i.e. \( \cup \text{kindness} \) \( \rightsquigarrow \) ‘acts of kindness’, i.e. \( \lambda x[\pi(x, p)] \) ranges over events. In both cases, instantiation of the property results in a predicate comprised of discrete individuals, allowing pluralization. In the case of event-anchoring, the derived set is comprised of events, which are by hypothesis discrete. In the case of participant-anchoring, the derived set is of participants which instantiate the property, and of course the human possessors are by their nature distinct from one another and do not overlap.

At this point, one might question the necessity of this additional machinery instead of deriving the availability of event-based readings from a better known distinction in the semantics literature, namely the stage-/individual-level distinction (Carlson, 1980). Indeed, the possibility of event-based readings appears to be at least partially correlated with the stage-/individual-level distinction. Recalling that stage-level predicates (drunk) are true of a temporal stage of its subject, while individual-level predicates (intelligent) are true throughout the existence of an individual, one could propose that event-anchoring occurs most happily with nouns related to stage-level predicates, for which multiple stages are then countable. This gives a straightforward explanation for the availability of countable interpretations of otherwise stative nouns such as drunkenness. This would also give a straightforward explanation for the lack of an event-based reading for intelligent—it does not designate stages which can be then quantified over. Yet, this correlation is not straightforward and at best partial. Aside from issues about the stage-/individual-level distinction not always being so clear-cut (see Jäger 2001 and references therein), the relation between stage-level predicates and event-anchored readings is most likely only a necessary, but not a sufficient condition. Although drunkennesses finds a ready interpretation, it is more difficult to place nakednesses (and I was not able to find a convincing example of its use). The opposite direction—that individual level predicates lack the event-anchored reading—does not hold either. While this is plausible for intelligence, kind patterns with individual level predicates for many of the diagnostics, but kindnesses is permissible with an eventive reading.

In sum, the domain of mental and behavioral properties manifests a different range of countability contrasts and types of polysemy than was observed for bodily and mental states. Comparing the two domains underscores the importance of examining countability from the vantage point of particular lexical semantic domains.
3.3. Psych-nouns

I now turn to psych-nouns, i.e. those nouns which designate psychological states or events: *annoyance, despair, fear, sorrow, pride*, etc. The central contrast at work in the domain of psych-predicates, and consequently for psych-nouns, is between the EXPERIENCER-STATE and STIMULUS, by which I mean the emotional state of the participant and that which evokes the emotion, respectively. For psych-nouns, the countability status of a noun hinges upon whether a noun either lexicalizes, or is interpreted as designating, a stimulus or an experiencer-state: nouns which designate the stimuli are always countable while those designating the experiencer-state are primarily uncountable.

Nouns may unequivocally lexicalize the stimulus or the experiencer-state. Although nouns which unequivocally lexicalize the stimulus are rare, *irritant* is an example. *Despair* is an example of a noun which unequivocally lexicalizes an experiencer-state. Very frequently, a noun is polysemous between experiencer-state and stimulus, and depending on the construal, the occurrence is non-countable or countable, respectively. For instance, the uncountable *much annoyance* refers to an experiencer-state while the countable *several annoyances* refers to the stimulus.

The nominalization of stimuli has been little discussed in comparison with, for instance, result nominalizations, but it appears that the stimulus reading is always countable regardless of what it refers to in the physical world. In the previous lexical semantic domains, it was plausible to relate the countability status of a noun to an ontological contrast based on the referent, e.g. state as opposed to event or property as opposed to a concrete instantiation of the property. In the case of stimuli, the eventual referent appears to be of little consequence to its countability status. An occurrence of *irritant* may refer to sneezing powder, which satisfies all the mereological requirements typically considered canonical for non-countable predicates, yet under the description of *irritant*, the noun is countable. The apparent reason for the discrepancy between the physical properties of the object and the countability status is that stimulus interpretations are not directly referring to the physical object as such, but rather to the physical object under its guise as an event participant. The identification of an entity as a stimulus is apparently sufficient for individuation.

Nouns which permit an experiencer-state designation, such as *despair*, always manifest an uncountable use, designating the state itself, as shown in the examples in (24). These nouns may also permit additional event-based readings, which are countable, as shown in the examples in (25).

(24) a. Nobody has the right to be in *that much despair*. (COCA)
b. The little Florian watched us with *some amusement*. (COCA)

(25) a. But I am forgetting another characteristic, a very pronounced one. That was his deep glooms, his despondencies, *his despairs*; . . . (*Autobiography of Mark Twain* via Googlebooks)
b. Skip could see clearly that someday he would be quite rich. Still, he was bored most of the time. **The amusements** he pursued, the girls, fooling the teachers, thinking about his money, did not keep him energized. (COCA)

Similar wide-ranging polysemy is found with other nouns that describe emotions, including de-adjectival nouns such as **pride**. The core meaning of **pride** designates the quality of being proud, but there are extended uses, as shown in the examples below, designating an entity which evokes the quality as in (26-a), participant-anchored readings as in (26-b) which quantify over pride in different individuals, or relational readings as in (26-c), where pride is quantified in relation to different things.

(26) a. Queen knighted Bouch for his achievement - **one of the prides** of Victorian engineering. (Google)
b. Now as economists we should have **strong prides** about income in this model. . . . (Google)
c. A man of **small but many prides**, he regarded the accurate guessing of a bird 's weight as proof of his expertise. (Google)

Much remains to be discovered about psych-nouns, but from this short survey it is clear that the countability contrast and the patterns of polysemy are systematic. Again, the examples of this section show that a deverbal noun such as **annoyance** may have countable or non-countable uses depending on its interpretation in a context, which would be unexpected on a strictly derivational account.

4. Outlook

This paper has tried to uncover some of the distinctions that determine the countability of abstract nouns. Nouns may have multiple interpretations within a semantic domain, viz. stimuli and experiencer, but once the noun’s interpretation is fixed, so is its countability. Thus, overall, the countability status of a particular noun occurrence appears due to its designation or construal in that occurrence, but this process is influenced by a complex set of factors including lexicalization patterns, ontological contrasts, and world knowledge. Additionally, it was seen that the frequent polysemy between countable and non-countable construals is at once systematic and at the same time highly dependent on the particularities of the given lexical semantic domain.

Although at first glance, abstract nouns may seem to create insoluble problems for standard formal treatments of countability, as discussed in section 1, this paper sketched how the distinctions underlying countability in the different lexical domains could be formalized either in ways congenial to the standard treatments of countability, e.g. in the case of episodic packaging, or through enriching the domain, e.g. with primitive properties. As more data is brought to bear on this issue,
no doubt these treatments will have to be extended accordingly.

References


Abstract. Hurford’s Constraint, which bans disjunctions in which one disjunct entails the other, has been central to the debate between the pragmatic and the grammatical view on Scalar Implicatures. We provide evidence that Hurford’s Constraint should be derived from more basic principles, and we propose such a derivation using a pragmatic prohibition against redundant constituents. In a first, more conservative version, the redundancy is specific to disjunctions. In a second, more general version, redundancy is banned regardless of constituent type. Both versions make new predictions about the emergence of oddness in cases that are not covered by Hurford’s Constraint. The first version is too restricted. The second one is incorrect. We explore a revised architecture in which the relevant redundancy principle applies locally in the semantic computation. This perspective makes different predictions about oddness than the first two and has a potentially interesting extension to oddness in quantificational constructions, which we discuss. All our attempts to generalize Hurford’s Constraint require the grammatical theory of Scalar Implicatures.

Keywords: Hurford’s constraint; scalar implicature; exhaustivity; redundancy; economy; presupposition; domain restriction.

1. Introduction

1.1. Scalar implicatures and exhaustification

Scalar implicatures (SIs) are computations in which an assertion $S$ gives rise to inferences of the form $\neg S'$, where $S'$ is an alternative of $S$. Descriptively, SIs can be thought of as being computed by a function, $f$, which takes a sentence, $S$, and a set of alternatives, $A(S)$, and negates some members of $A(S)$.

\begin{align*}
    S &= \text{John gave some of his students an A (=} \exists) \\
    a. \quad &f(A(\exists))(\exists) = \exists \land \neg \forall \\
    b. \quad &A(\exists) = \{\exists, \forall\} \\
    c. \quad &f \text{ negates alternatives}
\end{align*}

\footnote{We thank Amir Anvari, Emmanuel Chemla, Gennaro Chierchia, Danny Fox, Tova Friedman, Clemens Mayr, Jacopo Romoli, Benjamin Spector, Philippe Schlenker, Ida Toivonen, and Yimei Xiang, and audiences at \textit{Sinn und Bedeutung 18} in Vitoria, Spain and the LLI Lab at Carleton University. RK has been supported by ISF grant 187/11. RS has been supported by SSHRC grant 435-2012-1573.}
Broadly speaking, there are two distinct views on how SIs come about. On what is often called the ‘pragmatic’ view, \( f \) is the output of global, domain general processes of rational thought (e.g., Grice (1975), Horn (1972), and many others). On the so-called ‘grammatical’ view, \( f \) is the output of domain-specific mechanisms (e.g., Chierchia (2004), Fox (2007), among others), and it is sometimes considered to be a syntactically-realized operator, \( \text{exh} \), which can be thought of as a silent variant of \text{only}.

1.2. Hurford’s constraint

At the center of much recent work on choosing between the pragmatic and the grammatical view stands an observation by Hurford (1974), who noted that disjunctive sentences are odd if one of the disjuncts entails the other. This observation is stated in (2) and illustrated in (3).

\begin{itemize}
  \item (2) Hurford’s Constraint (HC): A disjunction of the form \( X_1 \lor X_2 \) is odd if \( X_1 \) entails \( X_2 \) or vice versa
  \item (3) a. # John was born in France or he was born in Paris
      b. # John was born in Paris or he was born in France
\end{itemize}

Hurford further noted that HC has an apparent counterexample in sentences like (4).

\begin{itemize}
  \item (4) John ate (cake or ice-cream) or he ate both
\end{itemize}

The first disjunct, \text{cake or ice-cream}, is entailed by the second, \text{both} (= \text{cake and ice-cream}), in apparent violation of HC. And yet (4) is a perfectly acceptable sentence. Hurford concluded from such examples that \text{or} is lexically ambiguous between inclusive and exclusive disjunction: inclusive disjunction would cause a violation of HC in (4), but with exclusive disjunction neither disjunct would entail the other and HC would not be violated. It is thanks to the availability of exclusive disjunction, on Hurford’s analysis, that (4) is acceptable.

Hurford’s conclusion was challenged by Gazdar (1979), who noted that the pattern of apparent violations of HC in acceptable sentences is not specific to the use of \text{or} within one of the disjuncts and that a similar state of affairs obtains across scalar items. In (5), for example, the first disjunct appears to be entailed by the second, without giving rise to oddness:

\begin{itemize}
  \item (5) John gave some of his students an A or he gave all of his students an A
\end{itemize}
Gazdar concluded that HC is obviated whenever one of the disjuncts is a scalar alternative of the other. Not wishing to resort to systematic lexical ambiguity across scalar items, he took his refinement of Hurford’s pattern to imply a complication of HC so as to make room for the exemption of disjuncts that are scalar alternatives of one another.

1.3. The argument from HC

In recent work, Chierchia, Fox, and Spector (2011) point out that the apparent exceptions to HC noted by Hurford and Gazdar are predicted by the original formulation of HC—and without resorting to lexical ambiguities for scalar items—on the grammatical view on SIs. We illustrate using \textit{exh} as a grammatical device.

(6) Explaining (4) using \textit{exh}:
   a. \# ∃ ∨ ∀ (ruled out by HC)
   b. \textit{exh}(∃) ∨ ∀ (okay under HC)

(7) Explaining (5) using \textit{exh}:
   a. \# (A ∨ B) ∨ (A ∧ B) (ruled out by HC)
   b. \textit{exh}(A ∨ B) ∨ (A ∧ B) (okay under HC)

Contrasting with the straightforward explanation of the apparent exceptions to HC under the grammatical view, under the pragmatic view such cases are puzzling: from a globalist, pragmatic perspective, there seems to be no clear way to distinguish the bad (3) from the acceptable (4) and (5). Chierchia et al. use this preliminary challenge for the pragmatic view to construct a much more direct one. All disjunctions violating HC in its original form are equivalent to their weaker disjunct. In (4) and (5), which appear to obviate HC, the disjunction is still equivalent to the (unexhaustified version of what under the pragmatic view is) the weaker disjunct: for (5), (∃ ∧ ¬∀) ∨ ∀ ≡ ∃, and similarly for (4). But the grammatical view predicts that this will not always be the case. Specifically, following Fox and Spector (2008), suppose \( p \subset q \subset r \), and suppose \( p, q, \) and \( r \) are scalar variants of one another. Then \( r ∨ p, \) parsed as \textit{exh}(r) ∨ p, will be equivalent to \( (r ∧ ¬q) ∨ p \neq r \). As the following shows, this reading is indeed available:

(8) Peter either solved the first and the second problem or he solved all of the problems
   \textbf{Reading:} Peter either solved only the first and second problems, or he solved them all

We are not aware of attempts within the pragmatic view to address this challenge.
2. Concerns

Due to the centrality of HC to the debate between the pragmatic and the grammatical views, we would like to give HC a closer look. In particular, the statement of HC in (2) treats it as an unanalyzed condition of oddness, and in this section, we will discuss two concerns with HC that suggest that it should be derived rather than stipulated as a primitive. This does not directly damage Chierchia et al.’s argument from HC, but it does leave one wondering whether the argument will still hold under a better understanding of what derives HC. If our attempt to derive HC in the following section is on the right track, it does.

2.1. Naturalness and embedding

HC regulates only disjunctive sentences, which makes it an unlikely candidate for a general condition on speech acts: pragmatic constraints are more naturally formulated at the level of the entire sentence and the information contained within it, rather than with the particular form it happens to take. In particular, as a constraint on speech acts, it is not clear whether HC applies to embedded occurrences. However, applying disjunction to smaller constituents within (3) and various forms of embedding continue to lead to oddness:

(9) a. # John was born in France or in Paris
    b. # John was born in France or Paris
    c. # It is likely that John was born in France or (that he was born) in Paris
    d. # John wasn’t born in France or in Paris
    e. # Every man was born in France or in Paris

2.2. Context

As noted earlier (5) (= John gave some or all of his students an A) is generally felicitous, an observation that led Gazdar (1979) to propose a complication of HC and that has been argued by Chierchia et al. (2011) to support the grammatical view of SIs. (5) was presented within a null context. Surprisingly from the perspective of both Gazdar and Chierchia et al., the same sentence becomes infelicitous when uttered within the context provided in (10).

(10) John gave the same grade to all his students...# he gave some or all of them an A.

In (10) we follow Magri (2009) by creating a context in which ∃ (= John gave some of his students an A) and ∀ (= John gave all of his students an A) are equivalent. But why should this manipulation
be relevant? Magri explained the oddness of $\exists$ in similar contexts by appealing to a contradiction between $\exists$’s strengthened meaning $\exists \land \neg \forall$ and the contextual equivalence between $\exists$ and $\forall$; cf. the contrast in (11).

(11) John gave the same grade to all his students...
   a. # ...he gave some of them an A.
   b. ...he gave all of them an A

This line of explanation is unavailable in (10), however, because (5) does not generate an SI $\neg \forall$.

3. Generalizing HC

3.1. First attempt: penalizing redundant disjuncts

A common intuition regarding HC is that it relates to a dispreference for redundancy: the disjunction in a Hurford disjunction is equivalent to the weaker disjunct, so the speaker uttering the disjunction could have conveyed the same information by using that weaker disjunct alone. If we can make this informal sense more precise, we might have a handle on the naturalness concern. Moreover, non-redundancy offers a potentially helpful perspective on the effects of context: in (5), the use of disjunction is not generally redundant, but in the context provided in (10), it is (the same information could have been provided by $\exists$ or by $\forall$). Our first step, then, is to make the non-redundancy intuition precise.

What we need is a condition that blocks a structure $Z$ containing disjunction that conveys the same information as a variant of $Z$ with just one of the disjuncts instead of the entire disjunction. As it turns out, a very similar condition has been proposed – but for conjunctions rather than disjunctions – by Schlenker (2008) (see also Horn (1972), van der Sandt (1992), and Fox (2008)):

(12) Avoid Incrementally Redundant Conjuncts: $\# X \land Y$ if the same information could have been conveyed by $X$.

Condition (12) was proposed by Schlenker to account for presupposition projection. As Schlenker points out, however, it makes the correct prediction also for non-presuppositional cases. For example, it correctly predicts that (13a) below, the conjunctive counterpart of a Hurford disjunction, will be odd. Note that the formulation of (12) is asymmetric: a sentence containing a conjunction is odd if the conjunction can be replaced with the first conjunct; replaceability with the second conjunct does not lead to oddness. This asymmetry is motivated by the well-known asymmetry in presupposition projection, but Schlenker also notes that it makes the correct prediction that reversing the order of the conjuncts in (13a), as in (13b), will improve the sentence.
In section 3.4 we will take a closer look at the question of linear order, both in conjunctions and in disjunctions. For now, because (3a) and (3b) are both odd, let us take HC to be a symmetric, conjunctive variant of (12):

(14)  a. **Avoid redundant disjuncts** (replaces HC): If $X$ contains a disjunction $Y_1 \lor Y_2$, $X[Y_1 \lor Y_2]$, and $X$ is contextually equivalent in context $c$ to either $X[Y_1]$ or $X[Y_2]$ then use of $X$ is inappropriate in $c$.

b. **Contextual Equivalence** $\psi$ and $\xi$ are *contextually equivalent* in context $c$, $\psi \equiv_c \xi$, iff $\{w \in c : [\psi](w) = 1\} = \{w \in c : [\xi](w) = 1\}$ (cf. Schlenker (2012)).

By comparing the meanings of sentences and penalizing the representation of constituents that contribute nothing to content, (14) provides a more natural pragmatic statement than HC. More importantly it has desirable empirical consequences. In particular, it captures the fact that both unembedded and embedded Hurford Disjunctions should be odd. To see this, note that $X[Y_1 \lor Y_2]$, where $Y_1$ contextually entails $Y_2$ (say), is contextually equivalent to $X[Y_2]$ (this is because $\forall w \in c, [Y_1 \lor Y_2](w) = [Y_2](w)$; $Y_1 \lor Y_2$ and $Y_2$ will thus project meaning in the same way). Taking the France-or-Paris case (schematized as $F \lor P$) as an example, note that for the unembedded case, as in (3), $F \lor P \equiv_c F$ and for the embedded case, as in (9d), $\neg(F \lor P) \equiv_c \neg F$. In this way, the statement in (14) is readily shown to rule out both (3) and (9d).

We should add that the constraint is local: it penalizes redundant disjuncts but it does not penalize undue complexity in some global sense. For example, the sentence in (15) is perfectly acceptable, even though it is more verbose than but equivalent to (3b) (= *John was born in Paris or in France*) and the even simpler *John was born in France*. Under the statement in (14), (15) manages to escape oddness because neither of its disjuncts is equivalent to the disjunction itself.\(^3\)

(15)  *John was born in Paris or somewhere else in France*

---

\(^2\)Some informants report that (3b) is easier to rescue than (3a) when interpreted as ‘John was born in Paris, or at least in France.’ As noted in Schlenker (2009, p. 35), adding an overt *at least* at the second disjunct does improve (13a). We think the strategy of introducing an ‘at least,’ overtly or covertly, eliminates the disjunctive force of the sentence, though we do not attempt to develop a theory of where ‘at least’ can be inserted.

\(^3\)We thank Ida Toivonen for this observation and helpful discussion.
3.2. Exh persists

We can also see that (14) allows us to derive the re-emergence of oddness in the relevant contexts in cases in which HC was obviated using SIs. Consider again (5) above, repeated here.

(16) John gave some or all of his students an A

Without eXh, (16) is semantically equivalent (and hence always contextually equivalent) to its first disjunct Ǝ. This incorrectly predicts that (16) should be unusable in any context. But if eXh exists, (16) can be parsed as eXh(Ǝ) ∨ Ʌ. This parse breaks the semantic equivalence between (16) and its disjuncts, thus rescuing (16) from (14) unless context imposes an equivalence between (16) and its disjuncts. Unlike HC, we predict that (5) will be odd in a context that does impose such an equivalence, as in (10), repeated here as (17).

(17) John gave the same grade to all his students...# he gave some or all of them an A.

On our account, (17) (= eXh(Ǝ) ∨ Ʌ ≡ Ǝ = Ʌ) is odd because the same information could have been conveyed by either of the simpler disjuncts, Ǝ or Ʌ.

3.3. Second attempt: general economy

Condition (14) still makes reference to disjunctions, and hence is not fully general. One possible solution would be to replace it with a general ban against redundant material (modeled after Fox, 2008):

(18) Avoid redundant material: Do not use X[Y] in context c if Y contains Z, and X[Z] ≡c X[Y].

Condition (18) is a general ban against redundant material. It subsumes (14), which in turn replaces HC. Like (14), (18) does not allow us to eliminate eXh: to account for the lack of oddness in sentences such as (16), exhaustification must still apply disjunct-internally.

The data so far thus support the following conclusions: (i) SIs are computed by eXh; and (ii) the pragmatic system encodes a (restricted) preference for simpler expressions (either (14) or (18)).

4As mentioned earlier, Magri (2009) derives the oddness of Ǝ in such contexts. The present account, then, can be seen as complementing – rather than replacing – Magri’s account.
As we will shortly see, the relative generality of (18) gives rise to wrong predictions, leading us to adopt a more local conception of non-redundancy. For now, though, let us use (18) to explore certain oddness effects beyond disjunction.

3.4. Generalizing to conjunction

Up until the introduction of (18), our entire discussion was framed in terms of disjunctive sentences. (18) prohibits redundant material more generally, and thus extends to non-disjunctive sentences. Sticking to conjunction for the moment, substituting the second conjunct in each of the following (it’s upstairs in (19) and a smoker in (20)) for the entire conjunction would result in an equivalent sentence in each case; consequently, both are ruled out by (18).

(19) # If there is a bathroom in this house, then there is a bathroom in this house and it’s upstairs.
(20) # Every boy is a boy and a smoker

(18) also predicts that redundancy in conjunctive sentences will be bad symmetrically. In certain cases, this prediction seems to be borne out:

(21) a. # John walks and moves
    b. # John moves and walks

This symmetry is at odds with Schlenker’s pattern in (13) above, where, as predicted by (12), a stronger initial conjunct (as in (13a) = # John resides in Paris and lives in France) leads to oddness, while a stronger final conjunct (as in (13b) = John lives in France and resides in Paris) does not.

We believe that the representative pattern is the one in (21) and that redundancy in conjunction is prohibited in both directions.\(^5\) To account for (13), we tentatively propose that it is possible to reanalyze lives and resides such that entailment between the conjuncts can be broken. For example, one verb might be read as signifying the space that John actually occupies, while the other signifies a perhaps more abstract notion relevant for legal purposes such as taxes, citizenship, etc. Note for example that when there is only one verb present (say ‘lives in’), the oddness appears in both directions (Chemla, 2009):

(22) a. # John lives in Paris and in France

---

\(^5\)An alternative would be to argue for a left-to-right asymmetry in Hurford disjunctions. In fact, such an asymmetry has been pointed out and discussed in Singh (2008), but for those disjunctions in which a scalar item allows for an obviation of HC. For actual Hurford disjunctions, oddness holds in both orders, as we have discussed.
Moreover, when we turn to entailments that are due to logical operators, rather than content words that in principle allow some flexibility in interpretation, the oddness is there in both directions:

(23)  a. # John ate some of the cookies and he ate all of them
      b. # John ate all of the cookies and he ate some of them

We are thus left with a puzzle: some conjunctions are bad in both orders, such as (22) and (23), while others, such as (13), are not (nothing we have said speaks to why (13b) is less odd than (13a)). A particularly important case of the latter kind concerns the classic observation (Karttunen, 1973) that conjunctions with one conjunct $S_p$ presupposing the content of the other conjunct $p$ are felicitous only in the order $p \land S_p$:

(24)  a. John has children and he loves his children
      b. # John loves his children and he has children

Given (18) we might expect the redundancy of $p$ to be penalized in both cases (note that $S_p$ doesn’t merely presuppose $p$, but it also entails it). A possible explanation for this asymmetry – assuming that presupposition projection is asymmetric – comes from the observation that the sentence $p \land S_p$ has no presuppositions while $S_p$ does; hence, $p$ is not redundant here. In the reverse direction, $S_p \land p$ and $S_p$ both presuppose $p$; hence $p$ is redundant, and the sentence is thus ruled out by (18).

Needless to say, much more needs to be said about presupposition projection and its interaction with linear order, but at this point let us set this matter aside. We now turn to a different and perhaps more severe challenge for (18), brought to our attention by Gennaro Chierchia.

3.5. Chierchia’s challenge

Condition (18), which penalizes redundancy by considering the substitution of every constituent for every containing constituent, is probably too strong. As pointed out to us by Gennaro Chierchia,...
(p.c.), a pattern noted by Mayr and Romoli (2013) argues against any ban on redundancy that is as
general as (18). Here are some examples:

(25) a. Either there is no bathroom, or (there is one, and) it is upstairs
    b. Either Mary isn’t pregnant, or (she is, and) John is happy

The observation is that these sentences are appropriate, even though the bracketed phrases could be
deleted without any change in information (\(\phi \lor \psi \iff \phi \lor (\neg \phi \land \psi)\)). The problem is a general
one, stemming from the fact that our generalization of (14) in (18) is no longer local: whereas
(14) compared the meaning of a disjunction to its immediate constituent disjuncts, (18) makes it
possible to compare the meaning of a sentence with the meanings of other sentences derivable by
arbitrary substitutions of nodes in the sentence by their constituents. Thus, the following sentences
– which were not ruled out by (14) (cf. (16), (15)) – are now incorrectly predicted to be banned:

(26) a. John ate some or all of the cookies (= \(exh(\exists) \lor \forall\); blocked under (18) by \(\exists\))
    b. John is from Paris or somewhere else in France (blocked under (18) by \(John is from
       France\))

Our attempt to eliminate the stipulative restriction to disjunctive sentences has also eliminated the
locality that seems to be needed to correctly describe the data.

3.6. Third attempt: local redundancy checking

We believe that Chierchia’s challenge can be addressed, at least in part, by reassigning the redund-
dancy checking from the pragmatics to points in the structure-building process where the grammar
interfaces with the context. Specifically, we propose that the semantic computation evaluates, at
certain nodes, whether the semantic composition principle that applies there is non-vacuous. Fo-
cusing here on nodes \(\gamma\) that dominate binary operators \(O\) taking arguments \(\alpha\) and \(\beta\):

(27) **Local Redundancy Check:** \(S\) is deviant if \(S\) contains \(\gamma\) and \([\gamma] = [O(\alpha, \beta)] \equiv_c \)
    \([\zeta]\), \(\zeta \in \{\alpha, \beta\}\).

This principle bans sentences if there is a node in the sentence whose meaning is derived by apply-
ing an operator \(O\) to a pair of arguments \(\alpha\) and \(\beta\), and the result of this application is contextually
equivalent to the meaning of one of the arguments \(\alpha\) or \(\beta\). The statement in (27) maintains the
locality of (14) (note that (27) accesses only that information needed to compute the denotation of
the node under consideration), as well as some of the generality of (18) (no reference is made to any particular operator or constituent type). For now, we will assume that when $S$ is asserted in context $c$, for each node in $S$ where (27) is evaluated the context relevant to the evaluation is the global context $c$.7

The revised architecture provides a handle on Chierchia’s challenge. In particular, (27) does not penalize $\phi \lor (\neg \phi \land \psi)$ (e.g., (25b) = either Mary isn’t happy or she is and John is happy) even though it contains material that could be deleted without any change in meaning (the sentence is equivalent to $\phi \lor \psi$). To see why this is true, note that at node $\alpha = \neg \phi \land \psi$ the conjunction is not equivalent to either of its conjuncts (e.g., Mary is pregnant and John is happy is not equivalent to either constituent). Thus $\alpha$ passes the redundancy check and $[[\alpha]]$ gets passed on up to the root node, $\phi \lor \alpha$. Here, the redundancy check finds that neither of the disjuncts is equivalent to the disjunction itself. In other words, the local composition in $\phi \lor (\neg \phi \land \psi)$ is always meaningful.

The constraint in (27) further predicts that redundant conjuncts and disjuncts will be banned, symmetrically: $\phi \lor \psi$ and $\phi \land \psi$ are banned if they end up contextually equivalent to either $\phi$ or $\psi$. This prediction holds for matrix and embedded coordinated structures; the principle in (27) applies locally, and thus does not distinguish between embedded and matrix clauses. Thus, not only will embedded Hurford disjunctions like (9) above be ruled out, so will variants of Mayr and Romoli (2013)’s disjunctions (29) $\phi \lor (\neg \phi \land \psi)$, central to Chierchia’s puzzle, when the second disjunct is equivalent to one of its constituent conjuncts (symmetrically):

\[
\begin{align*}
\text{(28)} & \quad a. \ # \text{Either John ate none of the cookies or he ate some of them and he ate all of them} \\
& \qquad b. \text{Either John ate none of the cookies or he ate all of them} \\
& \qquad c. \ # \text{Either John doesn’t live in France or he lives in France and Paris} \\
& \qquad d. \text{Either John doesn’t live in France or he lives in Paris}
\end{align*}
\]

Note that $exh$ is still needed to account for the appropriateness of disjunctions like (16) = John gave some or all of his students an A. The parse $\exists \lor \forall$ is banned by (27) because the whole disjunction is equivalent in any context to $\exists$. However, the parse $exh(\exists) \lor \forall$ is not banned by (27): the whole disjunction is equivalent to $\exists$, which is not generally equivalent to either $exh(\exists)$ or to $\forall$.8 However, in contexts that do impose such an equivalence, such as (17), (27) is violated and oddness re-emerges. Interestingly, $exh$ has remained stable under our various attempts to replace HC with more descriptively and empirically adequate bans on redundancy.

7Opening the door to interactions between context and embedded constituents invites a ‘dynamic’ view on interpretation but does not necessitate it. In section 3.7 we will build on Schlenker’s (2009) demonstration that such interactions are also compatible with a classical semantics, but we will develop an alternative perspective for reasons we discuss more carefully there.

8Note that the disjunct with $exh$ will also satisfy (27): $exh$ takes two arguments, $\exists$ and the alternatives of $\exists$, and the meaning of the whole, $\exists \land \neg \forall$, is not equivalent to $\exists$. 

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Unfortunately, Chierchia’s challenge re-emerges in a slightly different form: the oddness of (19), repeated below as (29c), is now left unexplained. Under a material implication analysis of conditionals, for example, the sentence should behave exactly like (25a) \((\phi \rightarrow \psi) \iff \neg \phi \lor \psi \iff \neg \phi \lor (\phi \land \psi)\). At the consequent neither conjunct is vacuous, and at the root the entire conditional is equivalent to neither its antecedent nor its consequent. Assuming that redundancy is the relevant source of oddness in (19), the challenge we face is:

(29) Chierchia’s Challenge, Again: Why is there a bathroom in this house redundant in (29c) but not in (29a)?
   a. Either there is no bathroom in this house or there is a bathroom in this house and it’s upstairs
   b. Either there is no bathroom in this house or it’s upstairs
   c. # If there is a bathroom in this house, there is a bathroom in this house and it’s upstairs
   d. If there is a bathroom in this house, it’s upstairs

We will not be able to derive the asymmetry between disjunction and conditionals and will therefore have to stipulate it. In the next section we will explore ways in which the relevant stipulation can be stated.

3.7. Domain Restriction

One way to state the difference between \(A \lor B\) and if \(A\), then \(B\) is by restricting the evaluation of \(B\) in the conditional to those worlds where \(A\) is true, which makes the representation of \(A\) in such a position entirely redundant; in disjunction, on the other hand, \(B\) will be evaluated with respect to the context of the entire disjunction. This comes close to adopting the standard dynamic semantic denotation for the conditional: \(\phi \rightarrow \psi\) will now be analyzed as \(\neg \phi \lor (\phi \land \psi)\) instead of its truth-conditionally equivalent \(\neg \phi \lor \psi\). In a dynamic semantics, where \(\land\) is defined in the usual way as sequential composition, the equivalence between \(\neg \phi \lor \psi\) and \(\neg \phi \lor (\phi \land \psi)\) is lost: indefinites in \(\phi\) can bind pronouns in \(\psi\) in \(\neg \phi \lor (\phi \land \psi)\) but not in \(\neg \phi \lor \psi\). This is what allows for donkey anaphora: If John has a donkey, he beats it.

As pointed out by Schlenker (2009), the dynamic perspective is not required for the use of local contexts. Schlenker offers a general statement which, in conjunction with a classical semantics, predicts the context of evaluation for any embedded constituents. Specifically, he argues that such an assignment can be made by assuming: (i) that embedded constituents are evaluated with respect to subsets of the global context \(c\) (i.e., worlds in \(W\backslash c\) are ignored), and (ii) the interpretive system employs strategies that sometimes restrict attention to proper subsets of \(c\) when the result is guaranteed to not affect the truth-conditions of the sentence. Schlenker (2009) shows that the statement
predicts the following assignment of local contexts, which agree with the dynamic treatments of e.g., Chierchia, 1995; Beaver, 2001:

(30) Local Contexts Predicted by Schlenker (2009):
   a. The local context of $\psi$ when $\phi \lor \psi$ is uttered in context $c$ is $c \cap \lbrack \lnot \phi \rbrack$
   b. The local context of $\psi$ when $\text{if} \phi, \psi$ is uttered in context $c$ is $c \cap \lbrack \phi \rbrack$

This assignment of local contexts, together with assumptions demanding that each constituent be locally consistent and informative (Schlenker, 2009), would suffice to capture the oddness of (29c). However, important problems remain. First, these assumptions leave the appropriateness of (29a) unexplained (there is a bathroom in the house is redundant in the local context of the second disjunct). Moreover, as noted by Schlenker (2009, p. 35), the oddness of John was born in France or (John was born) in Paris is predicted (since John was born in Paris is contradictory in its local context), but the oddness of John was born in Paris or in France is left unexplained because John was born in France is neither inconsistent nor redundant in a context which entails that he was not born in Paris.

Let us consider a variant of Schlenker (2009)’s proposal that applies only in specific cases rather than as a general strategy. Specifically, we will assume that the evaluation of local contexts applies in the case of restricted quantification:

\[ \text{(31) Restricted Evaluation: For sentences } Op_E(A)(B), \text{ where } Op \text{ is a generalized quantifier in natural language and } E \text{ is the domain of } [[A]] \text{ and } [[B]], \text{ evaluation of } [[B]] \text{ is restricted to } c \cap [[A]], \text{ where } c \text{ is the global context of utterance.} \]

All restricted operators, such as determiners (e.g., Barwise and Cooper, 1981; van Benthem, 1983) and adverbs of quantification (e.g., von Fintel, 1994), will be odd in the same way as (29c) if the restrictor is repeated as a conjunct in the scope:

\[ \text{(32) a. } \# \text{ Every man is a man who is tall} \\
    \text{b. } \# \text{ When a cat falls, usually it falls and lands on its feet} \]

Assuming this, if we treat if as a generalized quantifier over propositions (van Benthem, 1984a), for example, the oddness of (19) follows from (27) and (31). In a conditional If $p$, then $p$ and
q, the consequent p and q selects that subset of p in which p and q are true, and of course, the
conjunct p here serves no role. Disjunctions, on the other hand, need to be prevented from using
local contexts in this way (so as not to lose the account of the contrast in (29)) and presumably
keep their truth-functional analysis, with each disjunct evaluated independently of the other.

4. Discussion

We tried to replace Hurford’s Constraint with a general pragmatic ban against redundancy and we
were led to a view in which redundancy is evaluated locally. The principle bans the representation
of locally vacuous constituents, where alternatives are derived only via replacements of functors
by their arguments and the evaluation of redundancy is made with respect to the global context,
sometimes restricted by the fact that natural language operators are restricted. The appeal to exh
was needed in all redundancy statements that we considered, which further supports Chierchia
et al. (2011)’s contention that the Hurford paradigm, and its obviation by scalar items, provides
strong evidence that exh computes scalar implicatures.

We should reiterate that our proposed constraint in (27) is restricted to local semantic composition.
It is not a general ban against redundancy, and thus leaves open the extent to which redundancies
not captured by (27) will be tolerated. For example, tautologies like either it’s raining or it’s not
are not banned by (27).

Many questions remain, and it is not clear to us how much of our proposal will remain intact once
these questions are seriously addressed. First, we have assumed a classical semantics and our local
redundancy check bans redundancy irrespective of linear order. We saw evidence that conjunctions
are banned symmetrically, an observation that goes against what is commonly assumed in the
literature (Horn, 1972; van der Sandt, 1992; Schlenker, 2008). More work will be needed to resolve
this discrepancy.

Second, we need to clarify how our system relates to left-right asymmetries in presupposition and
anaphora. In a system like Schlenker (2008), incremental evaluations of redundancy are responsi-
ble for presupposition projection. How a symmetric ban on redundancy would affect patterns of
projection in such a system, and related ones (e.g., Fox, 2008), needs to be worked out.

Finally, we have so far been concerned with bans on redundancy, and we have argued that incor-
porating such bans into the derivation itself provides a natural solution to patterns of oddness. We
believe the principle in (27) should be extended to a more general principle of optimality. Dis-
cussing this move would take us too far afield, but as motivation, consider the following paradigm
(we repeat (11) from Magri (2009) and section 2.2 as (33a), and we repeat (10) from section 2.2 as
(33b)):

(33) Context: Sam gave the same grade to all the boys . . .
  a. . . # he gave some of them an A.
Recall that Magri (2009) accounts for the oddness of (33a) by appealing to a contradiction between its strengthened meaning, $\exists \land \neg \forall$, and the contextual equivalence between $\exists$ and $\forall$. As we noted in section 2.2 this explanation does not extend to (33b), because it does not have the strengthened meaning $\exists \land \neg \forall$, and hence there can be no appeal to a contradiction between its strengthened meaning and the context. We suggested that (33b) is banned because of redundancy, and our local redundancy principle in (27) indeed rules it out because the whole disjunction is equivalent to one of its disjuncts, $\forall$. However, neither of these principles extends to (33c). This sentence, like (33b), does not have a strengthened meaning $\exists \land \neg \forall$, but unlike (33b) it is not equivalent to any of its sub-constituents. What we should ideally like – but do not have at present – is a single principle that would block each of (33a), (33b), and (33c) by the better alternative in (33d).

References


Two puzzles about appositives: Projection and perspective shift
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Abstract. This paper solves two puzzles about the interpretation of appositive constructions in English: (i) it explains why appositives robustly PROJECT even though they are interpreted in situ with respect to order-dependent phenomena such as discourse anaphora; (ii) it analyzes certain non-projective readings of appositives as instances of PERSPECTIVE SHIFT, a phenomenon that bears striking similarities with the phenomenon of shifted indexical pronouns. To solve the first puzzle, I assume that appositives are interpreted in surface position but adopt a less standard mechanism of operators scope according to which operators can bind lexical predicates or other operators. Since appositives form ForcePs and Force operators cannot be bound, it follows that appositives project even when placed in the syntactic scope of a higher operator. With respect to the second puzzle, I argue that shifted appositives are evaluated with respect to a secondary speech context introduced by a verb of saying or inferred from the larger discourse. Since the two mechanisms of projection and perspective shift are independent, they can be given a uniform analysis.

Keywords: appositives, projection, perspective shift, update semantics

1. First puzzle: Appositive projection despite in-situ interpretation

The consensus in the semantics literature is that appositive constructions cannot be interpreted in the scope of external operators, i.e. in the scope of operators that are placed elsewhere in the sentence (see e.g. Chierchia and McConnell-Ginet 2000, Potts 2005). The basic observation is illustrated below. In (1), despite the presence of an operator, each sentence implies the unaltered appositive content, i.e. that Edward is from Minnesota.\(^1\)

\[\]

(1) a. It is not true that Edward, who is from Minnesota, enjoys cold winters.
   b. Lindsey believes that Edward, who is from Minnesota, enjoys cold winters.

Examples like these demonstrate a very robust pattern and have motivated the view that appositives PROJECT, i.e. do not interact with operators placed elsewhere in the sentence.

Such data could be taken as evidence that, at the relevant level of representation, appositives are not in the syntactic scope of main clause operators. However, appositives can participate in order-dependent phenomena like discourse anaphora (see Potts 2005, AnderBois et al. 2010), which suggests that they are interpreted in surface position. In (2), the anaphoric dependence between ‘Melanie’ and ‘who’ goes from the main clause into the appositive, and the anaphoric dependence between ‘an Italian’ and ‘him’ goes in the opposite direction, i.e. from the appositive into the main clause.

\(^1\)Appositives in linguistic examples and their contribution to logical representations are underlined.
(2) Melanie\(^u\), who\(^u\) adores an\(^u\) Italian, bought him\(_v\) a present.

Importantly, the anaphoric dependencies in (2) can be established only because in each case the antecedent *linearly precedes* the anaphor. This explains why the appositive cannot be interpreted as entirely preceding (3a) or entirely following (3b) the rest of the sentence.\(^2\)

(3)  
   a. # She\(_u\) adores an\(^u\) Italian and Melanie\(^u\) bought him\(_v\) a present.
   b. # Melanie\(^u\) bought him\(_v\) a present and / because she\(_u\) adores an\(^u\) Italian.

The fact that appositives can participate in order-dependent phenomena strongly suggests that they are interpreted in surface position. Given that, it is initially striking that they are exempted from the scope of external operators (recall (1)), as it might appear that appositives are interpreted in situ and not in situ at the same time. This is the first puzzle about appositives.

2. First puzzle solved

In the previous section, we saw that appositives behave as integrated into the sentence with respect to one class of phenomena while they behave as non-integrated into the sentence with respect to another class of phenomena. This section offers an account that reconciles those two seemingly contradictory properties.

2.1. Basic ideas and assumptions

I propose that appositives are adjoined to their anchors, i.e. the constituents they modify (see Jackendoff 1977, Potts 2005, a.o.). This directly explains the in-situ interpretation of appositives with respect to order-dependent phenomena, discussed in the previous section. In order to derive their projection behavior, I assume that appositives—similarly to main clauses—form FORCE PHRASES (ForcePs; cf. Rizzi 1997, Krifka to appear). Force, the syntactic head of ForceP, is an operator that makes two semantic contributions: (i) it introduces a fresh propositional variable for the content expressed by the constituent in its scope, and (ii) it conveys that the speaker is publicly committed to that content. Finally, I assume that operators and predicates are adorned with propositional variables (see Stone 1999, Stone and Hardt 1999), and thus operators can bind predicates while higher operators can bind lower operators. Given that Force cannot be bound, it follows that appositives project even when syntactically embedded under an operator.

I make the following assumptions about the way propositional variables are distributed in syntactic structures.

\(^2\)Similar results are obtained with respect to other order-sensitive phenomena, e.g. presupposition or VP-ellipsis (see AnderBois et al. 2010).
Assumptions about the distribution of propositional variables

i. Operators (e.g. Force, negation) introduce fresh propositional variables.

ii. Lexical operators (e.g. negation, modals, attitude verbs, but not Force!) and lexical predicates (e.g. ‘man’, ‘rich’) are marked by the propositional variable introduced by the closest higher operator.

Assumption (4i) requires operators to be assigned fresh propositional variables. This assumption allows operators to introduce variables which store the semantic content of the constituent in their scope (see below for details). Assumption (4ii) ensures that semantic content is interpreted relative to the closest operator that is higher up in the syntactic tree: a lexical operator, if such is present, or else a Force head. Unlike lexical operators, which are bound by higher operators, Force heads do not depend on propositional variables introduced by higher operators and thus cannot be bound. This is what makes appositives “invisible” to external operators.

Here is an illustration of how those two assumptions derive appositive projection. In (5a), the main clause is interpreted in the scope of the negation while the appositive content is not. The reason for this can be read off from (5b), the syntactic structure associated with (5a). There are three operators in (5b): the higher Force head, the negation, and the lower Force head. According to assumption (4i), each of these operators introduces a propositional variable. Given assumption (4ii), the main clause predicate ‘rich’ is bound by the negation via the variable $q$, the negation is bound by the higher Force operator via the variable $p$, and the appositive predicate ‘lawyer’ is bound by the lower Force operator via the variable $r$. Crucially, Force operators are not lexical and cannot be bound. Thus, the appositive, even though in the syntactic scope of the negation, is not bound by it and its content projects.

(5) a. Jack, who is a lawyer, is not rich.

b. 

```
  ForceP
    ForceP
      TP
        notP
      TP
        DP
        ForceP
          T
            AP
              who is a lawyer
```

According to my proposal, operators can target constituents in their syntactic scope selectively.
That is, constituents are interpreted in the scope of an operator only if they are relativized to the propositional variable introduced by that operator. The rest of the structure is interpreted as if it were outside the syntactic scope of the operator. This way of looking at things requires a modification of the traditional notion of OPERATOR SCOPE. The new notion requires operator scope to take into consideration not only syntactic scope but also the presence of propositional variables, thus equating operator scope with operator binding. Propositional content operators (such as negation or attitude predicates) can now be regarded as a particular kind of binding operators.

2.2. An overview of the logic

In this section, I spell out the analysis of appositive projection sketched above in a typed update logic called UPDATE WITH SPEECH CONTEXTS (USC). Below, I present its main characteristics.

USC is an update logic with basic types $e$ (for individuals), $\omega$ (for possible worlds), $s$ (for assignment functions), and $t$ (for truth values). Among the more important complex types are the type of propositions $\omega t$ (sets of worlds), the type of speech contexts $e \times (\omega t)$ (ordered pairs consisting of an individual and a proposition), the type of information states $st$ (sets of assignments), and the type of dynamic terms $(st)st$ (functions from information states to information states). SPEECH CONTEXTS are ordered pairs consisting of the speaker and her discourse commitments.\footnote{Speech contexts can easily be extended to include further coordinates, if needed.} I reserve the speech context variable $k$ for the UTTERANCE CONTEXT. Models for USC consist of non-empty and pairwise disjoint sets of individuals, possible worlds, assignment functions and truth values, and the basic interpretation function $I_M$, for a model $M$. Assignment functions and the basic interpretation function respect typing, i.e. they assign to an expression of some type a model-theoretic object of the same type. Information states are sets of WELL-BEHAVED assignment functions. Assignments are well-behaved if they assign to speech context variables values whose coordinates are linked in the right way. More specifically, we need to ensure that for any speech context value, the first coordinate (the speaker) is publicly committed to the second coordinate (her discourse commitments).

Next, I list the interpretation rules of USC and briefly discuss the ideas behind those rules.\footnote{Reference to models is dropped.}

(6) Def (SEMANTICS)

a. PRIMITIVE TERMS

- $\llbracket t \rrbracket^{g, \sigma} = \begin{cases} g(t) & \text{if } t \text{ is a variable} \\ l(t) & \text{if } t \text{ is a constant} \end{cases}$

b. FUNCTIONAL TERMS

- $\llbracket \text{sp}(c) \rrbracket^{g, \sigma} = \text{proj}_1(\llbracket c \rrbracket^{g, \sigma})$
- $\llbracket \text{dc}_{sp}(c) \rrbracket^{g, \sigma} = \text{proj}_2(\llbracket c \rrbracket^{g, \sigma})$
- $\llbracket \max(p) \rrbracket^{g, \sigma} = \{ w \mid \exists h \in \sigma : w \in \llbracket p \rrbracket^{h, \sigma} \}$
c. **Dynamic terms**

- \( \sigma[R_p\{t_1, ..., t_n\}] = \{ g \in \sigma | \forall w \in [p]^{0,\sigma} : \langle w, [t_1]^{0,\sigma}, ..., [t_n]^{0,\sigma} \rangle \in [R]^{0,\sigma} \} \)
- \( \sigma[t_1Rt_2] = \{ g \in \sigma | [t_1]^{0,\sigma}R[t_2]^{0,\sigma} \}, \) where \( R \in \{=, \subseteq, \emptyset\} \)
- \( \sigma[\phi \land \psi] = \sigma[\phi][\psi] \)
- \( \sigma[\exists u] = \{ h | \exists g \in \sigma : g[u|h] \} \)

Starting with primitive terms, variables are interpreted by the given assignment function and constants are interpreted by the basic interpretation function. Moving on to functional terms, the interpretation of the first two is straightforward: those terms extract (by means of projection functions) the first or the second coordinate of a speech context, here represented by the variable \( c \). The term \( \max(p) \) denotes the maximal value of the propositional variable \( p \) in a given information state, i.e. the set of all worlds that are contained in some value assigned to \( p \) by assignments in that information state. Dynamic terms introduce a few peculiarities. First, arguments and predicates have access not only to individual assignments but also to entire information states. Assignments are used for the dynamic interpretation of variables, while access to entire information states is needed for the interpretation of \( \max(p) \). Second, dynamic terms describing lexical (but not logical) relations are relativized to sets of worlds and require that the relation hold throughout that set. The remaining part of the interpretation rules is straightforward: conjunction is interpreted as sequential update, and random assignment to a variable amounts to introducing into the information state any assignment that differs from some old assignment at most with respect to the value it assigns to that variable.

### 2.3. First puzzle: Formal account

Let us first consider sentences without operators. The simple sentence in (7a) is represented in USC as in (7b).

\[
(7) \quad \text{a. } [\text{Force} P \text{ Jack is rich }] \\
\text{b. } \exists p \land \exists u \land u = \text{jack} \land \text{rich}_p\{u\} \land \text{dc}_{sp}(k) \subseteq p
\]

An utterance of this sentence introduces a propositional variable \( p \) with the semantic content that Jack is rich. This is because \( p \) is restricted by the conjunct \( \text{rich}_p\{u\} \), which requires that \( u \), i.e. Jack, be rich in all of the worlds represented by \( p \). The fact that the proposition expressed by \( p \) is asserted is represented by the conjunct \( \text{dc}_{sp}(k) \subseteq p \), which ensures that the discourse commitments of the speaker contained in the value of \( k \) are included in the value of \( p \). Since, in general, different assignments will assign to \( k \) values with different discourse commitments, the DISCOURSE COMMITMENTS of the speaker in an information state \( \sigma \), \( \text{DC}_{sp}(\sigma) \), is the set of all worlds found in the value of some \( \text{dc}_{sp}(k) \) in \( \sigma \), i.e. \( \text{DC}_{sp}(\sigma) := \{ w | \exists g \in \sigma : w \in [\text{dc}_{sp}(k)]^{0,\sigma} \} \).

---

5The symbol \( \emptyset \) stands for set-theoretic non-overlap. Note that I use the same relational symbols in the object and the metalanguage.
If the content expressed by (7a) is accepted by the addressee, the context set will be updated with that content. In order to model this, we could enlarge speech contexts with a third coordinate for the context set. If we did that, accepting semantic content could be represented as $$cs(k) \subseteq p$$, where $$cs(k)$$ denotes the third coordinate of the utterance context represented as $$k$$, i.e. $$[cs(k)]^g_{\sigma} = \text{proj}_3([k]^g_{\sigma})$$. The context set in $$\sigma$$ could be defined as $$CS(\sigma) := \{ w \mid \exists g \in \sigma : w \in [cs(k)]^g_{\sigma} \}$$. In what follows, I will disregard acceptance of semantic content.

Sentences with appositives contain multiple ForcePs and thus make multiple assertions. In (8), the main clause receives the same interpretation as in (7) above: it asserts the proposition that Jack is rich, represented as $$p$$. The appositive asserts another proposition, that Jack is from Brooklyn, represented as $$q$$. By uttering (8a), the speaker commits herself to both propositions.

(8) a. [ForceP Jack [ForceP who is from Brooklyn] is rich ]
   b. $$\exists p \land \exists q \land \max_\phi \exists u \land u = jack \land \exists q \land from.brklnq\{u\} \land dcsp(k) \subseteq q \land rich_p\{u\} \land dcsp(k) \subseteq p$$

Let us now turn to sentences with operators. In update semantics, negation is usually modeled as a sentential operator that has the semantic effect of removing all assignments from the information state that survive after the information state is updated with the non-negated sentence (see e.g. Heim 1982, Veltman 1996). The interpretation rule for negated sentences is usually stated as $$\sigma[\neg \phi] = \sigma - \sigma[\phi]$$, for an information state $$\sigma$$ and a dynamic term $$\phi$$. However, this rule is hard to reconcile with the observation that certain parts of the non-negated sentence, i.e. the ones contributed by appositives, escape the scope of negation. This is why I will follow Stone and Hardt (1999) in assuming that operators like negation state a relationship between two propositions. I introduce the abbreviation in (9) for what is intuitively not $$\phi$$.

(9) $$\text{not}_q(\phi) := \exists q \land \phi \land p \not\max(q)$$

Negation has the following three semantic effects: (i) it introduces a propositional variable (here represented as $$q$$) for the content of the term in its scope (here represented as $$\phi$$), (ii) it processes its scope term (assume that $$q$$ occurs free in $$\phi$$), and (iii) it states that the proposition expressed by the negated sentence (here represented as $$p$$) is disjoint from the maximal value of the proposition expressed by the scope term. Let us call the proposition introduced by an operator the scope proposition and the proposition that operators are anaphoric to the reference proposition.

In (9), the scope proposition is represented as $$q$$ and the reference proposition is represented as $$p$$.\footnote{This is in Koev (2013), I argue that the order in which semantic content is accepted explains the typically NOT-AT-ISSUE status of appositives.} In

\footnote{Strictly speaking, the scope proposition in (9) is expressed by $$\max(q)$$, not by $$q$$, which is potentially non-maximal. Nevertheless, it would be easier if we gloss over this technicality and informally think of the scope proposition as the proposition expressed by the variable introduced by the operator.}
the absence of higher lexical operators, the reference proposition would simply be the proposition introduced by the Force operator sitting on top of the structure.

Let us consider the sentence with negation in (10) below. The representation of that sentence is given in (10a), which, by the abbreviation in (9), can be more succinctly represented as in (10b).

(10) Jack is not rich.
    a. \( \exists p \land \exists q \land \exists u \land u = jack \land rich_q(u) \land p \not\emptyset \max(q) \land dcsp(k) \subseteq p \)
    b. \( \exists p \land \not q_p(\exists u \land u = jack \land rich_q(u)) \land dcsp(k) \subseteq p \)

In (10b), there are two propositions present: the reference proposition, represented as \( p \) and introduced by the Force operator, and the scope proposition, represented as \( q \) and introduced by the negation operator. The negation operator states that the reference proposition is disjoint from the scope proposition that Jack is rich. That is, the entire sentence expresses the proposition that Jack is not rich, as required.\(^8\)

We are now ready to offer an explanation for why appositives project past negation. Consider the example in (11a) and its logical representation in (11b).

(11) a. Jack, who is from Brooklyn, is not rich.
    b. \( \exists p \land \not q_p(\exists u \land u = jack \land \exists r \land from.brooklyn_r(u) \land dcsp(k) \subseteq r \land rich_q(u)) \land dcsp(k) \subseteq p \)

The negation operator requires that the content of the variable \( p \) introduced by the Force operator in the main clause be disjoint from the scope proposition, represented as \( q \). However, the variable introduced by the Force operator in the appositive is \( r \), and thus the appositive is not bound by the negation. In other words, the appositive content scopes out of the negation, making (11a) synonymous in propositional content to ‘Jack is from Brooklyn and he is not rich’.

Let me also demonstrate why appositives project when found in the syntactic scope of attitude predicates such as ‘believe’. Where \( p,q \) are propositional variables, \( v \) is an individual variable, and \( \phi \) is a dynamic term, I will make use of the following abbreviation.

(12) \( \text{believe}_p^q(v,\phi) := \exists q \land \phi \land \text{believe}_p\{v,q\} \)

\(^8\)Since assigning values to variables is exhaustive, at least one value of \( p \) will be the entire complement of the scope proposition. This guarantees that the speaker of (10) is not committed to more than necessary.
According to (12), $\text{believe}_p^q(v, \phi)$ stands for a dynamic term which requires that in all of the worlds in the reference proposition the attitude holder believes the content of the scope proposition.\footnote{Again, assume that $q$ occurs free in $\phi$ and thus records its propositional content.} To illustrate, in (13) the verb ‘believe’ introduces the scope proposition that Jack is rich and states that Mary believes that proposition in all of the worlds in the reference proposition. In short, this sentence expresses the proposition that Mary believes that Jack is rich, which is the intuitively correct result.

\begin{enumerate}
\item[(13)]
\begin{enumerate}
\item Mary believes that Jack is rich.
\item $\exists p \land \exists v \land v = mary \land \text{believe}_p^q(v, \exists u \land u = jack \land \text{rich}_q \{u\}) \land \text{dc}_{\text{sp}}(k) \subseteq p$
\end{enumerate}
\end{enumerate}

Finally, let us look at examples in which an appositive occurs in the syntactic scope of ‘believe’.

\begin{enumerate}
\item[(14)]
\begin{enumerate}
\item Mary believes that Jack, who is from Brooklyn, is rich.
\item $\exists p \land \exists u \land u = mary \land \text{believe}_p^q(u, \exists v \land v = jack \land \exists r \land \text{from}.brooklyn_r\{v\} \land \text{dc}_{\text{sp}}(k) \subseteq r \land \text{rich}_q\{v\}) \land \text{dc}_{\text{sp}}(k) \subseteq p$
\end{enumerate}
\end{enumerate}

In (14a), the proposition that Jack is from Brooklyn is attributed to the utterer of the sentence and not to the attitude holder, i.e. Mary. This intuition is captured in the logical representation in (14b). The propositional variable introduced by the ‘believe’-operator is $q$, and only the embedded clause predicate ‘rich’ is relativized to this variable. The appositive predicate ‘from Brooklyn’ is relativized to the propositional variable $r$, introduced by the Force operator in the appositive. Thus, (14a) is correctly predicted to mean the same as ‘Jack is from Brooklyn and Mary believes that he is rich’. The appositive is syntactically part of the embedded clause, yet it is not interpreted in the scope of the attitude operator and projects.

This way of viewing operators as stating a relationship between propositions is general enough and can be applied to other operators, e.g. epistemic modals (see Stone 1999, Stone and Hardt 1999).

3. Previous approaches to appositive projection

In this section, I briefly review four existing approaches to appositive projection.

The main idea behind the SCOPAL APPROACH to appositive projection is a syntactic one: appositives escape the scope of external operators because, at the relevant level of representation, they are attached to a high syntactic node, typically the root node of the sentence (see Demirdache 1991, Del Gobbo 2003, Nouwen to appear, Schlenker ms). Since appositives appear string-adjacent to their anchors, this approach has to rely on some less standard syntactic assumptions in order to
derive high attachment. Yet, it correctly derives the fact that appositives are not interpreted in the scope of main clause operators.

One major issue for scopal accounts is that it is not obvious how they would explain the in-situ interpretation of appositives, witnessed by data as in (2) above (=‘Melanie, who adores an Italian, bought him a present’). However scopal accounts might want to interpret such examples, the interpretation procedure should be made sensitive to the linear order between the appositive and the remaining parts of the sentence. But this requirement goes against the assumption of such accounts that appositives are interpreted outside the clause in which they occur.

According to the TWO-DIMENSIONAL APPROACH, appositive content is separated from the main clause content not in the syntax but rather in a secondary meaning dimension (see Potts 2005; see also Karttunen and Peters 1979, Bach 1999). This explains why main clause operators have no effect on the way appositives are interpreted and derives the projection behavior of appositives. Under this approach, the sentence ‘Lance, a cyclist, didn’t win’ receives the rough interpretation \[^\Box \neg \text{win}(lance)\] \([-\text{cyclist}(lance)]\), in which the negation operator only takes scope over the main clause, as required.

The two-dimensional approach inherits the same major problem as that of scopal accounts: it does not leave room for the in-situ interpretation of appositives. This approach neatly separates the two meaning dimensions, thus excluding unwarranted scopal interaction between them. But in doing so, it destroys the linear order between the appositive and the rest of the sentence. Yet, it is exactly this order that the interpretation procedure should be made sensitive to, if the participation of appositives in order-sensitive phenomena is to be captured.

In addition, the two-dimensional approach seems to make wrong predictions with respect to truth-value intuitions about sentences with appositives. Since appositive content projects a secondary meaning dimension, the lack of a single truth value per sentence predicts that when speakers are forced into a binary judgment, they either disregard the appositive content or exhibit reluctance to render a judgment. However, none of those predictions is borne out: informants judge sentences with false appositives and true main clauses simply as false (see Syrett et al. ms). More generally, there seems to be an inherent tension between two-dimensionality and the fact that the secondary dimension is part of the regular truth conditions of the sentence.

The basic idea behind the PRESUPPOSITIONAL APPROACH is that appositives express presupposed content (see Sæbø 2011; see also Schlenker ms). Thus, whatever mechanism is evoked to explain presupposition projection, it would also explain appositive projection.

There are two general points which cast serious doubt on the idea that appositives are presuppositional. First, unlike classical presuppositions, appositives seem to make a purely truth-conditional contribution to the sentence in which they appear. As mentioned above, false appositives make the whole sentence false, not infelicitous (see again Syrett et al. ms). The second major difference
between presuppositions and appositive content is that the former are usually discourse-old while
the latter typically expresses new (see Chierchia and McConnell-Ginet 2000, Potts 2005) albeit
unsurprising information (see Schlenker ms).

In addition, the projection pattern of appositives significantly differs from that of classical presup-
positions (but see Schlenker ms for potential parallels). While presuppositions can be canceled,
this is harder for appositive content. To illustrate, in (15a) the presupposition triggered by ‘regret’
is blocked and the sentence as a whole does not imply that Betty slapped Fred. In contrast, in (15b)
the implication triggered by the appositive, i.e. the proposition that Obama is a socialist, is not
canceled. Since this proposition is also hypothetically assumed in the first part of the sentence, the
result is a piece of infelicitous discourse.

(15) a. If Betty slapped Fred, then she regrets that she slapped him.
    b. # If Obama is a socialist, then the President, who is a socialist, will raise taxes on the
       rich.

Finally, the DISCOURSE TOPIC APPROACH seeks to derive the projective nature of appositives and
other constructions from their not-at-issue discourse status (see Amaral et al. 2007, Roberts et al.
2009, Simons et al. 2010). According to this approach, semantic content is not at-issue if and only
if it is not relevant to the current topic of the conversation.

The discourse topic approach rides on the strong correlation between projective meanings and not-
at-issue meanings across empirical domains. However, this correlation cannot be seen as a mere
equivalence: meanings may not project but be not-at-issue, and meanings may project but be at-
issue. In the sentence ‘Jessica imagined she became the next Miss USA’ the embedded proposition
need not address the discourse topic, i.e. it need not be at-issue, yet it does not project, i.e. the
sentence does not imply it. Also, sentence-final appositive relative clauses as in ‘Liz might be
with her husband, who has prostate cancer’ project but can be at-issue, e.g. can be directly rejected
(see AnderBois et al. 2010, Koev 2013, Syrett et al. ms). Such data suggest that the relationship
between not-at-issueness and projection is more flexible and needs further investigation.

4. Second puzzle: Some non-projective readings of appositives

In the first part of this paper, I offered an explanation for the fact that appositives project out
of external operators. Yet, scholars have uncovered several exceptions to the claimed projection
behavior of appositives (see Thompson 1971, Amaral et al. 2007, Harris and Potts 2009, Sæbø
2011, Wang et al. 2006, Nouwen to appear, Schlenker ms). Here, I focus on the cases cited below.
In (16), the information that Harold’s girlfriend is a little bit crazy need not be attributed to the
speaker and can instead be attributed to Harold. In (17), the information that Joan’s chip was
installed last month is attributed to Joan and not to the speaker.
(16) Harold says that his girlfriend, who is a little bit crazy\textsubscript{Harold}, wants to go to Hanoi, but I think she’s too rational to try it. (Thompson 1971)

(17) Joan is crazy. She’s hallucinating that some geniuses in Silicon Valley have invented a new brain chip that’s been installed in her left temporal lobe and permits her to speak any of a number of languages she’s never studied. Joan believes that her chip, which she had installed last month\textsubscript{Joan}, has a twelve year guarantee. (Amaral et al. 2007)

Thus, despite the otherwise robust projection behavior of appositives, we find cases in which appositive projection seems blocked and the appositive content is not implied by the sentence as a whole. This is the second puzzle about appositives.

5. Second puzzle solved

This section argues that certain embedded-like readings of appositives arise through perspective shift to the speaker of a secondary speech context.

5.1. The nature of the phenomenon

In the previous section, we saw examples in which appositives fail to project (recall (16)-(17)). Such data might create the impression that the appositive is semantically embedded, i.e. interpreted in the scope of an attitude predicate. There are two pieces of evidence that this not so. First, the examples we saw above involved positive attitude predicates. In similar sentences with negative attitude predicates, the appositive is clearly not semantically embedded but can nevertheless give rise to non-speaker-oriented interpretations. In (18), the appositive content (that the brain chip was installed ten years ago) is not doubted / disbelieved by Joan but is actually part of what she believes.

(18) Joan is crazy. She’s hallucinating that some geniuses in Silicon Valley have invented a new brain chip that’s been installed in her left temporal lobe and permits her to speak any of a number of languages she’s never studied. She is now worried about the battery life of her chip.
Joan doubts / doesn’t believe that her chip, which she had installed ten years ago\textsubscript{Joan}, will last for another year.

In addition, Harris and Potts (2009) provide experimental evidence showing that non-speaker-oriented readings of appositives are possible in the absence of an embedding predicate.

(19) My aunt is extremely skeptical of doctors in general. Dentists, who are only in it for the money anyway\textsubscript{my aunt}, are not to be trusted at all. (Harris and Potts 2009)
I propose that such non-speaker-oriented readings of appositives result from PERSPECTIVE SHIFT to another agent. Shifted appositives are attributed to another agent not directly but through the intermediary of a secondary speech context. Such secondary speech contexts are canonically introduced by verbs of saying (see (16)), but their existence can be inferred in the presence of other attitude predicates (see (17)-(18)) or even in the absence of an intensional predicate (see (19)).

Put simply, my claim is that (i) shifted appositives are understood as uttered (not as believed, conjectured, doubted, etc.) and (ii) this utterance is performed by the speaker (not the addressee) of a secondary speech context. This claim makes two testable predictions. The first prediction is that appositive shift is blocked when the existence of a secondary speech context cannot be inferred. This prediction is confirmed in (20)-(21). In these examples, the appositive content is not inferred from verbal communication and appositive shift seems hard or impossible. Since a speaker-oriented reading of the appositive is excluded by the broader context, the discourses sound odd.

(20) My old horse is such a picky eater, it’s unbelievable. He only likes his food fresh. # He thinks the lush grass he got today, which looks so dry, is not worth eating at all.

(21) Sarah Palin, a right-wing politician with strong religious beliefs, has criticized liberal politicians on literally every social issue. Even though she never explicitly said it, it is clear that her political opinions stem from her belief that liberals have no moral values and should not be allowed to lead the country. You are liberally minded and don’t share Palin’s beliefs. You say: ?? Palin believes that liberals, who have no moral values, should not be allowed to lead the country.

The second prediction of the current proposal is that appositives cannot shift to a party other than the speaker of a speech context. This prediction too seems to be borne out. In (22), the appositive can only be attributed to the speaker of the reported speech context, i.e. the aunt. This is independent of the grammatical role of the speaker (subject in (22a) vs. oblique object in (22b)) and the fact that another person, i.e. the uncle, is mentioned in the sentence.

(22) Crazy aunt, crazy uncle.
   a. My aunt said to my uncle that the Feds, who are following her, have bugged her apartment.
   b. My uncle heard from my aunt that the Feds, who are following her, have bugged her apartment.

In the following section, I demonstrate how the formal account of appositive projection developed above can accommodate shifted appositives.
5.2. Second puzzle: The formal account

I have argued that sentences with verbs of saying exhibit a canonical environment in which appositives can undergo perspective shift (cf. Harris and Potts 2009 for further support). It is then reasonable to assume that verbs of saying, due to their lexical meaning, introduce reported speech contexts. I will use the dynamic term \( \text{say}^p_{\phi}(v, \phi) \) in order to express that \( v \) says \( \phi \) in the speech context \( c \).

\[
\text{say}^p_{\phi}(v, \phi) := \exists c \land v = \text{sp}(c) \land \exists q \land \phi \land \text{say}_p\{c, v, q\}
\]

According to (23), \( \text{say}^p_{\phi}(v, \phi) \) abbreviates a series of conjuncts and has the following semantic effects: (i) it introduces a secondary speech context (expressed by \( c \)) and requires that the thematic agent of ‘say’ (expressed by \( v \)) be the speaker of that context, (ii) it introduces a scope proposition (expressed by \( q \)) as recording the content of \( \phi \), and (iii) it states that the speaker of the secondary speech context uttered the scope proposition in all of the worlds in the reference proposition (expressed by \( p \)). The sentence with ‘say’ in (24a) can now be logically represented as in (24b).

\[
\begin{align*}
\text{a. Harold says that his girlfriend is a little bit crazy.} \\
\text{b. } \exists p \land \exists v \land v = \text{harold} \land \text{say}^p_{\phi}(v, \exists u \land g.f.of_q\{u, v\} \land \text{crazy}_q\{u\}) \land \text{dc}_{\text{sp}}(k) \subseteq r \land \\
\text{want.go.to.hanoi}_q\{u\} \land \text{dc}_{\text{sp}}(k) \subseteq p
\end{align*}
\]

We can offer the following straightforward explanation of why appositives can undergo perspective shift after verbs of saying. In the presence of two speech contexts (the utterance context and a secondary speech context introduced by ‘say’), appositive content can restrict the discourse commitments of the speaker of either context. When the appositive is anaphoric to the utterance context, it is interpreted as non-shifted; when, however, the appositive is anaphoric to the reported speech context, it gives rise to a shifted reading. This is illustrated in (25) below. In (25a), the appositive contribution is evaluated with respect to the utterance context and does not shift, while in (25b), it is evaluated with respect to the reported speech context and does shift. This contrast is captured by the difference between the conjuncts \( \text{dc}_{\text{sp}}(k) \subseteq r \) vs. \( \text{dc}_{\text{sp}}(c) \subseteq r \) in the underlined portion of the translations, where \( k \) stands for the utterance context and \( c \) stands for the reported speech context.

\[
\begin{align*}
\text{a. Harold says that his girlfriend, who is a little bit crazy, wants to go to Hanoi.} \\
\text{b. } \exists p \land \exists v \land v = \text{harold} \land \text{say}^p_{\phi}(v, \exists u \land g.f.of_q\{u, v\} \land \text{crazy}_q\{u\}) \land \text{dc}_{\text{sp}}(c) \subseteq r \land \\
\text{want.go.to.hanoi}_q\{u\} \land \text{dc}_{\text{sp}}(k) \subseteq p
\end{align*}
\]

Notice that the appositive in (25) is linked to the relevant speech context variable through discourse anaphora. This implies that no structural configuration is required to hold between the intensional
predicate and the shifted appositive. This analysis is empirically supported by the possibility that a verb of saying licenses appositive shift across a sentence boundary, as demonstrated in the following example.

(26) Harold told me a bunch of interesting things the other night. His new girlfriend, who is a little bit crazy Harold, wants to go to Hanoi.

Although in most of the examples discussed so far the shifted appositive was in the syntactic scope of an intensional predicate, (26) demonstrates that appositive shift is primarily a discourse-level phenomenon that calls for a dynamic analysis.

I now turn to the shifting possibilities of appositives in the absence of verbs of saying. Recall from the previous section that perspective shift after non-‘say’ attitudes is generally possible, except when it is clear from the larger discourse that no speech act communicating the content of the appositive has occurred. This necessitates two representations for verbs like ‘believe’: one that does and another that does not introduce a secondary speech context ((27a) is repeated from (12) above).

(27) a. \( \text{believe}^p(v, \phi) := \exists q \land \phi \land \text{believe}_p\{v, q\} \)
   b. \( \text{believe}^{\ast\ast}p(v, \phi) := \text{believe}^p(v, \phi) \land \text{say}^{\ast\ast}p(v, \phi) \land q = r \)

The representation in (27b) could be thought as the pragmatically enriched representation of (27a). Since one typically gains knowledge of other people’s mental states through verbal communication, from “A believes that \(p\)” the hearer will typically conclude “A said that \(p\)” . Alternatively, one could claim that non-‘say’ attitudes in English are lexically ambiguous between a regular form as in (27a) and a form as in (27b) which introduces a speech context. Here, I will not choose between those two options.

Finally, what about the possibility of appositive shift in the absence of intensional verbs? I will assume that in such cases a default inference can be drawn to the effect that a secondary speech act had occurred and thus an additional speech context is present. I leave the details of this analysis to further research.

In this section, I offered a formal analysis of the phenomenon of perspective shift in appositives. Importantly, doing so did not require any modifications to the account of appositive projection past external operators developed in the first part of the paper.

6. The parallels between shifted appositives and shifted indexical pronouns

Kaplan (1989) alleged that indexical expressions in English are directly referential and denote parameters of the utterance context. Kaplan conjectures that operators that shift the context—which
he famously called MONSTERS—do not exist in English. For example, the English indexicals ‘I’ and ‘you’ can only refer to the current speaker and hearer.

Yet, it has been known for some time that indexical pronouns, i.e. first and second person pronouns, in some languages can shift their reference in the presence of an intensional predicate (see Rice 1986, Speas 1999, Schlenker 2003, Anand 2006, a.o.). When shifting occurs, first person pronouns refer to the speaker of a secondary speech context and second person pronouns refer to the actual speaker. I illustrate the phenomenon on the following data from Kurmanji (Iranian), where the first person pronoun shifts its reference in the presence of a ‘say’-verb.10

(28)  
Ehmet is visibly not feeling well and says to you that he is ill. Later you say:

Ehmet go ki ez e nexos-im.
Ehmet.ERG say.PART that I NOM COP ill-1SG

‘Ehmet said that he (=Ehmet) is ill.’

The important question is: What are the conditions under which indexical pronouns can shift? Two universal constraints proposed in the literature on perspective shift are SHIFT TOGETHER and STRICT LOCALITY. According to Shift Together, a given perspective holds throughout the entire complement, i.e. all perspective-sensitive elements in a clause are interpreted with respect to the same context. Strict Locality states that the perspective of a complement clause is solely determined by the immediately dominating predicate, not by predicates that are higher up in the structure. There seem to be severe empirical challenges to both of those constraints (see Rice 1986, Speas 1999, Anand 2006 for discussion).

However, there appears to be another, more robust universal constraint on pronominal shift that is only cursorily mentioned in the literature. Authors often observe that pronominal shift is limited to or most natural under verbs of saying (see Speas 1999, Schlenker 2003, Anand 2006; but see Rice 1986 for potential challenges). The same is true for Kurmanji: while indexical pronouns in this language can shift in the presence of verbs of saying (recall (28)), pronominal shift in ‘belief’-reports is not possible, even when those are based on an existing speech act.

(29)  
Ehmet often says that he is a rich man. You meet Adan and say to her:

# Ehmet ino di-k-e ki ez e zengin-im.
Ehmet.NOM belief HAB-do-COP that I NOM COP rich-1SG

‘Ehmet believes that he (=Ehmet) is rich.’ (intended)

10In the glosses, the following abbreviations are used: 1S = first person singular, COP = copula, ERG = ergative, HAB = habitual, NOM = nominative, PART = participle, PL = plural.
Thus, Kurmanji adds more crosslinguistic evidence for the generalization that verbs of saying are the canonical environment for pronominal shift. I will then tentatively propose the following candidate for an implicational language universal.

(30)  **SAY SHIFT** (a potential language universal)
If a language allows a perspective-sensitive element to shift in the presence of any intensional operator, the element can shift in the presence of a verb of saying.

We are now ready to compare shifted appositives in English to shifted indexical pronouns in Kurmanji. My claim is that the two phenomena agree in at least two respects: (i) they both obey Say Shift, and (ii) they both can be licensed pragmatically. First, we already know that English appositives and Kurmanji indexical pronouns can shift after verbs of saying (see (16) and (28)) and thus obey Say Shift. Second, in most of the literature it is assumed that pronominal shift is licensed only if the pronoun is in the *syntactic scope* of a monstrous operator (see e.g. Schlenker 2003, Anand 2006). I already demonstrated that there is no such requirement on shifted appositives, which can be licensed pragmatically (recall (19) and (26) from above). Somewhat strikingly, the same holds for shifted indexical pronouns in Kurmanji: in (31), pronominal shift is licensed across a sentence boundary.

(31)  *You talked to Ehmet last night and he complained that he is ill. Later, you say:*

\[
\text{Mın \ dhuni \ Ehmet \ ra \ şor \ kr-ın. Ez e nexoş-im.} \\
\text{I.ERG \ yesterday \ Ehmet \ with \ word \ did-PL \ I.NOM \ COP \ ill-1SG}
\]

‘Yesterday I talked to Ehmet. He (=Ehmet) is ill.’

Data as in (31) suggest that analyses of pronominal shift in terms of c-commanding monstrous operators might be mistaken, at least for Kurmanji. In this language, pronominal shift can be licensed from preceding discourse without the need for a particular structural configuration.

The fact that shifted appositives in English and shifted indexical pronouns share certain distributional restrictions suggests that the two phenomena should be given a uniform analysis. Below, I sketch an analysis of the Kurmanji data within the current account. Let us assume that Kurmanji ‘say’-predicates but no other intensional predicates introduce secondary speech contexts. Unlike in English, where indexical pronouns are lexically specified to refer to the participants of the utterance context, indexical pronouns in Kurmanji are lexically underspecified. If they are anaphoric to the utterance context, they refer to participants of the actual context and do not shift. If, however, they are anaphoric to a secondary speech context, they refer to participants of this latter context and shift. This simple analysis is illustrated on the example in (32) below. In it, ez ‘I’ is translated as \(\text{sp}(k)\) for the non-shifted reading and as \(\text{sp}(c)\) for the shifted reading.
Despite the similarities, it is important to keep in mind that English appositives differ from Kurmanji indexical pronouns in that the former can shift in the absence of a verb of saying (recall (17)-(19)). Under the assumption that drawing of pragmatic inferences is not subject to crosslinguistic variation, we seem forced to conclude that—for reasons to be further investigated—indexical pronouns can only refer to speech contexts that have been lexically introduced.

7. Conclusion

This paper was devoted to two puzzles about appositives: (i) the fact that appositives are interpreted in situ with respect to order-dependent phenomena such as discourse anaphora but nevertheless project past external operators, and (ii) the fact that appositive projection can be blocked in certain environments. I solved the first puzzle by claiming that appositives are interpreted in surface position but cannot be bound by external operators. The second puzzle was attributed to an independent perspective-shifting mechanism that does not involve interpreting appositives in the scope of an operator. More generally, both puzzles have been explained in a uniform formal account that preserves the robust projection behavior of appositives.

Acknowledgments

I am particularly indebted to Artemis Alexiadou, Mark Baker, David Beaver, Maria Bittner, Cornelia Ebert, Jane Grimshaw, Robert Henderson, Hans Kamp, Manfred Krifka, Emar Maier, Philippe Schlenker, Roger Schwarzschild, Giorgos Spathas, Matthew Stone, Kristen Syrett, and Ede Zimmermann. I would like to also thank Ümit Atlamaz for providing the Kurmanji data. All mistakes are my own.

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Towards a feature-based semantics of ASL loci
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Abstract. American Sign Language famously disambiguates pronoun antecedents with the use of space. In ASL, NPs can be signed at different locations (‘loci’) in the signing space; pronouns later retrieve these NPs by pointing at the same locus. Many analyses of ASL pronouns assume that these spatial loci are the overt realization of formal variables (Lillo-Martin and Klima 1990, a.o.), based on the observations that there are arbitrarily many loci and that pronominal ambiguity can be resolved under multiple levels of embedding. In this paper, I argue that loci should not be analyzed as variables, but rather as morphosyntactic features. These results directly bear on the theory of Variable-Free Semantics (Jacobson 1999). A feature-based fragment is provided.

Keywords: American Sign Language, loci, pronouns, variables, features, variable-free semantics.

1. Introduction

American Sign Language famously disambiguates pronoun antecedents with the use of space. In ASL, both referential and quantificational noun phrases (NPs like Bill or every boy) can be signed at different locations (‘loci’) in the signing space. Pronouns can later retrieve these NPs by pointing at the same locus. For example, (1) is disambiguated depending on whether the pronoun (IX) points at the locus of JOHN or the locus of BILL. (In my transcriptions of ASL, different subscripts indicate different locations in the signing space.)

(1) 7 JOHN$_a$ WANT BILL$_b$ THINK IX-$a$ LIKE IX-$b$.
    a. = ‘John$_a$ wants Bill$_b$ to think that he$_a$ likes him$_b$.’
    b. ≠ ‘John$_a$ wants Bill$_b$ to think that he$_b$ likes him$_a$.’

Many analyses of ASL pronouns assume that these spatial loci are the overt realization of formal variables (Lillo-Martin & Klima 1990, a.o.). This assumption arises from the observation that there are arbitrarily many loci and that pronoun ambiguity can be resolved under multiple levels of embedding, mirroring the use of indices in formal systems.

Here, I argue that loci should not be analyzed as variables, but rather as morphosyntactic features (as in, e.g., Neidle et al. 2000). In Section 3, I show that the variable-based analysis undergenerates. Specifically, I present cases in which two loci-sharing pronouns appear free in the same expression, but nevertheless receive different interpretations. The variable-based analysis incorrectly predicts variable capture. I suggest that this favors a system in which feature mismatch can

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8Special thanks to Philippe Schlenker, Chris Barker, Kate Davidson, and Jonathan Lamberton. This work was supported in part by NSF grant BCS-0902671 and the ERC Advanced Grant Project, ‘New Frontiers of Formal Semantics’. The views expressed here do not necessarily reflect those of the NSF or the ERC. All errors are my own.
prevent pronoun binding, but where syntactically independent choices can’t force two pronouns to co-refer. On the other hand, I show that loci share certain important properties with morphosyntactic features: (a) they may remain uninterpreted in certain environments (specifically, in ellipsis and under focus sensitive operators), (b) they induce verbal agreement, and (c) they display patterns of underspecification.

These results directly bear on the theory of Variable-Free Semantics (Jacobson 1999), which posits that the logic underlying natural language does not make use of formal variables. In Section 5, I provide a constructive proof that ASL loci can be captured in a variable-free framework: I present an explicit fragment (using Combinatory Categorial Grammar) in which loci are analyzed as a spatial feature that subdivides the syntactic category NP.

1.1. Methodology and Transcription Convention

All data were gathered following the ‘playback method’ (Schlenker 2011). A Deaf native signer was asked to sign a paradigm of sentences for a video recording. The resulting video was then played back for the same signer, who gave grammaticality judgements using a 7 point scale (7 is perfectly grammatical) and answers to any interpretation questions. Judgements could then be repeated on separate days or with different signers. In this paper, I adopt the following notational convention: ratings of 1-4 receive a ‘*’ to indicate ungrammaticality, ratings of 5-7 receive no star; I then specify the average numerical judgement in a superscript.

Following standard convention, signs are glossed with their English translation in all capitals. Subscripts on signs represent different locations in the horizontal plane in front of the signer; in any given sentence, alphabetical order of subscripts indicates right-to-left placement of loci. A subscript \( i \) on a noun indicates that the noun was signed at location \( i \). A subscript before or after a verb (e.g. \( \text{GIVE}_b \)) indicates that the verb moves in space from or to that locus, respectively. Three pronominals are discussed. IX-\( i \) (short for ‘index’) is a pronoun (‘he, she’), signed by pointing at locus \( i \). POSS-\( i \) is the possessive pronoun (‘his, her’), signed by directing a B-handshape (flat hand with fingers together) at locus \( i \). SELF-\( i \) is the reflexive pronoun (‘himself, herself’), signed by directing an A-handshape (fist with thumb sticking out) at locus \( i \).

2. Background

In American Sign Language, NPs may be associated with locations (‘loci’). Pronouns refer back to these NPs by literally pointing at the relevant locus. For example, the sentence in (2) is disambiguated depending on whether the pronoun points back to the locus established by the first or the second NP (shown in (3a) and (3b)). These loci can be placed at arbitrary locations in the horizontal plane in front of the signer (modulo some pragmatic restrictions, to be discussed), and there can be arbitrarily many loci, up to the limitations of memory.
These pronominal signs in ASL are not only referential. In particular, pronouns can undergo true quantificational binding: in (4) and (5), the meaning of the pronouns co-varies with the quantifier.

(4) \[\text{7 ALL BOY}_{a} \text{ WANT ALL GIRL}_{b} \text{ THINK } \{\text{IX-}a/\text{IX-b}\} \text{ LIKE } \{\text{IX-b/IX-a}\}.\]

‘Every boy wants every girl to think that \{he/she\} likes \{her/him\}.’

(5) \[\text{7 NO BOY}_{a} \text{ WANT ANY GIRL}_{b} \text{ THINK } \{\text{IX-}a/\text{IX-b}\} \text{ LIKE } \{\text{IX-b/IX-a}\}.\]

‘No boy wants any girl to think that \{he/she\} likes \{her/him\}.’

Further, loci may even be used to disambiguate quantificational antecedents that have the same domain of quantification. For example, sentence (6) has a reading in which both indefinites range over the same set of individuals (truth-conditionally evident because they scope under another operator); as above, however, the sentence is disambiguated by the use of loci.

(6) \[\text{7 WHEN SOMEONE}_{a} \text{ HELP SOMEONE}_{b} \text{, IX-b HAPPY}.\]

‘When someone helps someone, the latter is happy.’

Taking these examples together, there is a striking parallel between loci and formal variables; indeed, even the English glosses in much of this paper use variables as subscripts! It is this observation that motivates Lillo-Martin and Klima (1990) and others to propose that, in fact, variables are the overt phonological manifestation of variable names.

3. Variables or Features?

In this paper, I compare two possible avenues of analysis. The first option, following Lillo-Martin & Klima 1990, is to hypothesize that loci are in direct correspondence with formal variables. The second option is to hypothesize that loci are in fact some kind of morphosyntactic feature, which is manipulated by the same syntactic mechanisms which govern canonical features (gender, number, person) elsewhere in language. This latter option is chosen by Neidle et al. 2000, although we note that they do not give an explicit formalization.
The two hypotheses are presented formally in the following:

(7) **The (strong) loci-as-variables hypothesis:** There is a one-to-one correspondence between ASL loci and formal variables.

(8) **The loci-as-features hypothesis:** Different loci correspond to different values of some morphosyntactic spatial feature.

In the following sections, I distinguish properties and test predictions of the two hypotheses. We find that the feature-based analysis allows a larger set of interpretations and grammatical sentences than the variable-based analysis: specifically, only the feature-based analysis allows two individuals to be indexed at the same locus. I show that these examples are attested, and that the variable-based analysis undergenerates.

3.1. Binding with variables

What is a variable? Linguists have employed variables to describe natural language, but the concept is a more basic, logical notion. Conceptually, a variable is characterized by its relation with other variables: critically, two variables of the same name are semantically tethered, and must receive the same value. In the lambda calculus, for example, this property arises from the definition of variable substitution; specifically, a recursive syntactic definition ensures that all instances of a given variable are replaced by the substituted term. (For a detailed exposition of this point and the finer details of the lambda calculus, see Barker ms.)

In natural language semantics, the semantic tethering of variables is traditionally accomplished through the use of **assignment functions** (Heim & Kratzer, 1998, p. 111), which map each free variable (taken to be the natural numbers 1, 2, 3, ...) to an individual (John, Mary, ...). Critically, assignment functions are *functions* (i.e. each input is related to exactly one output), so all occurrences of a given free variable are mapped to the same individual.

Within these theories, variable binding is accomplished by manipulating the assignment functions: if S1 is a sentence with a free variable 8, the value of $[S1]_g$ is a function that takes an individual $x$ and returns $[S1]_{g'}$, where $g'$ is identical to $g$ but with 8 mapping to $x$. Examples (9) and (10) provide an example.
Importantly, this system has the property of **variable capture**: a variable is bound by the lowest operator which scopes over it and quantifies over that variable. As a correlate: if two occurrences of the same variable are free in some sub-expression, they will both be captured by the same operator.

### 3.2. Variable-Free Semantics

A second theory of pronominal binding is the framework of Variable-Free Semantics (VFS: Jacobson 1999), a model of natural language semantics in which the denotation of every constituent can be expressed as a term with no free variables. In VFS, pronouns denote the identity function over individuals, as in (11). The argument slot introduced by the pronoun can then be passed through the syntax via function composition, using the ‘Geach’ operator in (12). Finally, binding is accomplished using Jacobson’s z-combinator, which merges two argument slots (shown in (13)).

(11)  $he = \langle \text{NP}^{\text{NP}}, \lambda x.x \rangle$

(12)  **Syntactic and semantic definitions of function composition via Geach ($g$):**
   
   a.  $g(A/B) = A^{\text{NP}}/B^{\text{NP}}$
   
   b.  $g(f) = \lambda h.\lambda y[f(h(y))]$

(13)  **Syntactic and semantic definitions of binding ($z$):**
   
   a.  $z((B/\text{NP})/A) = (B/\text{NP})/A^{\text{NP}}$
   
   b.  $z(V_{(\alpha,\epsilon,\beta)}) = \lambda f_{(\epsilon,\alpha)}\lambda x_{\alpha}[V(f(x))(x)]$

Examples (14) and (15) demonstrate how $g$ and $z$ interact in the grammar to achieve binding. In (14), the $g$ combinator passes up the individual argument slot; because this pronoun is never bound, the (extensional) meaning of the sentence is a function from individuals to truth values. In (15), the $z$ combinator acts on the verb, merging the $e$-type argument of the *mother-of* function with the second $e$-type argument of *loves*. The extension of the sentence is a truth value.

(14)  “He laughed.” $= g(\text{laughed}')(he') = \langle S^{\text{NP}}, \lambda y.e.\text{laughed}'(y) \rangle$
Logically, both variable-full and variable-free systems have the same expressive power (for example, the lambda calculus can be translated into Combinatory Logic, which does not make use of variables). Thus, the theoretical question is not whether one or the other is able to express a certain meaning (both can), but rather, how well each framework fits into a believable syntactic model.

One argument against variables is the observation that indices have no phonological manifestation in spoken language — we do not pronounce "he\(_x\)" and "he\(_y\)" differently. As we have seen, however, American Sign Language has been argued to be a counter-example to this generalization. Thus, if loci did indeed show all the properties of formal variables, this would be a strong argument against the Variable-Free hypothesis.

### 3.3. Evidence against variables: no accidental variable capture

As we saw in Section 3.1, variables have the property that two occurrences of the same variable must refer to the same individual. Features do not have this property. If two NPs have different features, they are not able to be co-referent (thus, ambiguity can be eliminated in some cases); however, if two NPs have the same feature, they are not forced to denote the same individual. For example, the gender features on he and she in (16) prevent the pronouns from referring to the same individual. However, although both pronouns in (17) bear identical features, they nevertheless can refer to different individuals.

\[
(16) \quad \text{John told Mary that he thinks she will win.}
\]

\[
\rightarrow 'He' \text{ and 'she' cannot pick out the same individual.}
\]

\[
(17) \quad \text{John told Barry that he thinks he will win.}
\]

\[
\rightarrow \text{The two occurrences of 'he' need not pick out the same individual.}
\]

This is therefore a property which distinguishes the two analyses. In this section, we observe that loci do not force co-reference, thus falsifying the strong loci-as-variables hypothesis.

### 3.3.1. Loci indexing more than one individual

As discussed, the variable-based analysis employs assignment functions, which, by definition, map each variable to exactly one individual. On the hypothesis that there is a one-to-one relation between variables and loci, the variable-based analysis therefore predicts that a given locus can only index one individual at a time. Sentence (18) provides a counter-example to this prediction. Here,
Both JOHN and MARY are signed at locus $a$, so IX-$a$ can retrieve either individual. Likewise, both BILL and SUZY are signed at locus $b$.

(18) 6 EVERY-DAY, JOHN$_a$ TELL MARY$_a$ IX-$a$ LOVE IX-$a$. BILL$_b$ NEVER TELL SUZY$_b$ IX-$b$ LOVE IX-$b$.

‘Every day, John$_i$ tells Mary$_j$ that he$_i$ loves her$_j$. Bill$_k$ never tells Suzy$_l$ that he$_k$ loves her$_l$.’

In contrast, the grammaticality of (18) comes automatically under the agreement analysis, in which a NP may bind any pronoun that agrees in locus.

A possible counter-analysis is that JOHN and MARY are not actually indexed at the same locus, but rather that they are indexed at two loci which are so close together that they are phonetically indistinguishable. However, evidence against this analysis comes from both production and reception. In production, the signer was asked explicitly to place the pairs of people at the same locus; the sentence above is what was produced. In reception, the sentence was judged as technically ambiguous, but with one very implausible reading (in which John tells Mary her own opinions.)

Nevertheless, in most contexts, it still seems to be the case that indexing two individuals at the same locus is dispreferred. This dispreference, as well as the relative acceptability of (18), can be explained in pragmatic terms. First, there is a general pragmatic pressure to avoid ambiguity. (In fact, Grice 1975 posits this as an explicit maxim in the Manner category.) In ASL, one way to accomplish this end is through the use of multiple loci. However, in the example above, this pragmatic pressure is reduced by other means: two logically-possible readings are ruled out by binding theory (Condition B), and the final reading is ruled out by implausibility.

This analysis is supported by the observation that sentence judgements decrease when ambiguity increases. For example, (19) is parallel to (18) except that Condition B no longer eliminates readings. In a paired paradigm, (18) receives a rating of 6/7; (19) receives a rating of 4/7.

(19) * 4 EVERY-DAY, JOHN$_a$ TELL MARY$_a$ IX-$a$ THINK IX-$a$ SMART. BILL$_b$ NEVER TELL SUZY$_b$ IX-$b$ THINK IX-$b$ SMART.

‘Every day, John tells Mary that he$_i$ thinks {he/she} is smart. Bill never tells Susan that he$_k$ thinks {he/she} is smart.

In short, in certain specific examples where pragmatic effects are controlled for, it appears that ASL loci can, in fact, be indexed at the same locus. The variable-based analysis gets the wrong prediction.

3.3.2. Uninterpreted loci under only

In spoken language, pronouns under only are known to optionally co-vary in the focus alternatives, depending on whether the pronoun is bound by the lambda operator or free and co-referential with
Further, Kratzer (2009) observes that when two pronouns appear under \textit{only}, there are four possible readings, including two mixed readings, with one pronoun bound and one free. The two mixed readings for the sentence in (21) are shown in (22) with disambiguating contexts.

(21) Only Billy told his mother his favorite color.

(22) a. [Only Billy$_x$] $\lambda y.y$ told $y$’s mother $x$’s favorite color.  
   \textit{Context:} In class on Friday, Sally learned that Billy’s favorite color is pink, and, to his horror, soon told everybody else in the class. Later, Billy told his mother the situation, and said he was worried that the children would spread the gossip to their mothers. It turns out that Billy had nothing to worry about.

b. [Only Billy$_x$] $\lambda y.y$ told $x$’s mother $y$’s favorite color.  
   \textit{Context:} Billy’s mother can be very embarrassing sometimes. When she has his friends over to play, she asks them all sorts of personal questions, which they are usually reluctant to answer. Yesterday, she asked them what their favorite color is, but only Billy answered.

But, if ASL loci are variables, then the use of loci should make these mixed readings unavailable. In particular, when two spatially co-indexed pronouns appear under \textit{only} (as in (23)), both are predicted to give the same (bound or free) reading, since both of them — denoting the same variable — must be captured by the same operator. However, mixed readings are attested.

(23) 7 IX-$a$ JESSICA TOLD-ME IX-$b$ BILLY ONLY-ONE FINISH-TELL POSS-$b$ MOTHER POSS POSS-$b$ FAVORITE COLOR.  
   ‘Jessica told me that only Billy told his mother his favorite color.’  
   \textit{Can be read as:} bound-bound, bound-free, free-bound, or free-free.

To capture these data, the variable-based analysis would need to sacrifice the strong hypothesis in which loci directly correspond with variables$^1$.

On the feature based analysis, the example in (23) displays a striking similarity to the phenomenon of \textit{uninterpreted features} in spoken language. Specifically, Kratzer 2009 observes that under

---

$^1$A possible alternative way out for the strong variable hypothesis is to reject the assumption that all readings arise from the Logical Form. For example, in Fox’s (2000) analysis of ellipsis, elided pronouns may get a bound reading from the Logical Form (“structural parallelism”) but may also receive a free reading through “referential parallelism.” We note, however, that Fox’s analysis of ellipsis fundamentally does not translate over to the \textit{only} examples discussed here.
focus sensitive operators (like *only*), features are not interpreted in the focus alternatives. For example, both sentences in (24) have a bound and free reading. Critically, on the bound reading, (24a) entails that John didn’t do his homework, even though he is not a female; (24b) entails that John didn’t do his homework, even if he is not the speaker.

(24)  
   a. Only Mary did her homework.  
   b. Only I did my homework.  

Sentence (23) is exactly parallel: the pronouns bear a spatial feature which is uninterpreted in the focus alternatives. So, for example, the bound-bound reading of (23) entails that Jessica didn’t tell her mother her favorite color, even though Jessica (at locus *a*) bears a different spatial feature from Billy (at locus *b*).

Thus, the readings in (23) pose no problem for a feature-based analysis. Either pronoun may be bound or free; in both cases, it must agree with the same locus. The spatial feature in bound readings is uninterpreted, just as the gender and person features in (24) are uninterpreted.

3.4. Parallels with features

In the previous section, I gave evidence against a variable-based analysis, showing that a strong form of the loci-as-variable hypothesis is not tenable under a set of standard assumptions. In this section, I approach the question from the opposite side — I show that loci share a number of important properties with features in spoken language.

Section 3.3.2 already showed one such commonality: we saw that loci, like features, may remain uninterpreted under focus-sensitive operators. Here, I discuss two further parallels: verbal agreement and underspecification. I take these examples as further evidence that an analysis of loci (whatever its final form) should be the same as an analysis of features elsewhere in language.

3.4.1. Directional verbs as verbal agreement

One of the fundamental properties of morphosyntactic features — indeed, a major reason why they are interesting for theories of formal syntax — is that they are able to induce changes on verbal and adjectival morphology in the form of agreement. ASL loci, like standard morphosyntactic features, also show this property. In particular, a large class of verbs — neutrally entitled “directional verbs” — move in space from the locus of one argument to the locus of another. These directional verbs may agree with a single argument (as in (25a,b)) or both of the arguments (as in (25c,d)).

(25)  
   a. *TELL*$_{a}$: motion starts at the chin and moves to the locus of the indirect object (*a*).  
   b. *SEE*$_{a}$: motion starts at the eyes and moves to the locus of the direct object (*a*).  
   c. *HELP*$_{a}$: motion starts at the locus of the subject (*a*) and moves to the locus of the direct object (*b*).
Example (26) demonstrates the interaction of NP loci with directional verbs. Specifically, a sentence is only grammatical if the locus of the argument matches the locus that is activated by the agreeing verb.

(26)  

a. BOOK, JOHN \( a \) GIVE \( b \) MARY. \((\text{Match})\)  
b. BOOK, JOHN \( c \) GIVE \( b \) MARY. \((\text{Mismatch})\)  
c. BOOK, JOHN \( d \) GIVE \( b \) MARY. \((\text{Mismatch})\)  

A lively debate has centered around the correct analysis of directional verbs. The standard view (Fischer & Gough 1978, a.o.) is that these are simply an instance of verbal agreement. On the other hand, Liddell (2000), recognizing the often iconic properties of directional verbs, proposes that directionality is ultimately non-linguistic gesture. Lillo-Martin and Meier (2011) argue against this view, pointing to examples of exceptional first-person forms, as well as a number of syntactic effects of directional verbs. I follow Lillo-Martin and Meier (and much of the rest of the literature) in considering directionality to involve a truly linguistic system.

Under a feature-based analysis, the basic data falls out as a special case of feature agreement on verbs. In contrast, a variable-based approach would need to posit a new mechanism of index agreement. For example, Aronoff et al. (2005) proposes one such analysis, in fact going so far as to suggest that all feature agreement is index copying.

So, unlike the examples in the previous section, this is not a place in which the variable-based analysis fails as such. Rather, it is an place where the properties of loci seem to pattern with the properties of features: features are generally able to induce agreement on verbs. Given the existence of directional verbs, loci appear to have this property.

3.4.2. Underspecification

Another commonality between loci and features is the phenomenon of underspecification. As just discussed, some verbs (or syntactic heads more generally) require their arguments to bear a specific, agreeing feature. On the other hand, verbs may also be underspecified, accepting arguments with any feature. For example, in English, agreement morphology on present tense verbs dictates the number of their subject (as in (27)). However, past tense verbs are underspecified in this respect: they can take either singular or plural subjects (as in (28)).
(27)  *Sleep* and *sleeps* subcategorize for the number of the subject.

   a. A boy sleeps.
   b. * A boy sleep.
   c. * Boys sleeps.
   d. Boys sleep.

(28) *Slept* takes either a singular or plural subject.

   a. A boy slept.
   b. Boys slept.

Turning to ASL loci, we find that a similar property (unsurprisingly) holds here. Although some verbs are directional, many verbs are not, and are signed in a neutral location, and may take arguments at any loci. A very simple example is the predicate *HAPPY*, as seen in (29).

(29)  *HAPPY* takes a subject at any locus.

   a. 7 JOHN_a HAPPY.
   b. 7 JOHN_b HAPPY.

Thus, in both verbal agreement and underspecification, we find that loci pattern with morphosyntactic features. So, although variable-based analyses could be built for both of these patterns, the patterns will fall out from independently needed technology under a feature-based analysis.

4. Interim summary

4.1. A second chance for variables.

At this point, the strong loci-as-variables hypothesis has been falsified. Specifically, in Section 3.3, we showed two cases where the theory wrongly predicts variable capture and undergenerates readings. On the other hand, modifications may be made to our assumptions to salvage a variable-based analysis. In particular, weaker forms of the hypothesis are available which do not fall subject to the same incorrect predictions. In particular, if we allow each locus to correspond with a set of more than one variable (as in (30)), then pointing to that locus does not necessitate variable capture.

(30)  **A weakened variable-based hypothesis:**

   Loci create *partitions* of variables; pointing to a locus retrieves one of a set of variables.

We will not discuss predictions of this hypothesis here, but it bears pointing out that this new formulation may effectively be recreating the feature-based theory in terms of variables.

It is also important to note that the arguments above do not preclude the existence of variables in general. That is, even if a variable-based analysis of *loci* is falsified, it doesn’t mean that variables don’t exist in natural language, it just means that loci aren’t them.
4.2. Implications for theories of features

As an alternative to the variable-based analysis, I have argued that loci pattern with morpho-
syntactic features, based on a number of important shared properties. On the other hand, if loci are
features, then they are typologically unique in one important respect: spoken languages display
a finite (if sometimes large) set of morpho-syntactic features, but the set of possible loci in ASL
is theoretically infinite. Lillo-Martin and Klima (1990) stress this point, observing that although
there are generally not more than a few loci used at a given time, it is always in principle possible
to establish a new locus between any two existing loci.

On the other hand, the existence of infinite feature sets in sign language has been independently
motivated by Schlenker (2013), approaching questions of iconicity in sign language. Schlenker
shows that certain iconic properties of referents, like height and body orientation, share formal
properties with morpho-syntactic features; he is led to an analysis in which features themselves
bear structured iconicity. A theoretical consequence of this analysis, then, is the existence of
infinitely many features in sign language, since the iconic properties dictate that there are infinitely
many possible forms of these features.

Thus, although unbounded feature sets are typologically rare in spoken languages (although see
Aronof et al. 2005 on ‘literal alliterative agreement’ in Bainouk and Arapesh), they nevertheless
seem to be attested in sign languages.

4.3. Rescuing Variable-Free Semantics

The arguments above also carry ramifications for the theory of Variable-Free Semantics. As dis-
cussed in Section 3.2, Jacobson (1999) argues that the logic underlying natural language does not
make use of formal variables, and that both free and bound pronouns can be captured through other
combinatorial mechanisms. This was motivated in part by the observation that spoken language
never overtly realizes the difference between two different variables. As we saw, though, the ASL
data posed a potential counter-example: if indeed loci were variables (or formally isomorphic to
them), then the Variable-Free hypothesis would have been falsified. Therefore, in arguing against
the variable-based analysis of ASL loci, I concurrently removed what would otherwise be a fatal
argument against Variable-Free Semantics.

5. A feature-based fragment

This section presents a fragment which implements a feature-based analysis using Combinatory
Categorial Grammar. As mentioned in Section 4.1, a feature-based analysis of loci does not ne-
cessitate a fully variable-free system. Nevertheless, in order to provide a constructive proof that
loci do not necessitate a variable-full semantics, the fragment presented is both variable-free and
Directly Compositional (in the sense of Jacobson 2007). For exposition, I present it piece by piece
through the prose of this section, but the full fragment is repeated in one place in Appendix A.
The system has one basic composition schema, implemented as two rules: composing with an argument on the right and composing with an argument on the left. These appear in (31).

(31) Composition rules (f.a.):
   a. \( \langle A_R B, f \rangle \langle B, x \rangle \rightarrow \langle A, f(x) \rangle \)
   b. \( \langle B, x \rangle \langle A_L B, f \rangle \rightarrow \langle A, f(x) \rangle \)  
   (Subscripts \( R \) and \( L \) are left out below.)

Before we come to pronouns and binding, it will be helpful to understand how loci work as features in the rest of the grammar. As in English, a proper name denotes a specific individual and is an NP. In ASL, though, NPs may be localized, bearing a spatial feature; I represent this with a subscript: an NP at locus \( i \) is of category NP\(_i\). For example, the lexical entry for JOHN\(_a\) is \( \langle \text{NP}_a, j \rangle \).

Definitions for verbs are given in (32). Agreeing verbs specify a spatial feature on one or more of their NP arguments. Thus, \( _a \text{HELP}_b \) (which moves in space from locus \( a \) to locus \( b \)) is of category \( (S/\text{NP}_a)/\text{NP}_b \): it is a function which requires two NPs: one at locus \( a \) and one at locus \( b \).

(32) Lexical entries for verbs (lex):
   a. LIKE = \( \langle (\text{S/}\text{NP})/\text{NP} \rangle, \lambda xy. \text{like}'(x)(y) \rangle \)
   b. THINK = \( \langle (\text{S/}\text{NP})/S \rangle, \lambda py. \text{think}'(p)(y) \rangle \)
   c. SEE\(_a\) = \( \langle (\text{S/}\text{NP})/\text{NP}_a \rangle, \lambda xy. \text{see}'(x)(y) \rangle \)
   d. \( _a \text{HELP}_b \) = \( \langle (\text{S/}\text{NP}_a)/\text{NP}_b \rangle, \lambda xy. \text{help}'(x)(y) \rangle \)

Ungrammaticality of incorrect verbal agreement arises from subcategorization mismatch. Example (33) shows a successful derivation, in which both arguments match the argument specifications in the lexical entry of the verb. Example (34) shows an unsuccessful derivation; the predicate \( _a \text{HELP}_b \text{BILL}_b \) requires an argument of category NP\(_a\), but the subject is of category NP\(_c\).

(33) \( ^7 \text{JOHN}_a _a \text{HELP}_b \text{BILL}_b \).

(34) \* \( ^3 \text{JOHN}_c _a \text{HELP}_b \text{BILL}_b \).

5.1. Underspecification as subsumption

As we saw in section 3.4.2, verbs may be underspecified in ASL as in English: in English, past tense verbs take singular or plural NPs; in ASL, non-directional verbs take NPs at any locus.
Following Bernardi and Szabolcsi (2007), we propose that syntactic categories are organized as partially ordered sets; being a satisfactory argument for a given function requires subsumption, not identity. In English, for example, they propose that NP_{plur} and NP_{sing} are both subsumed by the umbrella category NP. The past-tense verb *slept* is of category S/NP; thus, both singular and plural NPs serve as satisfactory arguments.

ASL loci are exactly parallel: NP subsumes NP\_i for all i. Non-directional verbs subcategorize for the umbrella category NP, so will be satisfied by any subcategory — that is, by any localized NP.

(37)  
$$\text{NP} \leftarrow \begin{array}{c} \text{NP}_a \\
\text{NP}_b \\
\text{NP}_c \\
\vdots \end{array}$$

For example, the lexical entry for HAPPY is $\langle S/NP, \lambda x. \text{happy}(x) \rangle$. Parallel to the English example above, all localized NPs serve as satisfactory arguments.

This deduction pattern can be formalized as a combinator which fills in the spatial feature on an argument slot of an underspecified verb.

(38)  
$$\text{loc} = \langle ((A/NP_i)/B)/(A/NP)/B \rangle, \lambda X. X \rangle$$

Example (39) shows the ‘loc’ combinator in action; example (40) provides a derivation.

(39)  
\begin{align*}
a. \ & \text{HAPPY} = S/NP \xrightarrow{\text{loc}} S/NP_a \\
b. \ & \text{LIKE} = (S/NP)/NP \xrightarrow{\text{loc}} (S/NP_b)/NP
\end{align*}

(40)  
$$7 \ \text{JOHN}_a \ \text{HAPPY}.$$
5.2. Pronouns and binding

Having sorted out verb agreement and underspecification, it turns out that binding requires no further additions: the binding facts fall out “for free” from the lexicon and from a generalized definition of the \( z \)-operator presented in Section 3.2. In particular, it should be observed in the following exposition that the only combinator which explicitly makes reference to features is the underspecification operator. All the instances of features appearing in the \( g \) or \( z \) rules are special cases of a generalized schema.

As in Jacobson’s (1999) variable-free semantics, pronouns are the identity function over individuals. In Jacobson’s system, pronouns have category NP\(_N\P\), indicating that they have a gap to be filled by something of category NP. However, this gap could conceivably be of a different category. For example, in Charlow’s (2008) analysis of VP ellipsis, does\(_{pro} \) is of category VP\(_{VP}\); for ACD, it is of category TV\(_{TV}\). For ASL, I have represented the spatial feature with a subscript; accordingly, pronouns at locus \( i \) are of category NP\(_i\P\). This is summarized in (41).

\[(41) \quad \text{Lexical entries for pronouns (lex):} \]
\[
a. \quad \text{IX-}a = \langle \text{NP}_{a}^{NP} , \lambda x.x \rangle \\
b. \quad \text{SELF-}a = \langle \text{NP}_{a}^{NP} , \lambda x.x \rangle \\
\]

As before, when a pronoun is free, it is passed through the system using function composition (in the form of \( g \)). The syntax preserves the featural information of the gap, passing along subscripts.

\[(42) \quad \text{Syntactic and semantic definitions of function composition via Geach (g):} \]
\[
a. \quad g'(A/B) = A^C/B^C \\
b. \quad g(f) = \lambda h\lambda y[f(h(y))]
\]

\[(43) \quad \text{Special case — Passing through the gap of a localized NP:} \]
\[
a. \quad g'(A/B) = A^{NP}/B^{NP},
\]

Binding is accomplished using Jacobson’s \( z \)-combinator, which merges two argument slots. Critically, the syntactic definition requires the binder to be exactly the same category as the gap being bound (see (44)). Thus, when the binder has category NP\(_i\), the pronoun must also be of category NP\(_i\) (see (45)). In short: a pronoun and its binder must share the same locus.

\[(44) \quad \text{Syntactic and semantic definitions of binding (z):} \]
\[
a. \quad z((B/C)/A) = (B/C)/A^C \\
b. \quad z(V(\alpha,\gamma,\beta)) = \lambda f(\gamma,\alpha)\lambda x\gamma[V(f(x))(x)]
\]

\[(45) \quad \text{Special case — Binding a localized NP:} \]
\[
a. \quad z((B/NP;)/A) = (B/NP;)/A^{NP},
\]
The following two derivations demonstrate how locus agreement is achieved. Effectively, the z-combinator turns the verb phrase into an agreeing predicate; the reason why the derivation in (47) crashes is exactly the same reason why sentences are ungrammatical when there is a mismatch between a directional verb and the locus of a noun (as in (34)): the verb phrase subcategorizes for an NP with the wrong feature.

(46) \[ \text{JOHN}_a \text{ LIKE SELF-}a. \]

(47) \[ \ast \text{JOHN}_b \text{ LIKE SELF-}a. \]

Essentially, the z-rule turns a predicate into an agreeing predicate: \[ \text{[z-LIKE SELF-}a] \] is of the same syntactic category as \[ \text{[HELP}_b \text{ JOHN}_b] \]: both are of category S/NP. The fragment thus reduces pronominal agreement to a special case of verbal agreement.

6. Conclusion

This paper untangled two theories of loci in American Sign Language: the first held that loci are variables; the second, that loci are morphosyntactic features. Two different cases were given in which the variable-based analysis wrongly predicted variable capture; the availability of unexpected readings thus falsified the strong loci-as-variables hypothesis. I suggested that this shows that the grammar of natural language cannot force coreference of syntactically independent constituents.

On the other hand, we saw a number of close parallels between loci and features. First, we saw that loci, like features, appear to be uninterpreted under focus-sensitive operators. Second, we saw that loci can induce verbal agreement. Third, we saw that loci seem to share the same patterns of underspecification that exist in the feature systems of spoken language.

As a constructive demonstration that variables are not necessary to analyze loci, a fragment was provided that covered all the observed facts within a variable-free system. Of note, as soon as verbal agreement facts were accounted for, the patterns of binding arose naturally from independently proposed combinators.
Appendix A: The full fragment

(48) Composition rules (f.a.):

a. \( \langle A/R,B,f \rangle \langle B,x \rangle \rightarrow \langle A,f(x) \rangle \)
b. \( \langle B,x \rangle \langle A/L,B,f \rangle \rightarrow \langle A,f(x) \rangle \) (Subscripts R and L are left out below.)

(49) Definitions of lexical items (lex):

a. JOHN\(_a\) = \( \langle \text{NP}^a, \mathbf{j} \rangle \)
b. IX-\(_a\) = \( \langle \text{NP}^a, \lambda x.x \rangle \)
c. SELF-\(_a\) = \( \langle \text{NP}^a, \lambda x.x \rangle \)
d. LIKE = \( \langle \text{(S/NP)}/\text{NP}, \lambda xy.\text{like}'(x)(y) \rangle \)
e. THINK = \( \langle \text{(S/NP)}/\text{S}, \lambda py.\text{think}'(p)(y) \rangle \)
f. SEE\(_a\) = \( \langle \text{(S/NP)}/\text{NP}^a, \lambda xy.\text{see}'(x)(y) \rangle \)
g. aHELP\(_b\) = \( \langle \text{(S/NP)}/\text{NP}^b, \lambda xy.\text{help}'(x)(y) \rangle \)

(50) Locus underspecification deductions on verbs (loc):

a. loc = \( \langle ((\text{A/NP})/\text{B})/((\text{A/NP})/\text{B}), \lambda X.X \rangle \)

(51) Syntactic and semantic definitions of function composition via Geach (\(g\)):

a. \( g = \langle \langle \text{(A/C)}/\text{(B/C)}, \lambda f \lambda h \lambda y.\text{f}(\text{h}(y)) \rangle \rangle \)

(52) Syntactic and semantic definitions of binding (\(z\)):

a. \( z = \langle \langle \text{(B/C)}/\text{(A/C)}/\text{((B/C)/A)}, \lambda V_{\langle \alpha,\beta,\gamma \rangle}.\lambda f_{\langle \alpha,\beta,\gamma \rangle}.\lambda x_\gamma.\text{f}(x)(\text{V}(x))(x) \rangle \rangle \)

References


A Single-Type Semantics for the PTQ*-Fragment
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Abstract. In (Montague, 1970), Montague defines a formal theory of linguistic meaning which interprets a small fragment of English through the use of two basic types of objects: individuals and propositions. In this paper, I develop a comparable semantics which only uses one basic type of object (hence, single-type semantics). Such a semantics has been suggested by Partee (2009) as a ‘minimality test’ for the Montagovian type system, which challenges the need for a bi-partitioned ontology. The proposed semantics captures the propositional interpretation of proper names, unifies Montague’s semantic ontology, and yields insight into the apparatus of types in formal semantics.

Keywords: foundations of formal semantics, natural language metaphysics, single-type hypothesis, type theory, unification.

1. Introduction

Natural languages presuppose a rich semantic ontology. To provide an interpretation for, e.g., English, we require the existence of individuals (e.g. Bill), propositions (Bill walks), properties of individuals (walk), relations between individuals (find), and many other kinds of objects. Theories of formal semantics (paradigmatically, Montague (1970, 1973)) tame this ontological ‘zoo’ by casting its members into a type structure, and generating objects of a more complex type from objects of a simpler type via a variant of Church’s (1940) type-forming rule:

\[(\text{CT}) \quad \text{If } \alpha_1, \ldots, \alpha_n \text{ and } \beta \text{ are types, then } (\alpha_1 \ldots \alpha_n; \beta) \text{ is the type for functions from ordered } n\text{-tuples of objects of the types } \alpha_1 \ldots \alpha_n \text{ to objects of the type } \beta.\]

In this way, Montague (1970) reduces the referents of a small subset of English (hereafter, the PTQ*-fragment\(^1\)) to constructions out of two basic types of objects: individuals (or entities, type \(e\)) and propositions (or functions from indices to truth-values, type \((s; t)\)). Proper names (e.g. Bill) and sentences (Bill walks) are then interpreted as individuals, respectively propositions, intransitive verbs (walk) as functions from individuals to propositions (type \((e; (s; t)))\), transitive verbs (find) as functions from pairs of individuals to propositions (type \((e e; (s; t))))\), etc.

Montague’s distinction between individuals and propositions (or between individuals, indices, and truth-values, cf. (Gallin, 1975)) has today become standard in formal semantics. This is due to the resulting semantics’ modeling power, and the attendant possibility of explaining a wide range of syntactic and semantic phenomena. However, the question remains whether it is also possible to construct the ontological zoo from a single semantic basis, which unifies the types \(e\) and \((s; t)\).

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\(^1\)This name is justified by the similarity of this fragment to the fragment from Montague (1973) (‘PTQ-fragment’) without intensional nouns (e.g. temperature, price), intransitive verbs (rise, change), and prepositions (about). I show in (forthcoming) that, by coding individual concepts as type-\(((s; t); e)\) objects, we can model the full PTQ-fragment.
The assumption behind the above question, i.e. that the PTQ\(^\star\)-fragment has an even simpler semantic basis than the one adopted in Montague (1970), has first been proposed by Barbara Partee. In particular, Partee (2009) makes the following suggestion about the linguistic type system:

**Proposition 1** (Single-Type Hypothesis). *The distinction between individuals and propositions is inessential for the construction of a rich linguistic ontology. The PTQ\(^\star\)-fragment can be modeled through the use of one basic type of object.*

Below, we will sometimes refer to Proposition 1 as Partee’s conjecture. This conjecture suggests the possibility of obtaining all classes of PTQ\(^\star\)-referents from a single basic type (dubbed ‘\(o\)’), whose objects encode the semantic content of individuals and propositions. From them, objects of more complex types are constructed via a variant, \(ST\) (for *single-type* rule), of the rule \(CT\):

\[
(ST) \quad \text{If } \alpha_1, \ldots, \alpha_n \text{ and } \beta \text{ are single-type types, then } (\alpha_1 \ldots \alpha_n; \beta) \text{ is a single-type type.}
\]

In virtue of the neutrality of the type \(o\) between Montague’s types \(e\) and \((s; t)\), any semantics which satisfies Proposition 1 (hereafter, *single-type semantics\(^2\)*) will identify basic-type objects with the values of proper names (traditionally, type \(e\)) and of sentences and complement phrases (type \((s; t)\)). As a result, it will also assign the same type, \((\alpha; o)\), to common nouns (type \((e; (s; t))\)) and to complementizers and sentence adverbs (type \(((s; t); (s; t))\)). The types of all other syntactic categories are obtained by replacing the labels ‘\(e\)’ and ‘\((s; t)\)’ by ‘\(o\)’ in these categories’ Montague types.

Partee supports her conjecture by identifying a preliminary single-type object (i.e. extensional properties of Kratzer-style situations, type \((s; t)\); cf. (Kratzer, 1989)), and giving an \((s; t)\)-based model for a miniature fragment of English. This model interprets the expressions you, a snake, and see into the single-type objects \([you\], \[a snake\], and \[see\], cf. (Partee, 2009, p. 40):

\[
\begin{align*}
[you] & \quad \text{the property of (being) a minimal situation containing you;} \\
[a\ snake] & \quad \text{the property of (being) a snake-containing situation;} \\
[see] & \quad \text{a function from two situation properties } p_1 \text{ and } p_2 \text{ to a property } p_3 \text{ which holds of a situation } s_3 \text{ if } s_3 \text{ contains two situations, } s_1 \text{ and } s_2, \text{ with the properties } p_1, \text{ resp. } p_2, \text{ where (something in) } s_1 \text{ sees (something in) } s_2.
\end{align*}
\]

The above interpretations enable the compositional interpretation of the sentence You see a snake:

\[
[\text{You see a snake}] \quad \text{the property of (being) a situation in which you see a snake (which is contained in the situation).}
\]

Partee’s model supports the possibility of providing a type-neutral interpretation of proper names and sentences. At the same time, it suggests a strategy for the model’s extension to larger PTQ-like fragments. However, the nature of her paper (a short *Festschrift* contribution) prevents a demonstration of the latter. A proof of workability is left to the semantic community.

\(^2\)Since such semantics still assume a type-hierarchy over the basic type \(o\) (by the use of the rule \(ST\)), they should more correctly be referred to as ‘*single-base-type semantics*’. I owe this observation to Jim Pryor.
This paper takes up Partee’s challenge. In particular, it develops a single-type semantics for the PTQ*-fragment which systematically extends Partee’s formal evidence for Proposition 1. The paper is organized as follows: To show the possibility (or desirability) of a single-type semantics, Section 2 presents different kinds of support for this semantics. Section 3 discusses the difficulty of providing a single-type semantics with a primitive basic type, and identifies Partee’s basic-type choice, \((s; t)\), as the simplest Montague type which answers this difficulty. Sections 4 and 5 demonstrate the ability of an \((s; t)\)-based logic to model the PTQ*-fragment. Section 6 identifies a number of constraints on the resulting single-type semantics, and draws a number of interesting conclusions for the role of the Montagovian type system. The paper closes with an evaluation of the success of single-type semantics and pointers to future work.

2. Support for Single-Type Semantics

Partee’s conjecture about the possibility of a single-type semantics suggests a ‘minimality test’ for the Montagovian type system: If we can formulate a single-type semantics without reference to Montagovian individuals or propositions, we will therewith refute the (commonly assumed) need for two distinct basic types. If our formulation of a single-type semantics relies on the availability of individuals or propositions, the semantics will support Montague’s basic-type distinction.

But our interest in single-type semantics is also motivated by other considerations: These include empirical considerations (which regard the greater modeling power of single-type semantics w.r.t. traditional Montague semantics; cf. (Partee, 2009)), formal considerations (which regard the possibility of constructing single-type models; cf. Sect. 1), and other methodological considerations (besides minimality testing). To illustrate possible applications of a single-type semantics – and to prime the reader’s intuitions about such a semantics –, we here focus on empirical considerations:

Empirical support for Partee’s conjecture lies in a demonstration of the fact that single-type semantics improves upon the modeling power of traditional Montague semantics. This improvement is a consequence of the neutralization of the distinction between the types for proper names and sentences, and the resulting existence of fewer ‘horizontal’ constraints on semantic merging.\(^3\) To illustrate the higher modeling power of single-type semantics, we identify a number of linguistic phenomena which can be accommodated in a single-type semantics, but which defy accommodation in traditional Montague semantics. Such phenomena occur in lexical syntax, the syntax of coordination, the semantics of specification, and nonsentential speech. They consist in the neutrality of certain classes of expressions between an NP- or a CP-complement, in the possibility of coordinating proper names with complement phrases (both, Bayer 1996), in the existence of specificational sentences with a postcopular CP (Potts, 2002), and in the use of names to assert a contextually salient proposition about their type-e referent (Merchant, 2008).

In particular, Montague semantics is unable to interpret (at least) one of the sentences from (1), and cannot interpret the sentences from (2) and (3):

\(^3\)As a result, transitive verbs (traditionally, type \((c; e, (s; t))\)) can apply either to a proper name or to a CP.
The inability to interpret the above sentences in Montague semantics is due to its assumption of a functional relation between syntactic categories and semantic types, and its assignment of different types (i.e. the types $e$, resp. $(s; t)$) to proper names and complement phrases. In virtue of the former, Montague semantics cannot associate the different occurrences of the verb remember from (1) with the distinct types $(e; e; (s; t))$ and $(e; (s; t); (s; t))$. However, in virtue of the latter, only this assignment enables the interpretation of both members of the sentence-pair from (1). The impossibility of accommodating sentences (2) and (3) in traditional Montague semantics is further due to Montague’s restriction of coordination and equation to same-type expressions. Since names (or NPs) and sentences are associated with distinct types, this restriction is not satisfied by (2) and (3).

Single-type semantics solves the above problems by cancelling the different-type assignents of names and CPs. In particular, since this semantics interprets all occurrences of names and CPs in the single basic type $o$, the pairs of arguments from (2) and (3) will satisfy Montague’s coordinability and equatability requirements, such that we can interpret these two sentences in this semantics. Since the single-type type of sentence-complement verbs, $(o o; o)$, allows its expressions to take a CP or a name as its complement, it enables the interpretation of the two sentences from (1).

Beyond the above, the desirability of a single-type semantics is supported by the possibility of accommodating recent findings in nonsentential speech: These findings show that isolated occurrences of names in a context can be interpreted as the result of applying a contextually salient property to the name’s type- $e$ referent. Thus, the name Barbara Partee – when uttered as a woman is entering the room – is interpreted as the sentence from (4b) (or (4c)) (Merchant, 2008, pp. 9, 25–26):

(4) CONTEXT: A woman is entering the room. A linguist turns to her friend, gestures towards the door, and says (a).
   a. $[\text{NP} \text{Barbara Partee}]$
   b. $[\text{NP} \text{Barbara Partee}]$ is (the woman) entering the room.
   c. $[\text{NP} \text{Barbara Partee}]$ is arriving.

Since Montague semantics does not interpret proper names in the semantic type for sentences, it is unable to model phenomena like (4). Single-type semantics, which assigns the type $o$ to both names and sentences, enables the accommodation of these phenomena.

---

Admittedly, one could obtain the required modeling power by introducing a different lexical entry for each of the occurrences of the verb remember from (1), by assigning the different entries the types $(e; e; (s; t))$, resp. $(e; (s; t); (s; t))$, and by connecting them by suitable meaning-relating postulates. However, since this differentiation of entries is not reflected in lexicographic research (cf., e.g., the OED entry for remember), we hesitate to adopt this strategy.
But the empirical scope of single-type semantics is not restricted to the sentence-type interpretation of proper names. The semantics further accommodates the propositional behavior of names, which cannot be modeled in Montague semantics: Our sketch of single-type semantics from the introduction of this section has suggested that proper names display the semantic behavior of sentences: If names receive an interpretation in the same domain as sentences, we expect that names – like sentences – can be evaluated as true or false with respect to a given set of contextual parameters, and that they may be related5 by semantic equivalence. This is indeed the case: In particular, in the situation from (4), the announcement (4a) – when the new arrival is, in fact, Angelika Kratzer – is a false statement, rather than a mere misidentification, cf. (Stainton, 2006, pp. 8–10, 16).

In virtue of their truth- and falsity-conditions, names of the above form will, in a given situation, be equivalent to all true sentences in this situation which carry information about the names’ type-e referent. For example, if the new arrival in the above situation is indeed Barbara Partee, the utterance of the name from (4a) will be equivalent to the sentence from (4b) (or (4c)) in that situation. The obtaining of equivalence relations between sententially interpreted names and sentences (or CPs) in a given context is supported by the assertion of an equivalence between the noun and complement phrases in the sentence from (3). This relation ensures that the replacement of an NP (or CP) by its CP- (or NP-) equivalent in the complement of an NP/CP-neutral verb does not change the truth-value of the original sentence. For the arguments from (3), this is demonstrated in (5):

(5)  a. Chris noticed [np the problem].
    b. Chris noticed [cp that Mary hates Bil].

Our expectations on the semantic behavior of proper names in a single-type semantics are summarized in Proposition 2:

**Proposition 2** (Assertoric interpretation of names). In a single-type semantics, proper names have truth-conditions (Prop. 2.i), and are equivalent to some contextually salient sentences (Prop. 2.ii).

The above-cited phenomena illustrate the advantages of interpreting natural language in a single-type semantics. However, the reader is admonished to note that these phenomena can also be accommodated by dropping the assumption of a functional category/type relation (Alternative 1), or by explaining the assertoric behavior of proper names with reference to pragmatics (Alternative 2). The first alternative (adopted in semantic accounts of nonsentential speech, cf. (Merchant, 2008)) assumes that certain occurrences of proper names have a non-standard semantic content, which results from ‘shifting’ the names’ standard interpretation (type e) to the standard interpretation of sentences (type \((s; t)\)). The second alternative (adopted in pragmatic accounts of nonsentential speech, cf. (Stainton, 2006)) assumes that certain utterances of names have a non-standard asserted content, which results from attributing names the illocutionary act of making an assertion. Alternative 1 follows the approach of flexible Montague grammar, cf. (Partee, 1987).

5to other names, or to sentences.
The possibility of accommodating the above phenomena in a *small* extension of an *existing* generalization of Montague semantics (i.e. flexible Montague grammar) suggests the relative *weakness* of the presented empirical support for single-type semantics. *Stronger* support for single-type semantics comes from *methodological* considerations. These include the complete unification of Montague’s semantic ontology and the identification of new representability relations between different types of objects. A detailed presentation of these considerations is given in (Liefke, forthcoming).

3. Motivating Partee’s Single-Type Choice

Our empirical arguments for Proposition 1 support Partee’s identification of the single basic type with the type for properties of situations (or *propositions*, type \((s; t)\)): The interpretation of names and sentences (or CPs) in this type explains the neutrality of certain verbs between an NP- or a CP-complement (cf. (1), (5)), allows for the coordination or equation of noun and complement phrases under the satisfaction of Montague’s coordinability resp. equatability requirements (cf. (2), (3)), and admits the propositional interpretation of isolated names in a given context (cf.(4)). The present section gives the rationale behind our single-type choice. To this aim, we first identify the problems of a single-type semantics with a primitive (i.e. unstructured) basic type (in Sect. 3.1). We then identify the type \((s; t)\) as the simplest Montague type which solves these problems (in Sect. 3.2).

3.1. Against a ‘Primitive’ Single-Type Semantics

The introduction to this paper has suggested a straightforward strategy for the provision of a single-type semantics. This strategy lies in the adoption of a single basic type, \(\sigma\), and the replacement of (terms or objects of) the types \(e\) and \((s; t)\) in Montague semantics by (terms and objects of) the type \(\sigma\). The characterization of type-\(\sigma\) objects as semantic primitives (which cannot be obtained by the application of ST to objects of another type) obviates the further specification of \(\sigma\)-based models.

But the apparent simplicity of the above approach is deceptive: Specifically, the identification of the type \(\sigma\) with a non-Montagovian type (s.t., in particular, \(\sigma \neq t\)) prevents the use of the familiar truth-functional connectives like *falsum* \((\bot, \text{type } t)\) or the symbol for logical implication \((\Rightarrow, \text{type } (\alpha \alpha; t))\), and disables an easy truth-evaluation of basic-type terms. These problems can be remedied by introducing (non-logical) single-type stand-ins for these connectives, and by restricting the behavior of these stand-ins through the use of meta-level axioms. However, since the formulation of these axioms still requires the assumption of a designated truth-value type \(t\), it must proceed at the level of a *multi*-typed metatheory. For the purposes of this paper, we identify the latter with the extension of an \(\sigma\)-based logic via the truth-value type \(t\).

The availability of the described metatheory facilitates the truth-evaluation of type-\(\sigma\) terms. The latter proceeds via a consideration of the membership (or inclusion) of the referents of type-\(\sigma\) terms in type-\((\sigma; t)\) (resp. type-\(\sigma\)) correspondents of indices. These evaluation strategies are derived from
the evaluation of proposition-denoting formulas in Pollard’s (2008) constructed worlds theory and in Fine’s (1982) theory of worlds as facts. However, since these strategies still require the introduction of a new meta- and object theory, since the representation of indices in the types \((o; t)\), resp. \(o\) requires some complex coding machinery, and since ‘primitive’ single-type semantics prevent the easy identification of a name’s sentential equivalents (cf. (4)), we refrain from their adoption.

The above observations motivate our attempt to identify the single basic type \(o\) with a particular Montague type. But the adoption of such a ‘familiar’ single-type type has many other advantages: For example, the adoption of an ‘\(o\)-defining’ Montague type will induce an algebraic structure on the basic-type domain (which will, in turn, facilitate the interpretation of linguistic connectives), and will enable a metalevel definition of the designated single-type constants. Beyond formal reasons, the interpretation of the type \(o\) as a concrete Montague type will lend our single-type semantics intuitive content, and will enable the identification of new representational relations between different types of Montagovian objects. We will identify some of these relations in Section 6. However, we first show the suitability of Partee’s type \((s; t)\) as a single basic type (in Sect. 3.2).

3.2. Why the Type \((s; t)\)?

The adequacy of the type \((s; t)\) as a single basic type for the modeling of the PTQ\(^*\)-fragment lies in its satisfaction of the semantic requirements from Properties (i) to (iv):

(i) **Familiarity** The basic type figures in the semantic analysis of some linguistic phenomenon.

(ii) **Conjoinability** The single-type domain has an algebraic structure.

(iii) **Representability** All Montagovian objects can be represented via single-type objects.

(iv) **Simplicity** Given its satisfaction of Properties (i) to (iii), the single basic type is obtained from the types \(e\) and \((s; t)\) through the least number of CT-applications.

Property (i) ensures the proximity of single-type semantics to mainstream formal semantics. Property (ii) allows the interpretation of linguistic connectives as algebraic operations. Property (iii) enables the bootstrapping of representations of all Montagovian objects from objects of the single basic type. Property (iv) guarantees the low semantic complexity of single-type objects.

Since the type \((s; t)\) is a common choice for the interpretation of sentences, it satisfies the Familiarity requirement from Property (i). Since there is an algebraic structure on the truth-value type \(t\) (s.t. it is possible to lift all algebraic operations to domains of some type \((\alpha_1 \ldots \alpha_n; t)\)), the type \((s; t)\) further satisfies the Conjoinability requirement from Property (ii).

That the type \((s; t)\) satisfies the Representability requirement from Property (iii) is ensured by its identity with Montague’s type for propositions, and by the existence of an injective function from individuals to propositions (s.t. single-type representations of type-\(e\) objects preserve the distinctions between these objects). Every proposition \(\varphi\) can then be represented by itself (cf. (3.1)). Eve-
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... and since the types e and (s; t) are the only basic types in the semantic ontology from (Montague, 1970), the type (s; t) is also the simplest suitable single-type type (cf. Property (iv)).

Its satisfaction of Properties (i) to (iv) identifies the type (s; t) as the ‘best’ (or most suitable) single-type candidate. However, the adequate interpretation of natural language in an (s; t)-based semantics further requires a partial interpretation of the type (s; t) (i.e. as partial sets of situations). This is due to our reference to an individual’s existence in the representation from (3.2), and to our wish to preserve the standard behavior of negation in single-type semantics: Conservative semantics evaluate both the result, \( Fa \), and the negation, \( \neg Fa \), of the result of attributing a contextually salient property \( F \) to an individual \( a \) at an index \( w \) where \( a \) does not exist as ‘\( \neg F \)’. For example, since Vulcan does not exist in the actual world, such semantics evaluate both the sentence Vulcan is a planet and the sentence Vulcan is not a planet as false. However, this violates the familiar axioms for negation.\(^7\) Since the truth-combination \( N \) (‘neither-true-nor-false’) is uncomplemented (s.t. \( \neg N = N \)), the evaluation of both \( Fa \) and \( \neg Fa \) at \( w \) as ‘\( N \)’ preserves the familiar behavior of negation.

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\(^6\)This is due to the fact that there are commonly more propositions than individuals, s.t. there is not injective function from the former to the latter.

\(^7\)According to the axiom of Top and Bottom, if \( Fa(w) = F \), then \( \neg Fa(w) = T \).
This completes our motivation of the type \((s; t)\) as an adequate single-type candidate. The next three sections incorporate the representational strategies from (3.1) and (3.2) into a formal single-type semantics. Our provision of this semantics uses Montague’s (1973) method of indirect interpretation, which proceeds via the compositional translation of some subset of natural language (here, the PTQ*-fragment) into some logical language: Correspondingly, we will first define a general class of languages and models of the single-type logic \(\text{STY}_1^{3}\) (in Sect. 4). We will then specify the translation rules which send logical forms of the PTQ*-fragment to \(\text{STY}_1^{3}\) terms (in Sect. 5, 6).

4. The Single-Type Logic \(\text{STY}_1^{3}\)

Our previous considerations have suggested the identification of single-type semantics with a model of an \((s; t)\)-based subsystem of an \(n\)-ary partial variant, \(\text{TY}_2^{3}\), of Gallin’s (1975) logic \(\text{TY}_2\). This semantics constructs all of its objects from properties of situations (or propositions, type \((s; t)\)).

The name of our single-type logic, ‘\(\text{STY}_1^{3}\)’, follows Gallin’s naming convention for type logics. In particular, the subscript ‘1’ is warranted by the construction of the lowest (or ‘basic’\(^8\)) \(\text{STY}_1^{3}\) type \((s; t)\) from \(1 + t\) basic Gallin types. The letter ‘S’ (for single-type) distinguishes our theory from Church’s (1940) Simple Theory of Types, \(\text{TY}_1\). The superscript ‘3’ indicates the partiality of the logic’s models.

From the type \((s; t)\), all other types of the logic \(\text{STY}_1^{3}\) are defined via the rule \(\text{ST}\) as follows:

**Definition 1** (\(\text{STY}_1^{3}\) types). The set \(1\text{Type}\) of \(\text{STY}_1^{3}\) types is the smallest set of strings such that, for \(0 \leq n \in \mathbb{N}\), if \(\alpha_1, \ldots, \alpha_n \in 1\text{Type}\), then \((\alpha_1 \ldots \alpha_n; (s; t)) \in 1\text{Type}\).

A language \(L\) for the logic \(\text{STY}_1^{3}\) is a countable set \(\bigcup_{\alpha \in 1\text{Type}} L_\alpha\) of uniquely typed non-logical constants. These include a constant for the absurd (or impossible) proposition, \(\bot\) (type \((s; t)\)). For every \(\text{STY}_1^{3}\) type \(\alpha\), we further assume a countable set \(V_\alpha\) of uniquely typed variables, with ‘\(\bigcup_{\alpha \subseteq 1\text{Type}} V_\alpha\)’ abbreviated as ‘\(\forall\)’. From these expressions, we form complex terms inductively with the help of functional application, abstraction, and the non-logical constant \(\Rightarrow\).

**Definition 2** (\(\text{STY}_1^{3}\) terms). Let \(\alpha_1, \ldots, \alpha_n, \beta \in 1\text{Type}\). The set \(T_\alpha\) of \(\text{STY}_1^{3}\) terms of the type \(\alpha\) is defined as follows:

\[(i) \ L_\alpha, V_\alpha \subseteq T_\alpha, \ \bot \in T_{(s; t)};\]

\[(ii) \text{ if } A \in T_{(\beta\alpha_1 \ldots \alpha_n; (s; t))} \text{ and } B \in T_\beta, \text{ then } (A(B)) \in T_{(\alpha_1 \ldots \alpha_n; (s; t))};\]

\[(iii) \text{ if } A \in T_{(\alpha_1 \ldots \alpha_n; (s; t))} \text{ and } x \in V_\beta, \text{ then } (\lambda x.A) \in T_{(\beta\alpha_1 \ldots \alpha_n; (s; t))};\]

\[(iv) \text{ if } A, B \in T_\alpha, \text{ then } (A \Rightarrow B) \in T_{(s; t)}\]•

The constants \(\bot\) and \(\Rightarrow\) are single-type stand-ins for falsum (\(\bot\), type \((s; t)\)) and for logical implication (\(\Rightarrow\), type \((\alpha \alpha; t)\)), respectively. Their introduction is required by the unavailability of the \(\text{TY}_2^{3}\) con-

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\(^8\)The description of the type \((s; t)\) as the “basic” type of the logic \(\text{STY}_1^{3}\) is, at best, unfortunate. Yet, since the two uses of the adjective *basic* are distinguished by their respective contexts, its ambiguity is harmless.
Given an object \( g \) their degrees of truth and definedness. As a result, denotation in the frame STY\( ^3 \) set of all assignments consist of a frame \( g \) with respect to a type-identical \( \alpha \) is the carrier of a general frame \( g \). The set of all assignments \( g \) with respect to a type-identical \( \alpha \) is the carrier of a complete De Morgan algebra, \( \langle D_\alpha, \cap, \cup, -, 0, 1 \rangle \). The func-
tion \( V_F : (G_F \times \cup_{\alpha} T_\alpha) \rightarrow F \) is such that

(i) \( V_F(g_F, c) := I_F(c) \) if \( c \in L \), \( V_F(g_F, x) := g_F(x) \) if \( x \in V \);

(ii) \( V_F(g_F, A(B)) := V_F(g_F, A)(V_F(g_F, B)) \);

(iii) \( V_F(g_F, \lambda x_\beta A) := \text{the fct. } f(x_1, \ldots, x_n; (s,t)) \text{ s.t., } \forall d_\beta f(d) = V_F(g_F[d/x], A) \).

Clause (ii) comprises a definition of the interpretation of \( \cup \)- and \( \Rightarrow \)-involving terms from Definition 2. The algebraic structure on \( \text{STY}_1^3 \) domains is a consequence of the De Morgan algebra on the set 3, and of our definition of \( \text{STY}_1^3 \) types.

As desired, the logic \( \text{STY}_1^3 \) enables the truth-definition of its basic-type terms. This is due to the identification of the basic \( \text{STY}_1^3 \) type with the type for propositions \( (s; t) \), and the definition of \( \text{TY}_1^3 \) truth and falsity for terms of this type. However, since the logic \( \text{STY}_1^3 \) does not command designated types for situations \( (s) \) or truth-combinations \( (t) \), the evaluation of the truth or falsity of basic \( \text{STY}_1^3 \) terms proceeds in models of the logic \( \text{TY}_2^3 \).

The truth (or falsity) of basic-type \( \text{STY}_1^3 \) terms is defined below. In the definition, an ‘embedded’ \( \text{STY}_1^3 \) model \( M_F \) and assignment function \( g_F \) of a general \( \text{TY}_2^3 \) model \( M_F \) (abbr. ‘\( M_2^3 \)’) and assignment \( g_F \) (abbr. ‘\( g_2^3 \)’) are understood as the result of restricting (the relevant constituents of) \( M_2^3 \) and \( g_2^3 \) to \( \text{STY}_1^3 \) terms and frames (s.t. \( M_F = M_2^3|_{\gamma_{\text{type}}} \) and \( g_F = g_2^3|_{\gamma_{\text{type}}} \)).

**Definition 5 (\( \text{STY}_1^3 \) truth).** An \( \text{STY}_1^3 \) term \( A_{(s,t)} \) is **true** (or **false**) at a situation \( w \) in an embedding \( \text{TY}_2^3 \) model, \( M_2^3 \), of a general \( \text{STY}_1^3 \) model \( M_F \) under an embedded assignment, \( g_2^3 \), of the assignment \( g_F \) iff \( w \models_M A \) (resp. \( w \models_M A \)).

In the logic \( \text{STY}_1^3 \), entailment between basic-type terms is defined through the partial order, \( \subseteq \), on the \( \text{TY}_2^3 \) set of truth-combinations as follows:

**Definition 6 (\( \text{STY}_1^3 \) entailment).** A set of \( \text{STY}_1^3 \) terms \( \Gamma := \{ \gamma \mid \gamma \in T_{(s,t)} \} \) **entails** a set of \( \text{STY}_1^3 \) terms \( \Delta := \{ \delta \mid \delta \in T_{(s,t)} \} \), i.e. \( \Gamma \models g \Delta \), iff, for all general \( \text{STY}_1^3 \) models \( M_F \) and assignments \( g_F \), \( \bigcap_{\gamma \in \Gamma} V_F(g_F, \gamma) \subseteq \bigcup_{\delta \in \Delta} V_F(g_F, \delta) \).

The subscript ‘\( g \)’ of the entailment relation refers to the generality of \( \text{STY}_1^3 \) models. We call a term \( \gamma \) **\( g \)-valid** if \( \models g \gamma \) for every general \( \text{STY}_1^3 \) model \( M_F \) and \( g_F \). Definition 6 allows the definition of semantic \( \text{STY}_1^3 \) equivalence in terms of mutual \( \text{STY}_1^3 \) entailment.

To enable a proof-theoretic characterization of \( \text{STY}_1^3 \) entailment, we use the \( \text{TY}_2^3 \) symbol for logical implication, \( \Rightarrow \). Its behavior is characterized by single-type variants of the sequent rules from (Muskens, 1995). The logic \( \text{STY}_1^3 \) has the expected metamathematical properties (e.g. Soundness, Completeness, Compactness).

This completes our presentation of the single-type logic \( \text{STY}_1^3 \). We next show that a designated model of this logic interprets the PTQ\(^*\)-fragment (cf. Prop. 1), accommodates the mentioned phenomena from lexical syntax, syntactic coordination, and specification (cf. Sect. 2), and accommodates the truth-evaluability of proper names (cf. Prop. 2).
5. STY$^3_1$-Based Single-Type Semantics

To identify the STY$^3_1$ interpretations of logical PTQ*-forms, we first specify the particular STY$^3_1$ language $\mathcal{L}$ and frame $\mathcal{F}$. The members of $\mathcal{L}$ are specified in Table 1. Our conventions for the use of STY$^3_1$ variables are introduced in Table 2. Since some of the designated STY$^3_1$ constants from Definition 2 will figure in our translation of logical PTQ*-forms, we assume their membership in $\mathcal{L}$. To enable the translation of the example sentences from (1) to (4), we extend the PTQ*-fragment via the lexical constituents of these sentences.\(^9\) For better visibility, we sometimes replace round by square brackets in the notation for types.

<table>
<thead>
<tr>
<th>CONSTANT</th>
<th>STY$^3_1$ TYPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\neg$</td>
<td>$\alpha_1 \ldots \alpha_n; (s; t)$</td>
</tr>
<tr>
<td>$\land, \lor$</td>
<td>$[\alpha_1 \ldots \alpha_n; (s; t)]$</td>
</tr>
<tr>
<td>$\land, \lor$</td>
<td>$[\alpha_1 \ldots \alpha_n; (s; t)]$</td>
</tr>
<tr>
<td>$\Rightarrow, \widetilde{\Rightarrow}, \Rightarrow, \leftrightarrow$</td>
<td>$[\alpha; (s; t)]$</td>
</tr>
<tr>
<td>$\Box, \Diamond, \text{john, mary, bill, partee, w}$</td>
<td>$(s; t)$</td>
</tr>
<tr>
<td>$\text{find, lose, eat, love, date, remember, hate, believe, assert}$</td>
<td>$[[\alpha_1 \ldots \alpha_n; (s; t)]$</td>
</tr>
<tr>
<td>$\text{rapidly, slowly, voluntary, allegedly, try, wish}$</td>
<td>$[[\alpha_1 \ldots \alpha_n; (s; t)]$</td>
</tr>
<tr>
<td>$\text{in, for}$</td>
<td>$[[\alpha_1 \ldots \alpha_n; (s; t)]$</td>
</tr>
<tr>
<td>$\text{seek, conceive}$</td>
<td>$[[\alpha_1 \ldots \alpha_n; (s; t)]$</td>
</tr>
</tbody>
</table>

Table 1: $\mathcal{L}$ constants.

<table>
<thead>
<tr>
<th>VARIABLE</th>
<th>STY$^3_1$ TYPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>$x, x_1, \ldots, x_n, y, z$</td>
<td>$(s; t)$</td>
</tr>
<tr>
<td>$p, p_1, \ldots, p_n, q, r$</td>
<td>$(s; t)$</td>
</tr>
<tr>
<td>$P, P_1, \ldots, P_n$</td>
<td>$(s; t); (s; t)$</td>
</tr>
<tr>
<td>$Q, Q_1, \ldots, Q_n$</td>
<td>$(s; t); (s; t); (s; t)$</td>
</tr>
<tr>
<td>$L, L_1, \ldots, L_n$</td>
<td>$[[\alpha_1 \ldots \alpha_n; (s; t)]$</td>
</tr>
<tr>
<td>$R, R_1, \ldots, R_n$</td>
<td>$[[\alpha_1 \ldots \alpha_n; (s; t)]$</td>
</tr>
</tbody>
</table>

Table 2: STY$^3_1$ variables.

To give a general translation of expressions from the PTQ*-fragment, we let the frame $\mathcal{F}$ be very large, such that it contains possible values for all elements in $\mathcal{L}$. The function $\mathcal{I}_\mathcal{F}: \mathcal{L} \to \mathcal{F}$ respects the way in which different content words are conventionally related.\(^10\) The specific role of the interpretation function $\mathcal{I}_\mathcal{F}$ will be discussed in Section 6.

---

\(^9\)For convenience, we hereafter use the term ‘PTQ*-fragment’ for the union of the constituents from (1) to (4) and the difference between the PTQ-fragment and the set of intensional nouns, intransitive verbs, and prepositions.

\(^10\)Thus, $\mathcal{I}_\mathcal{F}$ is such that $\mathcal{I}_\mathcal{F}(\lambda x. \text{bill} \equiv x) \subseteq \mathcal{I}_\mathcal{F}(\text{man})$, where $\lambda x. \text{bill} \equiv x$ and $\text{man}$ are the TY$_0$ translations of the phrase be Bill and the common noun man, respectively.
We identify Logical Form (LF) with the component of syntactic representation that is interpreted in STY$^3$ models. Logical forms are translated into STY$^3$ terms via the process of type-driven translation, cf. (Klein and Sag, 1985). The latter proceeds in two steps, by first defining the translations of lexical elements (or words), and then defining the translations of non-lexical elements compositionally from the translation of their constituents.

**Definition 7** (Basic STY$^3$ translations). The base rule of type-driven translation translates the lexical PTQ$^*$-elements into the following STY$^3$ terms, where $\vec{X} = X_1, \ldots, X_n$ is a sequence of STY$^3$ variables of the types $\alpha_1, \ldots, \alpha_n$. For reasons of space, we only translate some representative constants. Members of the same (sub-)category will receive an analogous translation:

<table>
<thead>
<tr>
<th>Bill</th>
<th>$\rightsquigarrow$</th>
<th>bill</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barbara Partee</td>
<td>$\rightsquigarrow$</td>
<td>partee</td>
</tr>
<tr>
<td>unicorn</td>
<td>$\rightsquigarrow$</td>
<td>unicorn</td>
</tr>
<tr>
<td>John</td>
<td>$\rightsquigarrow$</td>
<td>john</td>
</tr>
<tr>
<td>Mary</td>
<td>$\rightsquigarrow$</td>
<td>mary</td>
</tr>
<tr>
<td>woman</td>
<td>$\rightsquigarrow$</td>
<td>man</td>
</tr>
<tr>
<td>problem</td>
<td>$\rightsquigarrow$</td>
<td>problem</td>
</tr>
<tr>
<td>waits</td>
<td>$\rightsquigarrow$</td>
<td>wait</td>
</tr>
<tr>
<td>arrives</td>
<td>$\rightsquigarrow$</td>
<td>arrive</td>
</tr>
<tr>
<td>hates</td>
<td>$\rightsquigarrow$</td>
<td>hate</td>
</tr>
<tr>
<td>remember</td>
<td>$\rightsquigarrow$</td>
<td>remember</td>
</tr>
<tr>
<td>seek</td>
<td>$\rightsquigarrow$</td>
<td>seek</td>
</tr>
<tr>
<td>believes</td>
<td>$\rightsquigarrow$</td>
<td>believe</td>
</tr>
<tr>
<td>$t_n/\text{fl}_{t_n}$</td>
<td>$\rightsquigarrow$</td>
<td>$x_n$, for each $n$; for</td>
</tr>
<tr>
<td>$(s) \text{he}_{t_n}$</td>
<td>$\rightsquigarrow$</td>
<td>$x_n$, for each $n$; for</td>
</tr>
<tr>
<td>rapidly</td>
<td>$\rightsquigarrow$</td>
<td>$\lambda P \lambda x. \text{rapidly} (P, x) \land P(x)$;</td>
</tr>
<tr>
<td>and</td>
<td>$\rightsquigarrow$</td>
<td>$\lambda R \lambda \alpha \vec{X} (\vec{X}) \land R_1(\vec{X})$;</td>
</tr>
<tr>
<td>not</td>
<td>$\rightsquigarrow$</td>
<td>$\lambda R \lambda \vec{X} \neg R(\vec{X})$;</td>
</tr>
<tr>
<td>the</td>
<td>$\rightsquigarrow$</td>
<td>$\lambda P \lambda x. \forall x \forall y. (P(y) \leftrightarrow x \equiv y) \land P(x)$</td>
</tr>
</tbody>
</table>

Above, $t_n$ represents the trace of a moved constituent in an LF that is translated as a free variable $x_n$.

Definition 7 enables the single-type interpretation of all Logical Form-constituents of the PTQ$^*$-fragment. Some example translations are given below. The reader will observe that the latter share the form of the sentences’ translations from Montague (1973), cf. (Gallin, 1975).

\[
[s_{\text{np}} \text{Barbara Partee}]_{[\text{vp}_{\text{iv}} \text{arrives}]} \rightsquigarrow \text{arrive} (\text{partee}) \tag{5.1}
\]
\[
[s_{\text{np}} \text{a}_{\text{np}} \text{woman}]_{[\text{vp}_{\text{iv}} \text{arrives}]} \rightsquigarrow \bigvee x. \text{woman}(x) \land \text{arrive}(x) \tag{5.2}
\]
\[
[s_{\text{np}} \text{det}_{\text{every}} \text{woman}]_{[\text{vp}_{\text{iv}} \text{arrives}]} \rightsquigarrow \bigwedge x. \text{woman}(x) \leftrightarrow \text{arrive}(x) \tag{5.3}
\]
\[
[s_{\text{np}} \text{det}_{\text{the}} \text{woman}]_{[\text{vp}_{\text{iv}} \text{arrives}]} \rightsquigarrow \bigvee y. (\text{woman}(y) \leftrightarrow x \equiv y) \land \text{arrive}(x) \tag{5.4}
\]
\[
[s_{\text{np}} \text{a}_{\text{np}} \text{John}]_{[\text{vp}_{\text{iv}} \text{seeks}]} [s_{\text{np}} \text{a}_{\text{np}} \text{unicorn}] \rightsquigarrow \text{seek} ([\lambda P \bigvee \text{x. unicorn}(x) \land P(x)], \text{john}) \tag{5.5}
\]
\[
[s_{\text{np}} \text{a}_{\text{np}} \text{unicorn}]_{[\text{vp}_{\text{iv}} \text{seeks}]} [s_{\text{np}} \text{a}_{\text{np}}]_{[\text{vp}_{\text{seeks}}]} \rightsquigarrow \bigvee \text{x. unicorn}(x) \land \text{seek} ([\lambda P \bigvee P(x)], \text{john}) \tag{5.6}
\]

Notably, in virtue of its same-type assignment to proper names and complement phrases, our STY$^3$-based single-type semantics enables the translation of both guises of NP/CP-complement-
neutral verbs (cf. (1a), (1b); in (5.7), (5.8)), and of NP/CP-coordinations (cf. (2); in (5.9)):

\[
[s_{NP\,Mary}]_{VP\, remembers}[s_{NP\,Bill}] \leadsto \text{remember (bill, mary)} \quad (5.7)
\]

\[
[s_{NP\,Mary}]_{t_1} [VP \text{ remembers}][CP[c\, that][s_{NP\,Bill}] [VP \text{ waits}][PP[s\, for][s_{NP\,she}]]]]] \leadsto \text{remember (for (mary, wait, bill), mary)} \quad (5.8)
\]

\[
[s_{NP\,Mary}]_{t_1} [VP \text{ remembers}][s_{NP\,Bill}]
\]

\[
[\text{CONJ}\, and][CP[c\, that][s_{NP\,Bill}][VP\text{ waits}][PP[s\, for][s_{NP\,she}]]]]] \leadsto \text{remember ((bill \land for (mary, wait, bill)), mary)} \quad (5.9)
\]

The above examples suggest that our STY₁³-based semantics is a conservative extension of traditional Montague semantics: Like Montague semantics, it enables the interpretation of the PTQ*- (or the PTQ-) fragment. Our semantics improves upon Montague semantics by allowing the interpretation of sentences of the form (1) to (3). However, until now, the semantics has been unable to predict equivalence relations between proper names and sentences (cf. (4)). This is due to our restriction to an LF’s semantic type (rather than to a particular object of that type). As a result, we can only predict equivalence (or entailment) relations between pairs of logical forms of same-category expressions whose members receive an interpretation as ‘algebraically related’ objects (e.g. between the forms Partee arrives and It is not the case that Partee does not arrive, and Partee and Partee and (Partee or Mary)). But our accommodation of Proposition 2.ii requires exactly the equivalence of ‘algebraically unrelated’ logical forms from different categories (for (4), the equivalence of the forms Partee and Partee arrives).

6. Constraints on STY₁³-Based Single-Type Semantics

To identify equivalence relations between pairs of logical forms of different categories, we impose a number of constraints on the interpretation of primitive STY₁³ constants (in Def. 8). These constraints specify, for every member of \( \mathcal{L} \), which element in the ‘embedding’ \( \text{TY}_1^3 \) model it designates. From these constraints, constraints on the interpretation of the remaining STY₁³ terms from Definition 7 are then obtained via a compositional definition.

For representative STY₁³ terms from Table 1, these constraints are given in Definition 8. In this definition, we use the designated \( \text{TY}_1^3 \) constants from Table 3. Our typing conventions for \( \text{TY}_1^3 \) variables are given in Table 4. In Table 3, the predicate \( E \) applies to an individual- and a situation-denoting term to assert the existence of the individual at the situation. We assume that \( \mathcal{L} \subseteq \mathcal{L}^2 \) and \( \mathcal{V} \subseteq \mathcal{V}^2 \). The designated \( \text{TY}_1^3 \) frame \( \mathcal{F} \) and function \( I_{\mathcal{F}} \) are s.t. \( \mathcal{F} = \mathcal{F}^{2,1}_{\text{type}} \) and \( I_{\mathcal{F}} = I_{\mathcal{F}}^{1,1}_{\text{type}} \).

\[ ① \text{Since it is not currently relevant, we neglect the tense and aspect of the original examples.} \]
<table>
<thead>
<tr>
<th>Constant</th>
<th>TY\textsubscript{3} Type</th>
<th>Constant</th>
<th>TY\textsubscript{3} Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>john, mary, bill, partee</td>
<td>e</td>
<td>find, remember, hate</td>
<td>(e; (s; t))</td>
</tr>
<tr>
<td>believe, assert, ...</td>
<td>(s; t) e; (s; t)</td>
<td>seek, conceive</td>
<td>[(e; (s; t)); (s; t)]; e; (s; t)]</td>
</tr>
<tr>
<td>rapidly, allegedly, ...</td>
<td>[(e; (s; t)) e; (s; t)]</td>
<td>in, for</td>
<td>[e; (e; (s; t)); e; (s; t)]</td>
</tr>
<tr>
<td>man, woman, unicorn, problem, wait, arrive, E, ...</td>
<td></td>
<td></td>
<td>(e; (s; t))</td>
</tr>
</tbody>
</table>

Table 3: Non-logical \(L^3\)-constants.

<table>
<thead>
<tr>
<th>Variable</th>
<th>TY\textsubscript{3} Type</th>
<th>Variable</th>
<th>TY\textsubscript{3} Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>(i, j, k, k_1, \ldots, k_n)</td>
<td>(s)</td>
<td>(x, x_1, \ldots, x_n, y, z)</td>
<td>(e)</td>
</tr>
<tr>
<td>(p, p_1, \ldots, p_n, q, r)</td>
<td>(s; t)</td>
<td>(P, P_1, \ldots, P_n)</td>
<td>(e; (s; t))</td>
</tr>
<tr>
<td>(Q, Q_1, \ldots, Q_n)</td>
<td>[[e; (s; t)]; (s; t)]</td>
<td>(L, L_1, \ldots, L_n)</td>
<td>[[[e; (s; t)]; (s; t)]; (s; t)]; (s; t)]</td>
</tr>
</tbody>
</table>

Table 4: TY\textsubscript{3} variables.

**Definition 8** (Definition of \(L\)-constants). The interpretations of the STY\textsubscript{3} constants from Table 1 obey the following semantic constraints: In (C8)–(C10), we let \(X\) abbreviate \(\mathcal{P} \cdot (\lambda k_1 \forall z. P \cdot (z)(k_1) = P([i.z = (\lambda k_2. E(z)(k_2))](k_1))):\)

- (C1) \(\top\) = \(\lambda i. \bot\);
- (C2) \(B \Rightarrow C\) = \(\lambda i. B(i) \Rightarrow C(i)\);
- (C3) \(\text{partee}\) = \(\lambda i. E(\text{partee})(i)\);
- (C4) \(\text{woman}\) = \(\lambda x \lambda i. \text{woman}([i.x = (\lambda j. E(x)(j))](i))\);
- (C5) \(\text{arrive}\) = \(\lambda x \lambda i. \text{arrive}([i.x = (\lambda j. E(x)(j))](i))\);
- (C6) \(\text{believe}\) = \(\lambda p \lambda x \lambda i. \text{believe}([p, [i.x = (\lambda j. E(x)(j))]](i))\);
- (C7) \(\text{remember}\) = \(\lambda y \lambda x \lambda i. \text{remember}([i.y = (\lambda j. E(y)(j))], [i.x = (\lambda k. E(x)(k))](i))\);
- (C8) \(\text{rapidly}\) = \(\lambda P \lambda x \lambda i. \text{rapidly}([X, [i.x = (\lambda j. E(x)(j))]](i))\);
- (C9) \(\text{for}\) = \(\lambda y \lambda P \lambda x \lambda i. \text{for}([i.y = (\lambda j. E(y)(j))], [X, [i.x = (\lambda k. E(x)(k))]](i))\);
- (C10) \(\text{seek}\) = \(\lambda Q \lambda x \lambda i. \text{seek}([i.Q \cdot (\forall P. (\lambda k. Q(P, k)) = (\lambda k_3. Q(X, k_3)))]([i.x = (\lambda j. E(x)(j))](i))\)

The constraints (C1) and (C2) define the designated STY\textsubscript{3} constants \(\top\) and \(\Rightarrow\) as the results of lifting the TY\textsubscript{3} connectives \(\bot\) and \(\Rightarrow\) to constructions out of the basic STY\textsubscript{1} type (s; t).

In line with the type-(s; t) representation of individuals from Section 3.2 (cf. (3.2)), the constraint (C3) defines the STY\textsubscript{3} constant \(\text{partee}\) as the designator of a function which sends situations to the truth-value of the proposition ‘Barbara Partee exists’ at those situations (i.e. as the designator of the characteristic function of the set of situations in which Barbara Partee exists).

The remaining constraints enable the definition of the STY\textsubscript{3} translations of sentential PTQ\textsuperscript{*}-forms as (equivalents of) these forms’ Montagovian translations. Thus, the constraints (C4) to (C10) contribute to the STY\textsubscript{3} representation of constructions out of the basic STY\textsubscript{1} type along the lines of (3.1). In particular, the definition of the type-(s; t) term \(\text{arrive}\) as the designator of a function from propositions \(x\) to the set of situations at which the type-\(e\) correlate, \(i.x = (\lambda j. E(x)(j))\), of \(x\) arrives (cf. (C5)) enables the definition\textsuperscript{12} of the STY\textsubscript{3} translation of the sentence Barbara Partee arrives (cf. (5.1)).
Since the definitions of the STY$^3_1$ translations of the PTQ*-forms from (5.2) to (5.6) are analogously obtained, we abstain from their statement. The definitions of the STY$^3_2$ terms from (5.7) to (5.10) are given below:

\[
\text{remember} (\text{bill, mary}) = \lambda i. \text{remember} (\text{bill, mary})(i)
\]

(6.1)

\[
\text{remember} (\text{for (mary, wait, bill), mary}) = \lambda i. \text{remember} \left(\left[\forall y. [\lambda k. \text{for (mary, wait, bill), mary}](k)] = (\lambda j. E(y)(j)), \text{mary}(i)\right]\right)
\]

(6.2)

\[
\text{remember} (\text{for (mary, wait, bill), mary}) = \lambda i. \text{remember} (\text{for (mary, wait, bill), mary}) \\
= \lambda i. \text{remember} (\text{bill, mary}) \wedge \text{remember} (\text{for (mary, wait, bill), mary}) \\
= \lambda i. \text{remember} (\text{bill, mary}) \wedge \text{remember} (\text{for (mary, wait, bill), mary}) \\
= \lambda i. \text{remember} (\text{bill, mary}) \wedge \text{remember} (\text{for (mary, wait, bill), mary})
\]

(6.3)

\[
\text{remember} (\text{for (mary, wait, bill), mary}) = \lambda i. \text{remember} (\text{for (mary, wait, bill), mary}) \wedge \text{remember} (\text{for (mary, wait, bill), mary})
\]

\[
\lambda i. \text{remember} (\forall y. [\lambda k. \text{for (pat, wait, bill), mary}](k)] = (\lambda j. E(y)(j)), \text{mary}, i
\]

\[
\sqrt[\forall x \wedge y. (\text{problem}(y) \leftrightarrow x = y) \wedge x \equiv \text{hate (bill, mary)}](6.4)
\]

\[
= \lambda i \exists x \forall y. (\text{problem}(y)(i) \leftrightarrow x = y) \wedge x = [\forall z. (\lambda k. \text{hate (bill, mary), mary}](k)] = (\lambda j. E(z)(j))]
\]

The possibility of defining the STY$^3_1$ translations of $[[\text{TV}][\text{CP}]]$-structures in our single-type semantics is conditional on the existence of non-Montagovian individuals, which serve as type-$e$ correlates of propositions: The STY$^3_2$ correlate, i.e. remember, of the STY$^3_1$ term remember restricts its first argument to STY$^3_2$ terms of the type $e$. To satisfy the typing constraints of the relevant STY$^3_2$ terms, we need to identify the individual which encodes the semantic information of the propositional argument. In the definitions of the STY$^3_1$ translations from (5.8) and (5.9), this is achieved by identifying the unique individual which exists exactly in the situations at which the formula $\lambda k. \text{for (mary, wait, bill), mary}(k)$ is true (cf. the underlined STY$^3_2$ term in (6.2), (6.3)). A similar observation holds for the definition (in (6.4)) of the STY$^3_1$ translation from (5.10).

Our presentation of the logic STY$^3_1$ has already established the possibility of evaluating the truth or falsity of basic-type terms in models of the metatheory STY$^3_2$ (cf. Def. 5). Since we know that the STY$^3_1$ translation of every logical PTQ*-form is defined through a term of the logic STY$^3_2$, we can evaluate the truth of logical PTQ*-forms via the truth of their translations’ STY$^3_2$ definitions.

The identification of a STY$^3_1$ terms’ referent in the designated model of the logic STY$^3_2$ enables the identification of equivalence relations between proper names and sentences. The semantic equiva-

\[^{12}\text{In the definition, the step from the third to the last line of step 3. is justified by our assumption of the unique reference of type-$e$ constants and by the assumption that no two individuals exist in exactly the same situations (cf. Sect.3.2). As a result, the interpretation of the term }\forall x. [\lambda k. E(\text{partee},(k)] = (\lambda j. E(x)(j))\text{ will be defined in every model of the logic STY}^3_2\text{ which provides an interpretation for the constant partee.}\]
lence of logical PTQ*-forms in our single-type semantics is defined below. In the definition, we let \( A_{(s;t)} \) and \( B_{(s;t)} \) be the \( \text{STY}_1^3 \) translations of the logical forms \( X \), resp. \( Y \), s.t. \( X \leadsto A \) and \( Y \leadsto B \). We let \( M^2 \) and \( M_F \) be the designated models of the logics \( \text{TY}_2^3 \), respectively \( \text{STY}_1^3 \), and let \( g^2 \) and \( g = g^2|_{\text{Type}} \) be their associated assignments.

**Definition 9** \( (\text{STY}_2^3\text{-based PTQ*-equivalence}) \). A logical form \( X \) is semantically equivalent to \( Y \) in \( M \) under \( g \), i.e. \( \text{MEANS}_{M_F}(Y,X) \), if \( |_g A = B \) in \( M^2 \) under \( g^2 \).

Definition 9 supports the equivalence of proper names with their simple containing existential sentences. For the name Barbara Partee, this is shown below:

\[
\text{MEANS}_{M_F}\left(\left[\text{NP}\text{Barbara Partee}\right], \left[\left[\text{s[VPBarbara Partee]}\right]\left[\text{IV}\text{exists}\right]\right]\right) \iff \_g \text{partee} = E\left(\text{partee}\right) \iff \_g (\lambda i. E\left(\text{partee}\right)(i)) = (\lambda i. E\left(\text{partee}\right)(i)) \iff \_g \top
\]

Significantly, because of our particular single-type choice, our \( \text{STY}_3^3 \)-based single-type semantics fails to predict the attested equivalence relations between names and other contextually salient sentences besides existentials (e.g. the sentence Barbara Partee arrives) from Section 2. This is due to the fact that, for every individual and contextually salient (i.e. contingent) property, there will be situations in which the individual exists but does not have the property or at which it is undefined whether or not the individual has the property.

The satisfaction of Proposition 2.ii requires the adoption of semantically ‘richer’ single-type objects, which provide different representations of Montagovian objects at different parameters. Functions from situations to propositions (type\(-\left(\text{s; s; t}\right)\)) allow for this strategy: For example, these objects can represent individuals via functions from situations \( \sigma \) to the set of situations at which all true propositions at \( \sigma \) which carry information about the individual are true. We leave the development of this ‘strong’ single-type semantics for another occasion.

7. **Conclusion**

This paper has developed an \((s; t)\)-based single-type semantics for the set of English logical forms from Montague (1970). The latter is a designated model for the logic \( \text{STY}_1^3 \), which interprets logical forms into constructions out of propositions. Objects of this type interpret proper names as (characteristic functions of) the set of situations in which the names’ type-\( e \) referent exists, and interpret sentences and CPs as (characteristic functions of) the set of situations at which the sentence/CP is true. The semantics supports Partee’s hypothesis from Proposition 1 (Partee, 2009), and accommodates the truth-evaluability of proper names from Proposition 2.i. However, the need to define \( \text{STY}_2^3 \) interpretations through the use of the ‘lower’ types \( e, s, \) and \( t \) suggests the need for a multi-typed metatheory, and the prominent role of Montague’s (or Gallin’s) original type system.

Future work will investigate ‘stronger’ single-type semantics (which further accommodate Prop. 2.ii), and the relationship of these semantics to Partee’s original semantics. We hope that this research will give us further insight into the type system of natural language, and into the properties of minimal models in formal semantics.
References


The interpretation of superlative modifiers and deontic modals: An experimental investigation
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Doris Penka — University of Konstanz

Abstract. There has been much debate recently about the meaning of superlative modifiers like at least and at most. The main challenge analyses of superlative modifiers face is accounting for the ignorance implication they give rise to, whereby the speaker holds higher (in at least) or lower (in at most) numbers as possible. In this study, we present results from two experiments that test the interpretation of superlative modifiers when occurring in sentences with deontic modals. We show that the results of the experiments are only partially predicted by the various competing and incompatible analyses in the literature, and thus argue that an alternative, uniform analysis is required.

Keywords: superlative modifiers, ignorance inferences, experimental semantics, experimental pragmatics.

1. Introduction

There has been much debate recently about the meaning of superlative modifiers like at least and at most (Geurts and Nouwen, 2007; Büring, 2008; Cummins and Katsos, 2010; Schwarz, 2011; Cohen and Krifka, 2011; Coppock and Brochhagen, 2013). As Geurts and Nouwen (2007) observe, the superlative modifiers at least and at most give rise to ignorance inferences: By using a superlative modifier, a speaker generally conveys that she is unsure about the precise value, e.g. at least 15 pages in (1a) implies that the speaker considers both exactly 15 and higher values possible and at most 15 pages in (1b) implies that the speaker considers 15 and lower values possible, but not values higher than 15.

(1) a. The paper is at least 15 pages long.
   b. The paper is at most 15 pages long.

Geurts and Nouwen (2007) also observe that when at least is embedded under a necessity modal like have to in (2a) and when at most is embedded under a possibility modal like can in (2b), ignorance inferences can be suppressed. In these cases, an authoritative reading emerges: Under this reading (2a) specifies 15 pages as the minimally required paper length and (2b) specifies 15 pages as the maximally allowed paper length.

(2) a. Your term paper has to be at least 15 pages long.
   b. Your term paper can be at most 15 pages long.
According to Geurts and Nouwen (2007), in the other two combinations, namely when *at least* is embedded under a possibility modal like *can* in (3a) and when *at most* is embedded under a necessity modal like *have to* in (3b), there is no suppression of ignorance inference and the authoritative reading does not seem to be available.\(^1\)

\[
\begin{align*}
(3) & & \text{a. Your term paper can be at least 15 pages long.} \\
& & \text{b. Your term paper has to be at most 15 pages long.}
\end{align*}
\]

The main challenge analyses of superlative modifiers face is accounting for the ignorance implication they give rise to and the mechanisms that lead to the suppression of these inferences as well as to the availability of the authoritative reading in certain combinations with modals. We show in Section 2 that the various analyses that have been proposed for superlative modifiers differ greatly regarding the predictions they make about the derivation and suppression of ignorance inferences under modals.

Following the discussion of previous analyses, we present results from two experiments that test the interpretation of superlative modifiers when occurring in sentences with deontic modals. In Experiment 1, we tested which combinations of modals and superlative modifiers can obviate speaker ignorance and in Experiment 2, we investigated which readings are available for each one of the superlative modifier-modal combinations.

2. Previous analyses of speaker ignorance in superlative modifiers


Geurts and Nouwen (2007) account for ignorance inferences by incorporating epistemic modality into the lexical entries of superlative modifiers. According to their analysis, *at least n A are B* means that the speaker is certain that there is a set of *n* As that are B and considers it possible that there is a larger set of As that are B. *At most n A are B* means that the speaker considers it possible that there is a set of *n* As that are B and is certain that there is no larger set of As that are B.

Regarding the interaction with modals, Geurts & Nouwen assume that superlative modifiers generally take scope over the modal, which they motivate by the general preference of epistemic operators to outscope deontic ones. They also assume a rule of modal concord, which strips off the layer of epistemic modality in case the primary epistemic operator in the lexical entry of the superlative modifier (epistemic necessity for *at least*, epistemic possibility for *at most*) matches the

\(^1\)Results from Experiment 2 will call into question the observation that the authoritative reading is not available in these superlative modifier-modal combinations. Also, many readers may find these superlative modifier-modal combinations even ill-formed. Results from Experiment 1 suggest that participants do not always find the constructions in (3) significantly much worse than structures in (2).
The modal force of the modal. This accounts for the authoritative reading of sentences like (2): When \textit{at least} \(n\) is combined with a deontic necessity modal, the reading resulting from modal concord says that \(n\) is deontically necessary and higher numbers are deontically possible, which under a one-sided semantics of numerals (or a monotone semantics of gradable adjectives) is equivalent to saying that \(n\) is the minimally required number or the lower bound of the deontic range.

The truth conditions for this reading are visually illustrated in (4a), where \(\Box\) and \(\Diamond\) symbolize deontic necessity and possibility, respectively, and where the straight line signifies permissible paper lengths (which we will also call the deontic range). As modal concord is assumed to be optional, a compositional reading is also predicted to be possible in these cases. Under this compositional construal, \textit{at least} \(n\) combined with a necessity modal conveys that the speaker is unsure about the minimally-required number and thinks that the lower bound of the deontic range might be \(n\) or more. The truth conditions for this reading are shown in (4b), where \(\Box\) and \(\Diamond\) symbolize epistemic necessity and possibility, respectively, and the shaded area (marked with forward slashes) signifies the epistemic range.

\begin{enumerate}[label=(4),start=4]
  \item \(\Box + \textit{at least}:\) The paper has to be at least 15 pages long.
    \begin{enumerate}[label=(a),start=4]
      \item Modal concord reading: \(\Box \text{LENGTH}(p) \geq 15pp \land \Diamond \text{LENGTH}(p) > 15pp\)
        \begin{tabular}{ccc}
          13 & 15 & \ldots \\
        \end{tabular}
      \item Compositional reading: \(\Box \Box \text{LENGTH}(p) \geq 15pp \land \Diamond \Box \text{LENGTH}(p) > 15pp\)
        \begin{tabular}{ccc}
          \underline{13} & 15 & 17 \\
        \end{tabular}
    \end{enumerate}
  \end{enumerate}

The combination of \textit{at most} \(n\) with a possibility modal under the modal concord reading says that \(n\) is deontically possible whereas numbers higher than \(n\) are deontically impossible; that is, \(n\) is the maximally allowed number or the upper bound of the deontic range, cf. (5a). \textit{At most} \(n\) plus possibility modal under the compositional reading says that the speaker is unsure about the maximally-allowed number and is only certain that the upper bound of the deontic range is not more than \(n\). For all she knows, it might be \(n\), cf. (5b).

\begin{enumerate}[label=(5),start=5]
  \item \(\Diamond + \textit{at most}:\) The paper can be at most 15 pages long.
    \begin{enumerate}[label=(a),start=5]
      \item Modal concord reading: \(\Diamond \text{LENGTH}(p) \geq 15pp \land \neg \Diamond \text{LENGTH}(p) > 15pp\)
        \begin{tabular}{ccc}
          \ldots & 13 & 15 17 \\
        \end{tabular}
      \item Compositional reading: \(\Diamond \Diamond \text{LENGTH}(p) \geq 15pp \land \neg \Diamond \Diamond \text{LENGTH}(p) > 15pp\)
        \begin{tabular}{ccc}
          \ldots & \underline{13} & 15 17 \\
        \end{tabular}
    \end{enumerate}
  \end{enumerate}
In the other two combinations, given that the epistemic modal in the superlative modifier and the deontic modal do not correspond in their modal force, modal concord is not possible and thus only a compositional reading conveying speaker ignorance is available. At least $n$ combined with a possibility modal is predicted to mean that the speaker is unsure about the maximally allowed number and thinks that the upper bound of the deontic range might be $n$ or more, cf. (6a). At most $n$ plus necessity modal says that the speaker is unsure about the minimally required number. While she is sure that the lower bound of the deontic range is not more than $n$, it might be $n$, cf. (6b).

(6) a. ♦ + at least: The paper can be at least 15 pages long.
   Compositional reading: □♦ LENGTH(p) ≥ 15pp ∧ ♦♦ LENGTH(p) > 15pp
   \[
   \begin{array}{c|c|c}
   & \text{at least} & \text{at most} \\
   \hline
   13 & 15 & 17 \\
   \end{array}
   \]
b. □ + at most: The paper has to be at most 15 pages long.
   Compositional reading: ♦□ LENGTH(p) ≥ 15pp ∧ ¬♦□ LENGTH(p) > 15pp
   \[
   \begin{array}{c|c|c}
   & \text{at least} & \text{at most} \\
   \hline
   13 & 15 & 17 \\
   \end{array}
   \]

2.2. Nouwen (2010)

Rather than hard-wiring speaker ignorance into the lexical meaning of superlative modifiers as in Geurts and Nouwen (2007), Nouwen (2010) derives ignorance inferences from a covert epistemic possibility modal embedded under the superlative modifier. He proposes that superlative modifiers are degree quantifiers that indicate minima (for at least) or maxima (for at most). The proposal is built on two additional assumptions: The first is that for gradable predicates, a functional (in terms of $=$) as well as a relational (in terms of $\geq$) meaning is generally available. The second assumption is that linguistic expressions compete: If a certain meaning can be expressed by linguistic expressions differing in their complexity, the simpler expression is preferred, and thus more complex expressions are blocked. The components of the analysis, taken together, predict that in many cases superlative modifiers cannot be used because the resulting sentences either express a contradiction or a meaning that is equivalent to the sentence with a bare numeral and thus blocked. If superlative modifiers, however, apply to a degree property denoting a range of values, the result is non-contradictory truth-conditions, which are not equivalent to the ones expressed by the bare numeral. This is the case, in particular, if a possibility modal is in their scope. Nouwen thus argues that a covert epistemic possibility modal can be inserted in the scope of the superlative modifier to rescue a structure that would otherwise be ruled out, giving rise to speaker ignorance. That said, there is no need to have an additional covert epistemic one in cases with an overt possibility modal. Nouwen’s account thus predicts that authoritative readings always arise if at least and at most co-occur with a deontic possibility modal, as shown in (7). (The narrow scope reading is either contradictory or blocked by the bare numeral).
Regarding the interaction with necessity modals, Nouwen’s analysis predicts that neither at least nor at most expresses sensible truth-conditions. (The narrow as well as the wide scope readings are either contradictory or blocked.) But we can assume that these combinations too can be rescued by inserting a covert epistemic possibility modal in the scope of the superlative modifier and above the deontic necessity modal. At most combined with a necessity modal will then convey speaker ignorance regarding the lower bound of the deontic range, as illustrated in (8).

\[
\text{(7) a. at least } n \succ \Diamond : \quad \text{b. at most } n \succ \Diamond :
\]

\[
\begin{array}{c}
\vdash \ldots h \\
\end{array}
\quad \begin{array}{c}
\vdash \ldots n
\end{array}
\]

Nouwen (2010) moreover proposes that a necessity modal is interpreted as a possibility modal when minimality is at stake, such that at least plus necessity modal comes out equivalent to at least plus necessity modal and thus has the authoritative reading shown in (7a).

2.3. Büring (2008) and Schwarz (2011)

Büring (2008) proposes an account in which the ignorance implications of superlative modifiers arise as pragmatic inferences. It starts from the intuitive equivalence of at least \( n \) with \( n \) or more and builds on the observation that ignorance inferences also arise from disjunction (9).

\[
\text{(9) Ernie or Bert called.}
\]

\[
\Rightarrow \text{The speaker is not certain but considers it possible that Ernie called.}
\]

\[
\Rightarrow \text{The speaker is not certain but considers it possible that Bert called.}
\]

The ignorance inferences arising with disjunction are generally analyzed as quantity implicatures. Büring proposes that the lexical semantics of at least \( n \) corresponds to \( n \) or more and thus involves disjunction. He assumes, therefore, that the account of ignorance inferences arising with disjunction carries over to superlative modifiers, but semantic equivalence is in fact not sufficient for the generation of implicatures (see Coppock and Brochhagen, 2013).

Schwarz (2011) generalizes Büring’s proposal and shows that the effect of speaker uncertainty can be derived systematically as ignorance inferences under a neo-Gricean approach, similarly to scalar implicatures (Sauerland, 2004). Assuming the Horn set \{at least, exactly, at most\} of scalar modifiers in addition to the Horn set of numerals, the stronger scalar alternatives for at least \( n \) are...
at least \( n' \) for \( n' > n \) and exactly \( n' \) for \( n' \geq n \); for at most, \( n \) the stronger alternatives are at most \( n \) for \( n' < n \) and exactly \( n' \) for \( n' \leq n \). These scalar alternatives are symmetric and thus block the generation of scalar implicatures while leading to ignorance inferences. But if at least and at most are interpreted in the scope of a necessity modal, the alternatives are not symmetric, and consequently scalar implicatures rather than ignorance inferences are generated, assuming the speaker is competent. These authoritative readings are illustrated in (10a, b).

\[
\begin{align*}
\text{(10) } & \quad \text{a. } \Box \succ \text{at least } n: & \quad \text{c. } \text{at least } n \succ \Box: \\
& \quad \text{b. } \Box \succ \text{at most } n: & \quad \text{d. } \text{at most } n \succ \Box:
\end{align*}
\]

This pragmatic account thus predicts that both at least and at most are able to suppress ignorance inferences and give rise to authoritative readings when they are embedded under a necessity modal. In addition, readings with speaker ignorance are also available if at least and at most take wide scope over a necessity modal, cf. (10c, d).

With regards to possibility modals, in contrast, the neo-Gricean approach predicts obligatory ignorance inferences for both at least and at most, since the narrow as well as the wide scope reading leads to symmetric scalar alternatives.\(^2\) The truth-conditions of the readings where superlative modifiers take wide scope over the modal—which are the ones which lead to sensible ignorance implications—are shown in (11).

\[
\begin{align*}
\text{(11) } & \quad \text{a. } \text{at least } n \succ \Diamond: & \quad \text{b. } \text{at most } n \succ \Diamond:
\end{align*}
\]

2.4. Coppock & Brochhagen (2013)

Coppock and Brochhagen (2013), casting their analysis in Inquisitive Semantics, analyze superlative modifiers as expressions that denote sets of alternatives that are ranked higher (for at least) or lower (for at most) according to some pragmatic ranking. Speaker ignorance follows from the

\(^2\)An obvious way to extend the pragmatic account would be to build on the fact that disjunction in combination with possibility modals leads to free choice inferences, which would go beyond the neo-Gricean approach (Fox, 2007, among others). If we assume that the Büring-Schwarz-account can be extended along the line of free choice, we would expect that both at least and at most give rise to authoritative readings under possibility modals. The predictions of this extended version of the analysis would then be the same as the ones discussed for Coppock & Brochhagen’s (2013) account, albeit with a different pragmatic analysis.
MAXIM OF INTERACTIVE SINCERITY, according to which a speaker should only utter a sentence denoting a set of alternatives if her information state is consistent with those alternatives. Regarding the interaction with modals, we again have to consider the wide and narrow scope configurations.

The configurations in which superlative modifiers take wide scope over a modal denote sets of alternatives and thus convey speaker ignorance. The configurations in which superlative modifiers take narrow scope under a modal, no ignorance inferences arise due to Existential Closure, which applies in the scope of modals and whose function is to gather all the alternatives into a single proposition corresponding to the disjunction of all these alternatives. Coppock and Brochhagen (2013) therefore predict that for each superlative modifier-modal combination, both a reading with and without speaker ignorance is possible. In the scope of a necessity modal, at least and at most specify the lower and upper bound of the deontic range, respectively. For at most n in the scope of a possibility modal, Coppock and Brochhagen (2013) argue that the resulting reading, which says that values up to n are permissible, is strengthened by an exhaustivity implicature, according to which values higher than n are not permissible. The same reasoning should apply to at least n in the scope of a possibility modal: The truth conditions derived from this structure specify that n and higher numbers are permissible and are subsequently strengthened by an implicature to the effect that lower numbers are not permissible. Note that this strengthening by implicature effectively makes at least + ♦ equivalent to at least + □, and at most + ♦ equivalent to at most + □, as shown in (12).

\begin{align*}
\text{(12) a. } & \square \succ at \text{ least } n, \Diamond \succ at \text{ least } n: \\
\text{ b. } & \square \succ at \text{ most } n, \Diamond \succ at \text{ most } n:
\end{align*}

2.5. Summary of previous analyses

In sum, all the analyses discussed here make clear predictions regarding (i) which combinations of superlative modifiers and modals potentially give rise to the authoritative reading and which only have a reading conveying speaker ignorance, and (ii) what exactly the truth conditions are for the authoritative reading and the speaker ignorance reading. As the discussion in this section made clear, the different analyses vary considerably regarding the predictions. An experimental investigation that examines these questions is thus warranted. In what follows, we present an experimental paradigm that is designed to answer these research questions, report on the results of our investigation, and discuss their implications. In Experiment 1, we test which combinations bring about ignorance inferences. In Experiment 2, we determine which readings are available for each of the superlative modifier-modal combinations vis-à-vis the truth conditions predicted by the various analyses, as summarized in (13).
(13)  

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<td>ii.</td>
<td>G&amp;N, N, B/S, C&amp;B</td>
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<td>ii.</td>
<td>G&amp;N, B/S</td>
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</table>

3. Experiment 1: Ignorance inferences of superlative modifier-modal combinations

3.1. Research question

In Experiment 1, we tested which combinations of superlative modifiers and modals can suppress ignorance inferences. In order to test these questions, we pitted the speaker’s epistemic state, i.e. whether a speaker is knowledgeable or ignorant with respect to the number under discussion, against the ignorance inferences conveyed by a superlative modifier. If it is clear from the context that the speaker has the relevant information, then only utterances that can suppress ignorance inferences will be acceptable. If it is clear from the context that the speaker does not have the information, then utterances that do not lead to ignorance inferences will be ruled out. And finally, if it is not clear from the context whether the speaker has the knowledge or not, then either an utterance that leads to ignorance inference or not would be compatible with the speaker’s epistemic state.

3.2. Methods

In Experiment 1, 40 participants (18 Female; Mean Age: 43.8; Age range: 26-62) were asked to rate the coherence of a speaker uttering a sentence with a modal and a superlative modifier. The task was conducted on Amazon’s Mechanical Turk. Participants received $3.24 for answering 80 experimental items at a rate of $0.03 per item.

In this experiment, participants read scenarios like (14), in which Speaker A asks for information and Speaker B provides this information in the form of an utterance with one of the two types of deontic modals and one of the two types of superlative modifiers. Following the presentation of
the context and utterance, participants were asked to evaluate the speaker’s coherence on a Likert scale of $-5$ to $+5$, where $-5$ is definitely not coherent and $+5$ is definitely coherent. Cummins and Katsos (2010) show that this scale provides a way to differentiate between semantic falsity and pragmatic infelicity, whereby participants give false statements ratings in the $-5$ region, true and pragmatically felicitous statements in the $+5$ region, and statements that are true but pragmatically infelicitous in the 0 region. However, in contrast with Cummins and Katsos (2010), who asked participants to rate the coherence of the utterance, we directed participants’ attention to the speaker’s coherence instead.\(^3\)

(14) Boris is applying for a graphic designer position at an ad company. He called the secretary of the company asking for the amount of art works in the portfolio. The secretary, who was involved in the selection process, said:

“You are \(\{\text{allowed}\} \) \(\{\text{required}\}\) \(\{\text{at least}\} \) \(\{\text{at most}\}\) 3 works in the portfolio you send us.”

In light of the context given above, how coherent do you think the speaker is on a scale ranging from -5 to +5, where -5 is definitely not coherent and +5 is definitely coherent?

As discussed in Section 3.1, in order to determine which superlative modifier-modal combinations suppress ignorance inferences, we aimed to contrast the potential ignorance inference or authority reading that the utterances may generate with contextually-explicit speaker ignorance. We expected that mismatches in the explicitly-stated speaker epistemic state and the one inferred by the utterance would have an effect on the coherence rates attributed to the speaker.\(^4\) We created three different speaker epistemic state conditions (with illustrations from the example stimulus in (14)):

(15) a. ±knowledgeable: the speaker may or may not have the knowledge
   “The secretary said:”
   b. +knowledgeable: context makes it explicit that the speaker has the knowledge
   “The secretary, who is involved in the selection process and knows all the requirements, said:”

\(^3\)We modified the task from Cummins and Katsos further by changing the conversational and situational context in which the statement was evaluated. While they had participants evaluate the utterance containing the bare or modified numeral in light of a subsequent sentence in which the numeral was modified by exactly, we had participants evaluate the utterance in light of what they could infer about the epistemic state of the speaker.

\(^4\)The reader may observe a potential confound in the design, noting that the speaker’s epistemic state can be stated explicitly in the context or (automatically, as some may argue) inferred from the authority of the speaker. In this example stimulus as well, the secretary’s knowledge regarding the job search information may be inferred by virtue of her being an employee in the company who holds a position that entails being familiar with the intricacies of, and the processes taking place in, the company. We discuss this potential confound in Section 5. We thank Irene Heim and Ede Zimmerman for discussing this issue with us.
c. −knowledgeable: context makes it explicit that the speaker does not have the knowledge  
“The secretary apologized for not knowing the requirements for the application, and said:”

The experimental design was 2 (modals) × 2 (superlative modifiers) × 3 (speaker conditions). In addition to the 40 target items, there were also 20 control items that consisted of 10 contradictions and 10 entailments, which served as false and true (and pragmatically felicitous), respectively, baseline for comparison with the target items, as well as 20 filler items.

3.3. Results

Participants rated entailments as coherent (Mean = +4.41, SD = 0.89) and contradictions as incoherent (Mean = −4.70, SD = 0.63), thereby establishing that the negative and positive ends are associated with false and true (and pragmatically felicitous) sentences, respectively.

First looking at the −knowledgeable speaker condition, participants found statements uttered by an unknowable speaker less coherent than statements uttered by a knowledgeable speaker in general. This was shown by the overall lower coherence in the −knowledgeable condition, regardless of the type of modal or superlative modifier, in comparison with the other two speaker conditions, as well as a main effect of speaker condition in an ANOVA (F(2,1587) = 98.69, p < 0.01). We found that □ + at least (Median = 2.5, Mean = 1.14, SD = 3.33) was significantly more coherent than ◊ + at least (Median = 1, Mean = 0.32, SD = 3.14; t(392.59) = 2.51, p < 0.05) and that ◊ + at most (Median = 2, Mean = 1.32, SD = 2.86) was significantly more coherent than ◊ + at least (Median = 1, Mean = 0.32, SD = 3.14; t(387.69) = 3.31, p < 0.01), but did not find any other differences between the various superlative modifier-modal combinations.

In the ±knowledgeable speaker condition, we found a main effect of superlative modifier (ANOVA: F(1,410) = 4.75, p < 0.05) and that superlative modifier was a significant predictor (β = 0.25, p < 0.01), and this manifested itself by ◊ + at most (Median = 4, Mean = 3.17, SD = 2.47) judged as significantly more coherent than ◊ + at least (Median = 3, Mean = 2.21, SD = 2.79; t(195.21) = 2.57, p < 0.05) and □ + at most (Median = 4, Mean = 3.04, SD = 2.44) judged as significantly more coherent than ◊ + at least (t(197.65) = 2.27, p < 0.05).

And finally, in the +knowledgeable speaker condition, participants judged □ + at least to be more coherent (Median = 5, Mean = 3.59, SD = 2.50) than ◊ + at least (Median = 3, Mean = 2.42, SD: 2.85; t(194.80) = 3.08, p < 0.01). Likewise, ◊ + at most was judged as more coherent (Median = 4, Mean = 3.44, SD = 2.16) than □ + at most (Median = 4, Mean = 2.60, SD = 2.99; t(160.26) = 2.19, p < 0.05). Note also that the less coherent combinations in this speaker conditions still had ratings higher than contradiction.
3.4. Discussion

In the −knowledgeable and ±knowledgeable conditions, we have found differences between some superlative modifier-modal combinations, but no differences emerged in these speaker conditions that would suggest a grouping predicted by any of the four analyses discussed in the previous section. The results from the +speaker condition, however, show a robust contrast in coherence rates between two groups of superlative modifier-modal combinations. In this speaker condition, the combinations □ + at least and ◊ + at most are judged as more coherent than the other two combinations, ◊ + at least and □ + at most. This corresponds to the grouping delineated in Geurts and Nouwen’s analysis, but not to the predictions of any of the other analyses discussed in Section 2. Under Geurts and Nouwen’s analysis, □ + at least and ◊ + at most are able to suppress ignorance inferences and allow for an authoritative reading, whereas ◊ + at least and □ + at most have the speaker insecurity reading only. Under their account, the irrepressible, so to speak, ignorance inferences in the latter two combinations conflict in terms of inferred epistemic certainty with contexts in which the speaker has the knowledge and therefore should be certain about the information conveyed in the utterance. Moreover, since the coherence rates for these combinations in the +knowledgeable condition were low but distinct from those given to contradiction items—that is, since the mismatch between the speaker’s certainty and the ignorance inferences generated by these combinations was not judged as a contradiction—we conclude that ignorance inferences are pragmatic rather than semantic (contra Geurts and Nouwen 2007 and in line with, e.g., Büring 2008; Cummins and Katsos 2010; Coppock and Brochhagen 2013).

The coherence rates in the −knowledgeable condition strongly suggest that speakers found statements uttered by a speaker who did not have the information incoherent even though those statements allowed for ignorance inferences and therefore for a match between the contextual epistemic state as well as the one conveyed by the utterance. It seems that the effect of an ignorant
speaker is stronger than the ability of participants to choose the available reading of the superla-
tive modifier-modal combination that would match such ignorance, leading all utterances in this speaker condition to be judged as degraded.

**4. The truth conditions of superlative modifiers-modal combinations**

**4.1. Research question**

In Experiment 2, we tested which interpretations were available for certain combinations of deontic modals and superlative modifiers. As discussed in Section 2, the different analyses on the auction block make different predictions regarding the truth conditions and available inference regarding the permitted values. In what follows, we initially take Geurts and Nouwen (2007) analysis as an example for how our experimental task helps us determine whether the predictions regarding available readings of superlative modifiers under deontic modals are borne out. We then proceed to discuss the other analyses in light of our results.

**4.2. Methods**

In Experiment 2, 40 participants (17 Female; Mean Age: 34.2; Age range: 23-59) read scenarios similar to the ones read in Experiment 1, but in this experiment the contexts were underspecified regarding the knowledge of the speaker, as in (16). The utterance was then followed by a description of an action or a state of affairs concerning A (and directly relevant to B’s utterance), in which the stated number was either lower (the UNDER CONDITION) or higher (the OVER CONDITION) than the one used with the superlative modifier in B’s utterance. Then, participants were asked to judge whether A acted or was in accordance with what B had said.

(16) Professor Samsa is teaching an Introduction to Semiotics class. Jeremy, a student in his class, asked him about the length of the paper for the class, and Professor Samsa said:

```
“Your term paper \{ has to \_ \} be \{ at least \_ \_ at most \_ \} 15 pages long.”
```

Jeremy handed in a \{ 13 \_ \_ 17 \} page-long paper.

Did the length of Jeremy’s term paper comply with Professor Samsa’s specifications?

The experimental design was 2 (modal conditions) × 2 (superlative modifier conditions) × 2 (under/over conditions). In addition to the 40 target times, there were also 20 control items and 20 filler items. The control items consisted of 10 violation conditions, in which A’s action or the description sentence violates B’s utterance, and 10 compliance conditions, in which A’s action or the
description sentence was in accordance with B’s utterance. The task was conducted on Amazon’s Mechanical Turk. Participants received $3.24 for answering 80 experimental items.

Before we discuss the response rates in Experiment 2, we would like to illustrate how the experimental paradigm we utilized is helpful in determining which of the analyses makes the correct predictions about which readings are available for the various superlative modifier-deontic modal combinations. We discuss here the predictions the analysis in Geurts and Nouwen (2007) makes, but in Section 4.4 we return to the other analyses to assess them as well.

As exemplified in (17), under the authoritative reading only higher values than 15 would be allowable when at least 15 is combined with a necessity modal. Therefore, we expect to get No responses in the Under condition and Yes responses in the Over condition. Under the speaker insecurity reading the speaker is unsure about the minimally-required number and thinks that the lower bound of the deontic range might be 15 or more. Therefore, again, we expect to get No responses in the Under condition. But since the speaker only considers it possible, but is not certain, that 15 or 17 are permissible, both Yes and No responses in the Over condition are compatible with this reading. In sentences like (18), under the authoritative reading only lower values than 15 would be allowable when at most 15 is embedded under a possibility modal. Therefore we would expect to get Yes responses in the Under condition and No responses in the Over condition. Under the speaker insecurity reading, at most 15 plus possibility modal conveys that the speaker is unsure about the maximally-allowed number and is only certain that the upper bound of the deontic range is not more than 15; for all she knows, it might be 15. Therefore, again, we would expect to get No responses in the Over condition, while both Yes and No responses in the Under condition are compatible with this reading. It is important to point out that Geurts and Nouwen (2007) do not make any predictions about which one of the readings is preferred, but it is safe to assume that the stronger reading is preferred, especially in an experimental setting that does not allow for hedging or opting out.

(17) □ + at least: The paper has to be at least 15 pages long.
   a. 13 □ 15 17
      authoritative reading
   b. 13 [1111111111] □ 15 17
      speaker insecurity reading
(18) ♦ + at most: The paper can be at most 15 pages long.
   a. 13 □ 15 17
      authoritative reading
   b. 13 [1111111111] 15 17
      speaker insecurity reading

In sentences like (19a), higher values than 15 are consistent with the speaker’s knowledge and lower values than 15 are within the deontic range when at least is embedded under a possibility
modal. Therefore we would expect Yes responses in the Under condition, while both Yes and No responses in the Over condition are compatible with this reading. In sentences like (19b), lower values than 15 are consistent with the speaker’s knowledge and higher values than 15 are within the deontic range when \textit{at most} is embedded under a necessity modal. Therefore we would expect Yes responses in the Over condition, and both Yes and No responses in the Under condition are compatible with this reading.

\begin{itemize}
  \item (19) a. $\diamond + \textit{at least}$: The paper can be at least 15 pages long.
    \begin{tabular}{ccc}
      13 & 15 & 17
    \end{tabular}
    speaker insecurity reading
  \item b. $\Box + \textit{at most}$: The paper has to be at most 15 pages long.
    \begin{tabular}{ccc}
      13 & 15 & 17
    \end{tabular}
    speaker insecurity reading
\end{itemize}

4.3. Results

The results, given in Table 1, show that (i) in the $\Box + \textit{at least}$ combination, the number is interpreted as denoting the lower bound, shown by the fact that the vast majority of participants rejected the description of A in the Under Condition; and that (ii) in the $\diamond + \textit{at most}$ combination, the number is interpreted as the upper bound, shown by the fact that most participants rejected the description of A in the Over Condition. The other two combinations, $\Box + \textit{at most}$ and $\diamond + \textit{at least}$, exhibit a less robust contrast but clearly show that participants tended to interpret the number in the $\Box + \textit{at most}$ combination as specifying the upper bound, shown by the lower Yes rates in the Over Condition, and the $\diamond + \textit{at least}$ combination as specifying the lower bound, shown by the lower Yes rates in the Under Condition.

\begin{table}[h]
\centering
\begin{tabular}{|c|c|c|c|c|}
\hline
\textbf{Discrepancy Condition} & $\Box + \textit{at least}$ & $\Box + \textit{at most}$ & $\diamond + \textit{at least}$ & $\diamond + \textit{at most}$ \\
\hline
\textbf{Over} & 90\% & 16.67\% & 84\% & 1.05\% \\
\textbf{Under} & 4.7\% & 77.65\% & 16\% & 93.91\% \\
\hline
\end{tabular}
\caption{Results from Experiment 2: Means of ”Yes” Responses}
\end{table}

A series of Welch Two-Sample t-tests (after converting a Yes response to 1 and a No response to 0) to compare the eight different combinations shows that the response rates for each one of the superlative modifiers were different when it was embedded under a necessity modal vs. when it was embedded under a possibility modal. The response patterns for $\Box + \textit{at least}$ and $\diamond + \textit{at most}$, however, were not significantly different from each other, and neither were $\diamond + \textit{at least}$ and $\Box + \textit{at most}$.

Proceedings of Sinn und Bedeutung 18
Edited by Urtzi Etxeberria, Anamaria Fălăuș, Aritz Irurtzun & Bryan Leferman

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Returning to Table 1, notable response patterns are the ones for □ + at most and ♦ + at least, as they were not as robust as for the other two combinations. A closer look at the response pattern of each participant revealed that participants were not consistent in their response strategies; that is, we did not find that there were participants who consistently responded to the stimuli with, e.g., □ + at most in the Over Condition, with No (which happened in 13.37% of the cases). We likewise did not find specific stimuli that had led to a consistent response pattern that matched those low-percentage response.

4.4. Discussion

In order to evaluate the various analyses, we summarize in (20) the predictions the four analyses discussed in Section 2 make regarding the permitted values and compare them with the results of our Experiment 2. Starting with the combinations □ + at least and ♦ + at most, for which we found a clear response pattern, it turns out that the predictions of all four analyses are compatible with our results. For □ + at least (20a), greater values than \( n \) were accepted in 90% of the cases, cf. (20a-i), as all four analyses predict. The additional, weaker, reading given in (20a-iii) may be available as well, but we hypothesize that when participants are faced with a choice between a strong and a weak reading, they will tend to choose the stronger one. For ♦ + at most in (20d), only smaller values than \( n \) were accepted, cf. (20d-i), as is again predicted in all analyses.

The remaining two combinations, □ + at most and ♦ + at least, are more interesting, as here the different analyses make distinct predictions and the response patterns we found were not as uniform as for the other two combinations. For □ + at most (20b), smaller values than \( n \) were accepted in 77.65% of the cases but greater values were not always ruled out, cf. (20b-i). This suggests that in most cases, participants got the authoritative reading (20b-ii) predicted by Büring (2008)/Schwarz (2011) and Coppock and Brochhagen (2013), while a minority got the speaker insecurity reading in (20b-iii), which Geurts and Nouwen (2007) and Nouwen (2010) predict to be the only available
reading. For $\Diamond + \textit{at least}$ (20c), greater values than $n$ were accepted in 84% of the cases, but smaller values were not always ruled out (20c-i). This suggests that in most cases, participants got the authoritative reading in (20c-ii), as predicted by Nouwen (2010) and Coppock and Brochhagen (2013), while a minority got the speaker insecurity reading in (20c-iii), which Geurts and Nouwen (2007) and Büring (2008)/Schwarz (2011) predict to be the only available reading.

(20)  
   a. $\Box + \textit{at least }n$:  
      i. $4.7\% < 90\%$  
      ii. $\ldots \ldots$  
      iii. $[\ldots \ldots \ldots \ldots ]$  
   b. $\Box + \textit{at most }n$:  
      i. $77.65\% < 16.67\%$  
      ii. $\ldots \ldots \ldots$  
      iii. $[\ldots \ldots \ldots \ldots ]$  
   c. $\Diamond + \textit{at least }n$:  
      i. $16\% < 84\%$  
      ii. $\ldots \ldots \ldots$  
      iii. $[\ldots \ldots \ldots \ldots ]$  
   d. $\Diamond + \textit{at most }n$:  
      i. $93.91\% < 1.05\%$  
      ii. $\ldots \ldots \ldots$  
      iii. $[\ldots \ldots \ldots \ldots ]$  

5. General discussion

Let us summarize what the results of our experimental study can say about the predictions of different analyses of superlative modifiers. First, both the account of Nouwen (2010) and an approach in line with Büring (2008)/Schwarz (2011) seems untenable in light of the results from our Experiments 1 and 2. Each analysis makes some predictions regarding the suppression of ignorance inferences as well as the available readings that are not borne out. Regarding the predictions about which combinations of superlative modifier and deontic modal can suppress ignorance inferences and for which combinations ignorance inferences are obligatory, the analysis in Geurts and Nouwen (2007) fares best. Only their account predicts that $\Box + \textit{at least}$ and $\Diamond + \textit{at most}$ can suppress ignorance inferences, while $\Box + \textit{at most}$ and $\Diamond + \textit{at least}$ cannot. But they also assume that ignorance inferences are semantic, whereas our results suggests that they are pragmatic, which is in line with Büring (2008)/Schwarz (2011) and Coppock and Brochhagen (2013).

Note that none of the readings predicted by the discussed analyses is compatible with the fact that participants in our experiment rejected higher values in about 22% of the cases. We thus focus on the 16% acceptance rate of higher values.
Regarding available readings in terms of lower and upper bound of the deontic range, only Geurts and Nouwen’s (2007) predictions for □ + at least and ♦ + at most are fully borne out by our Experiment 2. For the other two combinations, □ + at most and ♦ + at least, they only predict a reading which we found to be only marginally available. The readings we found to be preferred for these combinations are correctly predicted by Coppock and Brochhagen (2013), as are the readings for the other two combinations. But their account does not explain the difference between these two groups of combinations, i.e. why only one reading is attested for □ + at least and ♦ + at most, whereas for □ + at most and ♦ + at least different readings seem to be available simultaneously. Thus, each of the existing analyses only partially predicts the results of this study.

In order to set the stage for a possible explanation for the attested response patterns in Experiment 2, we would like to discuss a potential confound in our experimental set-up. In most of our stimuli the speaker in the contexts could be claimed to be an authority on the topic the utterance evolves around. Recall, for example, our stimulus in which the secretary provides the number of works the applicant must send. The secretary’s knowledge regarding the job search information may be inferred by virtue of her being an employee in the company who holds a position that entails being familiar with the intricacies of, and the processes taking place in, the company. This is related to the concept of epistemic authority in psychology and sociology, whereby individuals attribute high confidence to information provided by a source they identify as an epistemic authority, consequently often assimilating it to the common ground as uncontested truth (Kruglanski, 1989). What is relevant to this study is that even in contexts in which the knowledge of the speaker was underdetermined, it could be that participants inferred that the speaker did in fact have sufficient information and thus participants would favour the authoritative reading. Note, however, that in Experiment 1 the coherence rates in the ±knowledgeable condition were not the same as in the +knowledgeable, in which the speaker clearly had the relevant information. This may be so because, lacking sufficient information in the ±knowledgeable condition to determine without doubt that the speaker was certain about the value in question, participants differed in how they evaluated the speaker’s epistemic state, perhaps even changing this evaluation from stimulus to stimulus. Moreover, this inferred epistemic authority may have led to the overall low coherence ratings in the −knowledgeable condition. If participants did in fact infer that the speaker should be certain about the relevant information given her authority, then utterances that potentially led to ignorance inference would be judged as incoherent due to the mismatch between the contextually-inferred certainty and the semantically/pragmatically-derived ignorance. In sum, even with the potential confound of inferred epistemic authority, the results from Experiment 1 shed light on the interaction between linguistically- vs. contextually-derived inferences about speaker’s certainty.

Having noted that participants in our experiment might have been biased towards an authoritative reading, we return to the question why in the majority of the cases participants in Experiment 2 interpreted the numeral as specifying the lower bound when it was modified by at least, independently of whether it co-occurred with a necessity or a possibility modal, and why they interpreted the numeral as specifying the upper bound when modified by at most, whether co-occurring with a possibility or a necessity modal. If we assume the analysis in Geurts and Nouwen (2007), we could...
hypothesize that participants resorted to a reanalysis of the modal to arrive at a clearer reading that better matched the task, an interpretive strategy we dub **MODAL REANALYSIS**. In the case of $\diamond + \text{at least}$ and $\Box + \text{at most}$, the only possible reading is one in which all values are potentially allowed, some within the deontic range and some within the epistemic range (that is, the speaker cannot rule out any values, modulo pragmatic restrictions involving relevance). This unrestricted reading might be felt to be at odds with the speaker’s utterance, which includes two expressions that normally communicate restriction, namely deontic modals and superlative modifiers. Participants might therefore have decided that the reading conveying speaker ignorance was not felicitous and opted to reanalyze the modal to arrive at an authoritative reading. This would also explain why we got mixed results for $\Box + \text{at most}$ and $\diamond + \text{at least}$: It seems that in the majority of cases, participants opted for the strong reading that necessitated modal reanalysis, but in the minority of cases, participants nevertheless opted for the weak reading conveying speaker ignorance.

**References**


The grammatical life of property concept roots in Malayalam

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Abstract. We provide an account of the morpho-syntax and semantics of property concept denoting expressions in Malayalam. We suggest that property concepts are lexicalized as uncategorized roots. Depending on the category of the functional heads they merge with, they participate in two types of predication. Both types are based on possession, overtly or covertly expressed. Our results add to recent work by Francez and Koontz-Garboden (2013) concerning variation in the lexicalization and grammar of property concepts cross-linguistically.

Keywords: property concepts, adjectives, possession, predication.

1. Property concepts

Property concepts are notions that are consistently lexicalized as adjectives across languages (Dixon 1982) – an affinity between meaning and category that is of interest to semantic theory, particularly in light of questions concerning universality and variation in the lexicon and the consequences for grammar. Addressing these issues, Francez and Koontz-Garboden (2013) have put forth the Lexical Semantic Variation Hypothesis, suggesting that property concepts can lexicalize as adjectives or as nouns (e.g., intelligent or intelligence), across languages or within one and the same language. The lexical semantics of the two categories differ: adjectival property concept lexemes have the usual semantics attributed to adjectives (e.g., relations between degrees and individuals, or measure functions that are then embedded in degree functional structure, etc.), whereas nominal property concept lexemes denote mass substances. Furthermore, the syntactic category and the associated lexical semantics of property concept lexemes determine what kind of predication these lexemes can participate in: adjectives participate in canonical predication, employing the morpho-syntax used with predicate nominals (e.g., John is intelligent / a doctor), whereas nouns participate in possessive predication, employing possessive morpho-syntax (e.g., John has intelligence / a child).

In this paper we investigate the structure and semantics of expressions that make reference to property concepts in Malayalam, a language that has no category of adjectives. We provide further evidence for the link between the nominal category of property concept lexemes and possessive predication. However, we also show that, in the absence of lexical adjectives, canonical predication involving property-concept lexemes is accomplished with an expression that includes a covert possessive. Thus, we argue that property concept predication in Malayalam is always based on possession, covert or overt. The analysis of Malayalam raises the possibility that property concepts universally lexicalize as roots, rather than as adjectives or nominals, and

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1 Thanks to Itamar Francez, Andrew Koontz-Garboden, Rebeka Baglini, and Veneeta Dayal for discussion, and also to the audiences at Sinn und Bedeutung 18 at the University of the Basque Country and at Syntax+ at USC. Any errors are our own.
that all property concept roots, rather than only nominal property concept lexemes, denote substance-like individuals, requiring possessive predication. Adjectives, in the languages that have them, can be treated as syntactically derived categories that too use a possessive strategy of predication, a covert one. Even more generally, cross-linguistic variation is not located in the lexicon; rather variation in morpho-syntax and logical semantics of property concepts is encoded at the level of the functional vocabulary that categorizes property concept roots.

2. Two types of roots denoting property concepts in Malayalam

The descriptive grammar of Asher & Kumari (1997:116-117, 350) notes that Malayalam has a class of ‘pure’, ‘morphologically simple’ adjectives, as in (1). However, Amritavalli and Jayaseelan (2003), Jayaseelan (2007), and Menon (2013), have argued against the claim that these expressions are lexical adjectives, suggesting instead that they have complex structure that incorporates other categories.

(1) nalla ‘good’, valiya ‘big’, paza‘‘old’, čeriya ‘small’

Amritavalli and Jayaseelan (2003) and Jayaseelan (2007) argue that expressions such as those in (1) are created by the incorporation of a noun into a preposition or a case-licensing head. Menon (2013) notes that these so-called ‘pure adjectives’ can be given an analysis as relative forms, -a being the relative verbal marker in the language. We follow this analysis. Thus we endorse the view that property concepts in Malayalam are always lexicalized as morphologically complex forms that, moreover, do not have an adjectival affix. Rather, such expressions are either a relative verbal form, as in (2a), or a nominalization, as in (2b).2

(2) a. Class 1 (native roots + a)
   valiya ‘having bigness’, čeriya ‘having smallness’, puthiya ‘having newness’
   nalla ‘having goodness’, pačča ‘having greenness’, niila ‘having blueness’

b. Class 2 (borrowed roots + am)
   santosham ‘happiness’, sankatam ‘sadness’, madhuram ‘sweetness’
   prayasam ‘difficulty’, santam ‘quietness’, pokkam ‘tallness’

There are no semantic differences between the two types of roots. The distinction is morpho-syntactic, based on etymology, and the morpho-syntactic class determines the type of structures the roots can appear in.

Our analysis of Class 1 and Class 2 roots is as follows. We suggest that both Class 1 and Class 2 roots denote property concepts, as in (3). We follow Chierchia and Turner (1988) in treating the expressions denoting property concepts (for us, roots) as sorts of the type of entities.

2 There is a small set of roots, also of Sanskrit origin, that take the ending –i, e.g. bhagni ‘beauty’, vrithi ‘cleanliness’, buddhi ‘intelligence’. They behave like the Class 2 forms, i.e. they are nominals.
A covert possessive little \( v \) categorizes Class 1 roots, and the verbal expression is then relativized by the relative marker \(-a\). Class 2 roots are categorized as nouns, and they enter further property concept predication as complements of overt possessive predicates, as in Francez and Koontz-Garboden (2013). Correspondingly, all property concept predication in Malayalam is possession-based.

3. Syntactic and semantic structures for property concept denoting roots

3.1 Class 1 roots

Let’s start with the grammatical life of Class 1 roots. Recall that they are always lexicalized with an \( a \)-suffix. Our proposal is that these expressions have the syntax of reduced relative clauses. We know that \(-a\) is the independently attested relative verbal morpheme, as the following examples illustrate ((4a) is from Asher and Kumari 1997: 54). The “__” in the examples below shows the position that has been relativized; as can be seen in (6), \(-a\) marks the verb in the highest clause that hosts the null relative operator.

(4) \([__a]\)utta pariksaykk\(\_\) varunn-\(a\)] coodyan\(\_\)al
next examination.DAT come.PRES.RP question.PL
‘the questions that come in the next examination.’

(5) njaan [Anil Komalan\(\_\) ko\(\_\)utt-\(a\)] pustakam vayicc\(u\)
I Anil Komalan-DAT gave-REL book read-past
‘I read the book that Anil gave to Komalan.’

(6) [naan \(\_\) ka\(\_\)u enna] ni\(\_\)al parayunn-\(a\)] kutt\(i\)
I see-PAST COMP you say-REL child
‘The child that you say that I saw.’

Importantly, the Class 1 roots must have been verbalized first, before the addition of the relative marker \(-a\), since \(-a\) only merges with verbs. So we propose that Class 1 roots are turned into non-finite verbal expressions by the addition of a null \( v \), with possessive semantics, as in (7). We use \( II \) as a meta-variable over property-concept-denoting expressions (similarly to Koontz-Garboden and Francez’ 2010 p).

(7) \([\emptyset v_{\text{poss}}]\] = \(\lambda II. \lambda x. [x \text{ has } II] \)
(to be modified)

The \( v \)Ps created by the merge of the null possessive \( v \) of (7) and Class 1 roots denote predicates of individuals. Semantically, they are of the appropriate type but syntactically they cannot be predicates or attributes just yet, they need to be further relativized by the verbal relative marker.
-a. This changes the syntactic category, as the structure is now participial; the semantic type remains unchanged.

(8) a. \[ [[\sqrt{nalla} + \emptyset_{v,\text{poss}}]_v \text{ (Class 1, to be modified)}} \]
   Lit. ‘have (the property of) goodness’

b. \[ [[\sqrt{nalla} + \emptyset_{v,\text{poss}}]_v + -a]_{\text{rel}} \]
   Lit. ‘having (the property of) goodness’

c. \[ [\text{nalla}] = \lambda x. [x \text{ has (the property of) goodness}] \]

The participial -a-forms can be used in attributive position – they have the appropriate participial syntax and <e,t>-type semantics to be interpreted through predicate modification.

(9) nalla kuṭṭi  
   having-goodness child  
   ‘a good child’ (lit. ‘having goodness child’)

The participial -a-forms can also be used in predicative position, after they are turned into light-headed relatives, i.e., DPs, through the merge of bound pronouns (similar to the analysis in Jayaseelan and Amritavalli 2004, for whom these expressions are free relatives).

(10) a. nalla-vał  
   having-goodness-F.SG  
   ‘one who has goodness’ (lit. ‘she having goodness’)

b. nalla-van  
   having-goodness-M.SG  
   ‘one who has goodness’ (lit. ‘he having goodness’)

The so-called equative (EQ) copula completes the predication structure, see (11). The EQ copula is the canonical predication strategy in Malayalam, as illustrated in (12) – it is the structure used with predicate nominals. The example in (12b) is particularly relevant, since it has the same structure as the property concept predicates in (11) – a verb (‘to hear’) is relativized by -a and turned into a participle; the pronominal then changes the participle into a light-headed relative – an appropriate nominal to be a complement to the EQ copula.

(11) a. aval nalla-val aaŋə  
   she having-goodness-F.SG EQ-COP  
   ‘She is good.’ (lit. ‘She is one having goodness.’)

b. avan nalla-van aaŋə  
   he having-goodness-M.SG EQ-COP  
   ‘He is good.’ (lit. ‘He is one having goodness.’)
An alternative account where the -a affix of Class 1 forms is a marker of adjectival category and thus different from the verbal relative affix -a, would additionally have to posit that adjectives too, not just relative participles, need to be nominalized before becoming the complement to the EQ copula – a complication to the grammar. Treating the Class 1 expressions as verbs that have been relativized to become syntactically good predicates, not only gives a uniform treatment to the -a affix, but also readily explains why the relative participles need to become light headed relatives in order to combine with the EQ copula.

We see that Class 1 property concept roots participate in canonical predication – with the EQ copula – just as predicted by the analysis of Francez and Koontz-Garboden (2013). But we also see that there is an analytical advantage in treating Class 1 forms as being verbal rather than adjectival – no two different morphemes -a need to be posited, and expressions incorporating pronouns are treating alike. If this analysis is indeed correct, then the null verb that is the input to -a-affixation needs to have possessive semantics. Thus, Class 1 property concept denoting roots use a covert possessive strategy.

3.2 Class 2 roots

Let’s now look at the grammar of Class 2 roots. Class 2 roots combine with the -am-marker, and we thus treat them as nominals, -am being a productive nominal marker in Malayalam.

(13)  
- a. chaat-uka ‘to jump’ – chaat-am ‘a jump’  
- b. oot-uka ‘to run’ – oot-am ‘a run’  
- c. sneh-ikk-uka ‘to love’ – sneh-am ‘love’

The affix -am categorizes the property concept root as a nominal. Since -am also appears in nominals other than Class 2 forms, as in (13), we take it to be the spell-out of different nominalizing heads, with different semantics. The particular nominalizing head that combines with Class 2 roots – but not with the forms in (13) – has the semantics in (14): it turns the abstract property concept into a predicate of individuals that are instances of the property.

(14)  
[[ -am ]] = λx. [x is an instance of II]  
(to be modified)

(15)  
- a. [[ pokk + am ]]_n  
  Lit. ‘being an instance of (the property of) tallness’  
  (Class 2, to be modified)  
- b. [[ pokkam ]] = λx. [x is an instance of (the property of) tallness]
We have chosen to treat these Class 2 nominals as having just one affix added to the root – the nominal categorizing head – but an alternative account could say that Class 2 roots combine with a null verbal head, which has the semantics attributed to -am in (14), while -am performs just a syntactic function of nominalization, without contributing to a change in meaning. We have not endorsed this account because if -am could combine with verbs, then it should be able to apply to Class 1 forms – which, as we posited, contain a possessive little v. Yet, this does not happen, -am attaches only to Class 2 forms (though see also footnote 3).

Class 2 -am-marked forms can participate in predication over individuals with the help of the possessive (called existential, EX) copula. Existential quantification over the individual variable is supplied in ways similar to that in regular existential/possessive predication (e.g., (17)).

(16)  ava[lkə pokkam unjə]
      she.DAT tallness EX-COP
      ‘She is tall.’ (lit. ‘To her there is tallness.’)

(17)  ava[lkə mookutthi unjə]
      she.DAT nose-pin EX-COP
      ‘She has a nose pin.’ (lit. ‘To her there is a nose pin.’)

When further relativized by -a, non-finite predicative structures with Class 2 forms can occupy attributive positions as well, see (18)-(19), where u[| ] is the non-finite EX copula – we again have an overt possessive strategy applied to the nominal property concept expressions.

(18)  [[\sqrt{pokk} + am]_{n} + u[l]_{v} + -a]_{rel}
      Lit. ‘tallness having’

(19)  pokkam u[|a kutti
      tallness having child
      ‘tall child.’ (lit. ‘tallness having child.’)

And of course, the relative structure in (18) can be turned into a light-headed relative, as in (20), similar to Class 1 forms in (10).

(20)  a. pokkam u[|a-val
      tallness having.F.SG
      ‘tall one’ (lit. ‘she having tallness’)

        b. pokkam u[|a-van
      tallness having-M.SG
      ‘tall one’ (lit. ‘he having tallness’)

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The EQ-copula can then combine with these light-headed relatives, for canonical predication, as in (21), similarly to Class 1 forms in (11). This is a second strategy for predication for Class 2 forms, in addition to the strategy illustrated in (16).

(21) a. aval pokkam u[a-val] aŋə
    she tallness having-F.SG EQ-COP
    ‘She is tall.’ (lit. ‘She is one having tallness.’)

b. avan pokkam u[a-van] aŋə
    he tallness having-M.SG EQ-COP
    ‘He is tall.’ (lit. ‘He is one having tallness.’)

We see that Class 2 property concept roots participate in overt possessive predication, as is to be expected from nominalizations on the account of Francez and Koontz-Garboden (2013). But we also see that with the help of the same syntactic mechanisms available to Class 1 forms – relativization with ‑a, and the creation of a light-headed relative with the help of pronouns – Class 2 forms can also participate in canonical predication. The structural similarity between (11) and (21) further supports the analysis of Class 1 forms as including a covert possessive verb. The type of copula – possessive or canonical – is determined by the category of the copula’s complement, but the complement can vary in complexity itself, and include both covert and overt possessive predicates. The intricacy of syntactic structure and semantic composition that are behind property concept expressions in Malayalam highlight the link between property concept predication and possession.

3.3 Combinatorial possibilities for the categorizing affixes

We saw that each root class combines with a dedicated categorizing morpheme – the null possessive v, followed by ‑a, combines with Class 1 roots, and the nominalizing ‑am morpheme with Class 2 roots. Are the reverse combinations also possible? The answer seems to be ‘no’. As far as we can tell, ‑a never combines with Class 2 roots; no evidence that the null possessive v does either; ‑am similarly is restricted to Class 2 roots. To nominalize a Class 1 root, the light-headed relative strategy, with a NEUT.SG pronoun, is needed (the same strategy illustrated with F.SG and M.SG in (20)).

(22) a. valiy-a-tə
    having-bigness-REL-NEUT
    ‘big thing’ (lit. ‘that having bigness’)

b. nall-a-tə
    having-goodness-REL-NEUT
    ‘good thing’ (lit. ‘that having goodness’)

3 ‑am can seemingly apply to some Class 1 forms, but judging by the extra morphology, it does not apply to the root directly:

(i) a. valiya ‘having bigness’, valippam ‘bigness’, valippəə ‘big space’

b. čeriya ‘having smallness’, čeruppam ‘youth’, čeruppəə ‘young age’
This pattern of distribution suggests that Class 1 roots are morphologically marked – they can only be categorized with the null possessive \( v \), and the null possessive \( v \) itself can only combine further with the relative marker \(-a\). Indeed, the limited number of such forms (Asher & Kumari 1997:116-117, 350), and their Old-Dravidian origin (Menon 2013) is consistent with such a characterization. Nominalization with \(-am\), on the other hand, is productive. The reason it does not apply to Class 1 roots is because they have to combine with the null \( v \), and as we discussed above, \(-am\) does not combine with \( v \). Thus we can say that the default categorization of property concept roots in Malayalam is as nouns.

Given the non-productive nature of possessive null \( v \) suffixation, an alternative account would posit that the property concepts behind Class 1 forms first make contact with the lexicon as verbs, not as category-less roots. We don’t have empirical arguments against such an account. We believe, however, that the account we suggested is to be preferred conceptually, since the lexicalization of property concepts can be treated in a uniform manner.

### 3.4 Intermediate summary and conclusions

The two classes of property concept roots undergo different syntactic derivations, but crucially start with, and end with, the same meaning. The derivations we proposed are summarized below.

(23) **Class 1:** native roots

<table>
<thead>
<tr>
<th>Example</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. ([vP \mathbf{[\emptyset + v_{\text{poss}}]} + a_{\text{rel}}])</td>
<td>‘having ( \Pi )’ (attributive)</td>
</tr>
<tr>
<td>b. ([DP [vP \mathbf{[\emptyset + v_{\text{poss}}]} + a_{\text{rel}}] \text{ pron }] \text{ EQ.COP} )</td>
<td>‘be someone having ( \Pi )’ (predicative)</td>
</tr>
</tbody>
</table>

(24) **Class 2:** borrowed roots

<table>
<thead>
<tr>
<th>Example</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. ([vP [DP \mathbf{\sqrt{2} + am_n}] \text{ EX.COP}<em>{\text{non-finite }} + a</em>{\text{rel}}])</td>
<td>‘having ( \Pi )’ (attributive)</td>
</tr>
<tr>
<td>b. ([DP \mathbf{\sqrt{2} + am_n}] \text{ EX.COP} )</td>
<td>‘have ( \Pi )’ (predicative)</td>
</tr>
<tr>
<td>c. ([DP [vP [DP \mathbf{\sqrt{2} + am_n}] \text{ EX.COP}<em>{\text{non-finite }} + a</em>{\text{rel}}] \text{ pron }] \text{ EQ.COP} )</td>
<td>‘be someone having ( \Pi )’ (predicative)</td>
</tr>
</tbody>
</table>

The possessive relation is expressed at the level of the word, through a covert possessive verbal morpheme, with Class 1 roots, and at the phrasal level, through an overt possessive verb, with Class 2 roots. The results build on Francez and Koontz-Garboden (2013)’s proposal about the role of possession in the grammar of property concept expressions, and about constraints on variation in this domain, even within the same language. The results also confirm that Malayalam lacks the category of adjectives, suggesting that Dixon’s (1982) typological observation needs to be understood at a deeper, more abstract level.
4. Introducing degrees

The above account of the morpho-syntax and semantics of Class 1 and Class 2 property concept expressions does not capture scalability yet. We need to introduce degrees as arguments to the functional heads that combine with the property concept denoting roots. We turn to this task next. Here too we rely on insights in Francez and Koontz-Garboden (2013) that property concept lexemes (when nominal for these authors) denote mass substances; we extend this idea to all property concept roots. The core idea is that to be II or to have II means to be/have an instance, a certain amount, of II.

4.1 Class 1 roots

We modify the meaning of the null possessive v as in (25). The function μ measures the instance of II to the degree argument of the null v.

(25) \[ \[ \varnothing_{\text{v.poss}} \] = \lambda II. \lambda d. \lambda x. \exists y \text{ [y is an instance of II and x has y and } \mu(y) \geq d] \]

The degree argument can be bound by POS, commonly assumed for gradable adjectives, (26)⁴, or by a measure phrase, as in (27)-(28).

(26) \[ \[ \text{POS} \] = \lambda g_{\text{<d, ≤e,t>}}. \lambda x. \exists d \text{ [g(d)(x) and } d > d_s] \]

(27) \begin{align*}
\text{anə} & \quad \text{mupattu} & \quad \text{kilo} & \quad \text{valiy-a-tə} & \quad \text{anə} \\
\text{elephant} & \quad \text{thirty} & \quad \text{kilo} & \quad \text{big-REL-NEUT} & \quad \text{EQ-COP}
\end{align*}

‘The elephant weighs 30 kilos.’ (lit. ‘The elephant is one having thirty kilos bigness.’)

(28) \begin{align*}
\text{pustakam} & \quad \text{etəə} & \quad \text{maasam} & \quad \text{puthiy-a-tə} & \quad \text{anə} \\
\text{book} & \quad \text{eight} & \quad \text{months} & \quad \text{new-REL-NEUT} & \quad \text{EQ-COP}
\end{align*}

‘The book is eight months old.’ (lit. ‘The book is one having eight months newness.’)

The rest of the analysis of Class 1 forms is modified accordingly. The meaning of forms such as those in (29) is norm-related – they are interpreted as making reference to a standard, as would be expected if POS is binding the degree variable rather than a regular existential degree quantifier. The meaning given in (29b) is similar to the meaning assigned to positive gradable adjectives such as good in English by many semantic accounts.

(29) a. \[ \{ [\sqrt{\text{nall} + \varnothing_{\text{v.poss}}}]_v + \text{POS} \}_v \cdot a \}_{\text{rel}} \] (Class 1)

Lit. ‘having an instance of goodness measuring to a degree that exceeds the standard’

b. \[ \{ \text{nalla} \} = \lambda x. \exists d \exists y \text{ [y is an instance of goodness and x has y and } \mu(y) \geq d \text{ and } d > d_s] \]

\[ \approx \lambda x. \exists d \text{ [x’s goodness } \geq d \text{ and } d > d_s] \]

⁴ We put aside complications about comparison classes.
4.2 Class 2 roots

The modified semantics of the n head that categorizes Class 2 forms, and spells out as –am, is as in (30): it turns the abstract property into a measured instance of the property. POS (as in (26)) can apply next, saturating the degree argument, or alternatively, a measure phrase can, (31).

\[(30) \quad \llbracket -am \rrbracket = \lambda n. \lambda \phi. \lambda x [x \text{ is an instance of } \phi \text{ and } \mu(x) \geq d] \]

\[(31) \quad \text{Anil}\text{-DAT} \quad \text{muunu ati pokkam un}\text{-COP} \]
\[\text{‘Anil is three feet tall.’ (lit. ‘To Anil there is three feet tallness.’)}\]

The degree argument can also be bound by an existential degree quantifier, without norm-related semantics (unlike the case of Class 1 forms, where, in the absence of a measure phrase, POS has to bind the degree argument).

\[(32) \quad \text{ente pokkam}\]
\[\text{me.GEN tallness} \]
\[\text{‘my height’ (no implication of the height exceeding the relevant standard)}\]

The structure of Class 2 forms is in (33). Class 2 nouns denote predicates of individuals that are instances of \(\phi\), in contrast to Class 1 forms, which are predicates of individuals that possess instances of \(\phi\).

\[(33) \quad \text{a. } \llbracket \sqrt[pokk]{am} + n \rrbracket + \text{POS} \]
\[\text{Lit. ‘being an instance of tallness measuring to a degree that exceeds the standard’} \]
\[\text{b. } \llbracket pokk \rrbracket = \lambda x \exists d [x \text{ is an instance of tallness and } \mu(x) \geq d \text{ and } d > d_s] \]

\[(34) \quad \text{a. } \llbracket \sqrt[pokk]{am} + n \rrbracket + \exists D \]
\[\text{Lit. ‘being an instance of tallness measuring to some degree’} \]
\[\text{b. } \llbracket pokk \rrbracket = \lambda x \exists d [x \text{ is an instance of tallness and } \mu(x) \geq d]\]

The forms in (33) and (34) can be the complement to a finite or non-finite EX copula. The individual argument is existentially closed off, as in regular possessive/existential predication.

4.3 Asymmetry in comparison

We expect the different syntax of Class 1 and Class 2 forms to extend to comparatives as well. We don’t offer here a detailed account of comparatives in Malayalam, but we note an asymmetry: the comparative marker kuuṭṭutal ‘more’ has a variable distribution with NPs and
with property concept lexemes of the two classes, in both predicative and attributive positions.\(^5\) Specifically, \textit{kuuTuttal} ‘more’ is obligatory with NP comparatives, see (35); it is disallowed with Class 1 forms, see (36)-(37); and it is optional with Class 2 forms, see (38)-(39), (40). The generalization holds whether the Class 1 and Class 2 forms are predicative or attributive, as the examples below show.

(35) a. anil komalan-e \textit{kaaf-um} *(\textit{kuuTuttal}) pazham kazhicc-u (NP)  
   Anil Komalan-ACC than-UM more bananas eat-PAST  
   ‘Anil ate more bananas than Komalan.’
   b. \(\ldots\)*(\textit{kuuTuttal}) vel\[am ku\[icc\]u ‘… drank more water’
   c. \(\ldots\)*(\textit{kuuTuttal}) kaatu vizhingi ‘… swallowed more air’
   d. \(\ldots\)*(\textit{kuuTuttal}) sneham labhičcu ‘… got more love’

(36) a. anil komalan-e \textit{kaaf-um} *(\textit{kuuTuttal}) nalla-van aan\[ə (Class 1)
   Anil Komalan-ACC than-UM more good-M.SG EQ.COP  
   ‘Anil is better than Komalan’ (lit. ‘Anil is one having goodness than Komalan.’)
   b. \(\ldots\) *(\textit{kuuTuttal}) valiya-van ‘… more big’
   c. \(\ldots\) *(\textit{kuuTuttal}) ceriya-van ‘… more small’

(37) Anil komalan-e \textit{kaalum} nalla vidhyarhi aan\[ə (Class 1)  
   Anil komalan-ACC than-UM good student EQ.COP  
   ‘Anil is a better student than Komalan’  
   (Lit. ‘Anil is a student having goodness than Komalan.’)

(38) a. Anil-in\[ə Komalan-e \textit{kaal-um} \textit{(kuuTuttal)} pokkam un\[ə (Class 2)
   Anil-DAT Komalan-ACC than-UM more tallness EX.COP  
   ‘Anil is taller than Komalan’ (lit. ‘To Anil there is (more) tallness than to Komalan.’)
   b. \(\ldots\) \textit{(kuuTuttal)} madhuram un\[ə ‘… more sweetness’
   c. \(\ldots\) \textit{(kuuTuttal)} santhosham un\[ə ‘… more happiness’

(39) Anil Komalan-e \textit{kaal-um} \textit{(kuuTuttal)} pokkam u[l\[a-van aan\[ə (Class 2)
   Anil Komalan-ACC than-UM more tallness having-M.SG EQ.COP  
   ‘Anil is taller than Komalan.’ (lit. ‘Anil is more tallness having than Komalan.’)
   b. \(\ldots\) \textit{(kuuTuttal)} madhuram u[l\[a-van aan\[ə ‘… more sweetness’
   c. \(\ldots\) \textit{(kuuTuttal)} santhosham u[l\[a-van aan\[ə ‘… more happiness’

(40) Anil Komalan-e \textit{kaal-um} \textit{(kuuTuttal)} pokkam u[l\[a vidhyarhi aan\[ə (Class 2)
   Anil Komalan-ACC than-UM more tallness having student EQ.COP  
   ‘Anil is a taller student than Komalan.’  
   (Lit. ‘Anil is a more tallness having student than Komalan.’)

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\(^5\) There is dialectal variation in the use of the comparison marker, between speakers from North Malabar and South Kerala. \textit{adhikam} ‘excess’ (from the Sanskrit \textit{adhik}) or \textit{othiri} ‘a lot’ can be used instead of \textit{kuuTuttal}.
The comparative marker kuṭuttal should properly be treated as a comparative marker rather than a positive form of a degree adverbial ‘many’/‘much’. It is only used in comparatives, it cannot appear with positive forms.

One possible analysis of the comparative facts is that Class 1 forms are relative clauses in attributive position and light headed relatives in predicative position, and thus cannot combine with kuṭuttal, whether it is nominal in nature (e.g., properly translated as ‘excess’) or adverbial (i.e., ‘more’, ‘in excess’). However, the acceptability of kuṭuttal with Class 2 forms, e.g., (39), suggests that there must be another position for kuṭuttal to merge, so the syntactic explanation is likely not the right one. A more likely line of explanation is that Class 1 forms allow only POS and measure phrases to saturate the degree variable. Indeed, Class 1 comparatives are norm-related.

Although Class 2 forms are nominal they differ from regular NPs in that they have a degree argument. The degree argument can be saturated by an optional more or by POS; either can apply in either attributive or predicative position. As expected, unlike Class 1 comparatives, Class 2 comparatives are not norm-related. Regular NPs, on the other hand, do not have degree arguments. A degree-introducing determiner is needed, and kuṭuttal, which contains a ‘many’/‘much’ measure determiner, fulfills this role. Thus, kuṭuttal is always necessary with NP comparatives.

We leave the actual account of comparison with property concept denoting expressions in Malayalam for another occasion. It suffices to say here that the facts presented above suggest that kuṭuttal is not the sole element that introduces comparative semantics – if it was it would be obligatory in all comparatives, yet it is optional with Class 2 forms and Class 1 forms prohibit it altogether. Rather, the facts of Malayalam suggest that kaal-um ‘than’ is not semantically vacuous but in fact encodes a comparative meaning, working in tandem with kuṭuttal ‘more’ when it is overtly present. (cf. Alrenga, Kennedy & Merchant 2012, and Schwarzschild to appear, on attributing a role to than in comparative semantics).

5. Summary and conclusions

We give below an updated summary of the structures for positive Class 1 and Class 2 forms, incorporating scalarity. The conclusion remains the same as before: the two classes of property concept roots participate in different structures, but both start with, and end with, the same meaning.

(41) Class 1: native roots

    a. \[[[vP \sqrt{1} + \varnothing_{v,pos} + POS ] + a_{rel}] \]
    ‘having an instance of \(\Pi\) that exceeds the standard’
    (attributive)

    b. \[[[DP [[[vP \sqrt{1} + \varnothing_{v,pos} ] + POS ] + a_{rel}] pron ] EQ.COP ] \]
    ‘be someone having an instance of \(\Pi\) that exceeds the standard’
    (predicative)
We demonstrated that in Malayalam, a language that does not have a category of adjectives, adjective-like meanings for attributive modification and predication are expressed by complex structures built from roots denoting property concepts. Our main contribution, apart from the detailed analysis of the attributive and predicative structures, is in suggesting that (i) possession, either covert or overt, is the basis for encoding property concept predication; (ii) property concepts universally lexicalize as roots, and they denote substance-like individuals, requiring possessive predication; (iii) variation in property concept predication is rooted in the morpho-syntax and semantics of the functional vocabulary that categorizes property concept roots; (iv) adjectives, in the languages that have them, are likely syntactically derived categories that too use a possessive strategy of predication, a covert one.

References


Revisiting *again*: The view from Kutchi Gujarati

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Abstract:

This paper discusses the interpretive behaviour of Kutchi Gujarati *pacho* ‘again’. It puts the Kutchi Gujarati facts in perspective with previous semantic analyses of *AGAIN* in other languages, in particular English, but also older varieties of English and German. We argue that the two predominant and competing semantic analyses of *AGAIN* both apply simultaneously to Kutchi Gujarathi *pacho* in order to account for the range of readings it gives rise to.

Keywords: *again*, repetitive, restitutive, counterdirectional readings, Kutchi Gujarati

1. Introduction

There is a considerable amount of semantic research on the English adverb *again* and its cross-linguistic counterparts (cf. McCawley (1968), Dowty (1979), von Stechow (1996), Fabricius-Hansen (2001), Jäger & Blutner (2000), Beck (2005), Gergel & Beck (to appear), among many others). Much of it is inspired by an interesting ambiguity that sentences with *AGAIN* give rise to (we use small caps to indicate that we are referring to English *again* as well as its counterparts in other languages). An example of the ambiguity is given in (1), which has the two readings in (1’), a so-called ‘repetitive’ reading and a so-called ‘restitutive’ or ‘counterdirectional’ reading. In (2) we provide contexts in which the sentence on the two readings can be used; (2a) is a context that gives rise to the reading in (1’a), and (2b) is a context that gives rise to the reading in (1’b).

(1) Leo jumped up again.

(1’) a. Leo jumped up, and he had done that before. *repetitive*
b. Leo jumped up, and he had been up before. *restitutive/counterdir.*

(2) a. The bell rang, and Leo jumped up. [...] A knock came on the door, and he jumped up again.
b. Leo slowly sat down in his favourite armchair. A knock came on the door, and he jumped up again.

More detailed paraphrases of the two readings that are stated in (1’) are given in (3). Note that (1’b) conflates two readings that are stated separately in (3b) and (3c). In (3b), the *jumping up* event is preceded by an event in the opposite direction (i.e. by a *sitting down* event); in (3c), no such ‘counterdirectional’ event is, strictly speaking, presupposed.

(3) a. (1) presupposes that Leo had *jumped up* before. *repetitive*

    If that is the case, (1) asserts that Leo jumped up.
b. (1) presupposes that Leo had \textit{sat down} before. \textit{counterdirectional}
   If that is the case, (1) asserts that Leo jumped up.

c. (1) presupposes that Leo had \textit{been up} before. \textit{restitutive}
   If that is the case, (1) asserts that Leo jumped up.

It is uncontroversial that \textit{again} has a repetitive reading, (1’a), adding the presupposition that what is described in the sentence has occurred before. The second, non-repetitive reading, (1’b), is generally referred to as the restitutive/counterdirectional reading, because the two types of analysis available for this reading are different in terms of how they characterise it: There is a lexical ambiguity analysis, represented by Fabricius-Hansen (2001), according to which \textit{again} has two meanings, a repetitive meaning, (3a), and a counterdirectional meaning, (3b). The latter adds the presupposition that earlier, the reverse of what is described in the sentence has occurred. The alternative approach, known as the \textit{structural ambiguity analysis} (cf. von Stechow (1996)), argues that there is only repetitive \textit{again}, but it can modify different constituents in the structure: either the predicate as a whole is repeated, or only its result state is restored, cf. (3c).

The two analyses, the lexical ambiguity analysis and the structural ambiguity analysis are usually seen as competitors, and arguments are brought forth favouring one analysis over the other (cf. also Jäger & Blutner (2000), von Stechow (2003), Beck (2005)). In this paper, we argue that both analyses must apply simultaneously in Kutchi Gujarati, an Indo-Aryan language. We show that sentences with Kutchi Gujarathi \textit{pacho} ‘again’ permits more readings than Present Day English \textit{again}, which can only be understood with the richer inventory of interpretive possibilities that the combination of both theories gives us.

In section 2 we introduce the semantic background: the two theories of \textit{AGAIN} as well as some core arguments brought forth in the debate surrounding them. Kutchi Gujarati and its variant of \textit{AGAIN}, \textit{pacho}, are introduced in section 3. We show that a reading that is strictly speaking counterdirectional can be distinguished truth-conditionally from a restitutive reading proper, given the right kind of predicate. On the basis of the empirical scope, we argue that both analyses are needed. We introduce a tentative analysis regarding the compositional interpretation of \textit{pacho}. Section 4 introduces further issues to be considered in this discussion, in particular, further readings of \textit{pacho} and word order effects in Kutchi Gujarati that relate to \textit{pacho}. Conclusions and consequences are presented in section 5.

2. Semantic background

In this section, we first summarize the lexical theory (subsection 2.1) and then the structural theory (subsection 2.2). Subsection 2.3 explains why two such different theories are both plausible, given that they end up describing the same overall situations. Then we turn to some of the more indirect arguments brought forth for one theory over the other (subsections 2.4 and 2.5), which will play a role for our discussion of Kutchi in section 3.

2.1. The lexical ambiguity theory

Fabricius-Hansen (2001) is the representative of the lexical ambiguity theory that we discuss here. The basic idea is that in addition to an adverb \textit{again} with a repetitive reading, there is an
adverb *again* with a counterdirectional reading. This causes the ambiguity in (4), repeated from above.

(4)  

a. Leo jumped up again.

b. (4a) presupposes that Leo had **jumped up** before.  
   *repetitive reading*  
   If that is the case, (4a) asserts that Leo jumped up.

c. (4a) presupposes that Leo had **sat down** before.  
   *counterdir. reading*  
   If that is the case, (4a) asserts that Leo jumped up.

Example (5) specifies a lexical entry for repetitive *again* (we use a Heim & Kratzer (1998) style framework and representation throughout). The adverb is a modifier of a property of events, type <v,t>, and it is adjoined to VP, which denotes a property of events. Furthermore, it adds the presupposition that the property is true of an earlier event. (6) illustrates application of the lexical entry to our example. Details aside, this reading and its derivation are essentially uncontroversial.

(5) \[[\text{\textit{again}_{rep}}]\] = \(\lambda P . \lambda e : \exists e' [e' < e \& P(e')]. P(e)\)

"Such an event has happened before."

(6)  

a. \([\text{VP} [\text{VP} \text{Leo jump up}] \text{again}_{rep}]\]

b. \([[[\text{VP} \text{Leo jump up}]]] = \lambda e . \text{jump}_\text{up}(e)(L)\)

c. \([[[\text{VP} [\text{VP} \text{Leo jump up}] \text{again}_{rep}]]] = \lambda e : \exists e' [e' < e \& \text{jump}_\text{up}(e')(L)]. \text{jump}_\text{up}(e)(L)\)

"Once more, Leo jumped up."

In (7), we provide a parallel lexical entry for *AGAIN* on its other, counterdirectional reading. This also modifies a property of events, however it differs from the lexical entry in (5) in that it adds the presupposition that the counterdirectional property \(P_c\) is true of an earlier event. As before, this adverb modifies a VP, as shown for our example in (8).

(7) \[[\text{\textit{again}_{ctrdir}}]\] = \(\lambda P . \lambda e : \exists e' [e' < e \& P_c(e')]. P(e)\)

"An event of the opposite kind has happened before."

(8)  

a. \([\text{VP} [\text{VP} \text{Leo jump up}] \text{again}_{ctrdir}]\]

b. \([[[\text{VP} \text{Leo jump up}]]] = \lambda e . \text{jump}_\text{up}(e)(L)\)

c. \([[[\text{VP} [\text{VP} \text{Leo jump up}] \text{again}_{ctrdir}]]] = \lambda e : \exists e' [e' < e \& \text{sit}_\text{down}(e')(L)]. \text{jump}_\text{up}(e)(L)\)

"Leo jumped back up."

In a nutshell, according to this theory, the ambiguity arises because *again* is lexically ambiguous, i.e. there are two distinct lexical entries for *AGAIN*. The lexical ambiguity theory predicts that an ambiguity arises whenever a predicate is modified that makes a counterdirectional predicate accessible (cf. *fall* vs. *rise*, *open* vs. *close*, *leave* vs. *return*, ...).
2.2. The structural ambiguity theory

The competing, structural analysis of the ambiguity, which has von Stechow (1996) as a core representative, denies that again is lexically ambiguous. According to this analysis, both readings of the sentence in (1), repeated in (9), are to be understood as repetitions. According to the first reading, the entire content of the sentence is repeated. According to the second reading, only the result state is repeated. Thus, there is only one lexical entry for again, namely the one in (5), repeated in (10).

(9) a. Leo jumped up again.

b. (9a) presupposes that Leo had jumped up before.  repetitive reading
   If that is the case, (9a) asserts that Leo jumped up.

c. (9a) presupposes that Leo had been up before.  restitutive reading
   If that is the case, (9a) asserts that Leo jumped up.

(10) \[[again_{rep}]\] = \(\lambda P . \lambda e : \exists e'[e' < e & P(e')] \cdot P(e)\)
   “Such an event has happened before.”

The idea in a structural ambiguity theory is that the adverb in (10) can modify different constituents in the clausal structure. In order to understand how this is possible, we have to see predicates like jump up as internally complex. They consist of an activity part (‘jump’) and a result state (‘Leo is up’), where the former causes the latter to come about. This semantic complexity is assumed to be represented in the syntax. An analysis in those terms is sketched in (11) (based on von Stechow (1996), Beck (2005)).

(11) a. \[\text{VP} \quad \text{Leo jump} \quad \text{[SC PRO}_{\text{Leo}} \quad \text{up}]\]
   \[\quad \text{activity (causes) result state}\]

b. \[\text{[[(11a)]]} = \lambda e . \text{jump}(e)(L) & \exists e'[\text{CAUSE}(e')(e) & \text{BECOME}(e')(\lambda e''. \text{up}(e'')(L))]\]
   “Leo’s jumping causes Leo to come to be up.”

Now it is easy to see, as sketched in (12), that an again modifying the whole VP will give rise to the repetitive reading, while an again modifying the result state will give rise to the restitutive reading, even though the only lexical entry for again is the repetitive one in (10).

(12) \[\text{VP V}_{\text{action}} \quad \text{causes} \quad \text{[SC result state]}\]
   \[\quad \text{repetitive again} \quad \text{restitutive again}\]

This is demonstrated in (13) and (14) for the example at hand.
In short, the ambiguity comes about according to this theory because (and whenever) again can modify two different constituents in the structure. From the perspective of the structural ambiguity theory, the ambiguity should depend on structural and semantic factors, namely on the accessibility of a sub-constituent that denotes the result state; i.e. this ambiguity should only arise with an achievement or accomplishment predicate.

2.3. Indistinguishable truth conditions

Although the intuitive ideas behind the two theories are quite different, and so are the resulting paraphrases for the truth conditions of the restitutive/counterdirectional reading, it is important to note that they will overwhelmingly describe the same situations. Sticking with example (1), consider the situation depicted in (15).

(15)   ......///////////////---------------------------//////////////////////----------->
         Leo up | Leo not up | Leo up
         Leo sits down  Leo jumps up

If there is a sitting down by Leo followed by a jumping up by Leo, then the overall situation contains a repetition: Leo has to have been up in the beginning, and he is up in the end. Conversely, if there is a jumping up by Leo, and earlier Leo had been up, then in between he has to have sat down (or undergone some alternative downward movement). Presuppositional and assertional content together with the inferences they support, amount to the same set of possible situations in which (1) is true for both analyses. The same is true for most predicates that are usually considered in connection with the repetitive/restitutive ambiguity. Consider e.g. (16) and its readings in (17):

(16)   Otto opened the door again.

(17) a.   Otto opened the door, and that has happened before.   (repetitive)
       b’.  Otto opened the door, and the door had closed before.   (counterdirectional)
       b”.  Otto opened the door, and the door had been open before.   (restitutive)

An overall situation that makes the counterdirectional reading true will make the restitutive reading true as well, and vice versa. Those are the situations informally depicted in (18).
The two theories are thus hard to distinguish in terms of predictions about truth conditions. More subtle arguments in favour of one theory over the other are generally discussed in the literature, and we present two such arguments below. We limit ourselves to those arguments that have a bearing on the discussion of Kutchi Gujarati in section 3.

2.4. A word order argument in favour of the structural theory

Von Stechow (1996) presents a word order argument in support of the structural ambiguity theory, based on the German data in (19)-(20); as indicated, (19) is ambiguous, whereas (20) only has the repetitive reading, (21a) and lacks a restitutive/counterdirectional reading, (21b).

(19) ... weil Ottilie die Tür wieder öffnete.  
... because Ottilie the door again opened  
‘... because Ottilie opened the door again.’  
(repetitive, rest./ctrdir.)

(20) ... weil Ottilie wieder die Tür öffnete.  
... because Ottilie again the door opened  
‘... because again, Ottilie opened the door.’  
(rep. only)

(21) a. Once more, Ottilie brought it about that the door was open.  
(b. Ottilie brought it about that the door was once more open.  
(repetitive)  
(rest./ctrdir.)

Von Stechow makes the following observations. When wieder ‘again’ follows the direct object, (19), both a repetitive and a counterdirectional/restitutive reading are possible. When wieder precedes the direct object, (20), only a repetitive reading is possible. Now, observe that for the structural theory, restitutive AGAIN modifies a smaller constituent than repetitive AGAIN. Restitutive AGAIN needs to look inside a predicate and combine with just the result-state-denoting constituent (a small clause SC in the structures that we provided). It seems that when AGAIN is as high in the surface structure as in (20), this is no longer possible, and only a repetitive reading is available. Von Stechow accounts for the data follows. He suggests that the direct object moves obligatorily to a fairly high position in the overt syntax, say, SpecAgrOP. When wieder follows the direct object, it can either be in a VP adjoined position or it can adjoin to the SC, as shown in (22a). In this case, both readings are possible. By contrast, when wieder precedes the direct object, it is higher in the structure than VP, and hence too high to give rise to a result state modifying reading. In this case, only the repetitive reading is possible. The relevant structure is given in (22b). Note that it is a built-in feature of the structural theory that only a repetitive reading can arise when AGAIN is high in the structure. The restitutive reading requires a low position for AGAIN.

(22) a. [ Ottilie [AgrOP [die Tür] [vP (wieder) [vP ∅ [SC (wieder) [SC offen]]]]]]

b. [ Ottilie [AgrOP wieder [AgrOP [die Tür] [vP ∅ [SC offen]]]]]
It is not clear that syntactic factors should play a role for the lexical ambiguity analysis, since its ingredients are lexical (two meanings for \textit{Again}) and conceptual (requiring a predicate that makes accessible a counterdirectional predicate). The German facts look like a better fit for the structural theory because that theory generally leads us to expect an influence of structural factors on the ambiguity, and specifically German \textit{wieder} ‘again’ seems to be able to be restitutive only if it is overtly low in the structure, as the structural theory predicts.

2.5. An argument from directional predicates in favour of the lexical theory

In contrast to von Stechow’s argument (presented above), an argument for counterdirectionality can be gleaned from data for which an analysis in terms of a result state is implausible. Note, however, that new arguments for the lexical theory have been based on the insight that the two theories impose different requirements on the predicate in order for the ambiguity to arise. The structural theory requires that there is a result state as a proper part of the composition of the predicate, whose repetition the adverb \textit{Again} can require. The lexical theory requires no result state, but instead that the predicate contains a direction that can be reversed. Fabricius-Hansen’s well-known \textit{fall/rise} example, in (23), attempted to make this point, based on the idea that there is no result state for \textit{fall}. However, this example was countered by von Stechow, who argues that (24a) should be given an analysis along the lines of (24b), where \textit{fall} has the result state \textit{be lower}.

\begin{enumerate}
  \item The temperature was rising all morning, but now it is falling again.
  \item a. The temperature fell again.
  \item b. The temperature became [\textit{sc} lower again].
\end{enumerate}

\begin{enumerate}
  \item Gergel & Beck’s (to appear) recent investigation of diachronic English corpora unearthed some predicates combined with \textit{Again} that differentiate between the two theories, in favour of the lexical theory. Among other relevant examples, Gergel & Beck found the following uses in Middle English (ME) and Early Modern English (EModE). This is illustrated by the data in (25a-c), which are simplified versions of Gergel & Beck’s examples.
  \item a. I talked \textit{again} to them.
    \begin{itemize}
      \item EModE: ‘I answered them. / I talked back to them.’
      \item b. She wrote \textit{again} to him.
    \end{itemize}
  \item b. \textit{Again} above all other ladies.
    \begin{itemize}
      \item ME: ‘He returned the queen \textit{again} above all other ladies.
    \end{itemize}
\end{enumerate}

In (25a), the predicate can be classified as an activity according to all the usual criteria, cf. (26b-c), which show that \textit{talk to Darcy} can be modified by \textit{for X} and not by \textit{in X}, and that the progressive \textit{was talking to Darcy} entails the simple past \textit{talked to Darcy}; there is thus no result state involved in its composition, and nothing for \textit{Again} to modify in order to produce a restitutive reading. The intended reading in (25a) is however easily understood in terms of counterdirectionality, as the paraphrase with \textit{back} indicates.
(26) no change of state in (25a) (activity predicate):
   
   a. Lizzy talked to Darcy.
   b. Lizzy talked to Darcy for an hour / #in an hour.
   c. Lizzy was talking to Darcy. \(\Rightarrow\) Lizzy talked to Darcy.

A predicate like write in (25b), on the other hand, can be seen as an accomplishment; a corresponding paraphrase is given in (27a). However, the result state of the creation verb write, namely ‘a message exists’, is not useful in describing the intended reading of AGAIN (see Beck & Johnson (2004) on AGAIN with creation verbs). The intended reading is once more understood in terms of counterdirectionality.

(27) change of state, but plausible result state not helpful in explaining (25b):
   
   a. She wrote to him.  
   = Her writing caused a message to him to come into existence.
   b. She wrote again to him.  
   ≠ Her writing caused a message to him to once more come into existence.

Gergel & Beck conclude that earlier stages of English had counterdirectional AGAIN, and that counterdirectional AGAIN can be distinguished from restitutive AGAIN semantically at least for some predicates. Since the readings in (25) are no longer possible in Present Day English (PDE; see also Schöller (2013)), they furthermore conclude that PDE again no longer has a counterdirectional reading. Accordingly, the structural theory has to apply in English today. Nevertheless, the findings of Gergel & Beck constitute an argument in favour of the lexical ambiguity theory in principle: a counterdirectional AGAIN in the spirit of lexical ambiguity must have been available in earlier stages of English, even if the lexical ambiguity theory does not apply to Present Day English.

### 2.6. Section summary

Two competing analyses of the ambiguity of (1) and similar data exist: one in terms of a lexically ambiguous adverb, the other in terms of structural ambiguity inside the predicate. Compelling arguments have been brought forth for either theory. While they are generally perceived as competitors, Gergel & Beck propose to reconcile them over time. Their evidence is a diachronic analysis of AGAIN in various stages of English. Kutchi Gujarati, discussed in the next section, allows us to make a much more direct argument, to similar effect.

### 3. Kutchi Gujarati AGAIN

Subsection 3.1 provides some general background on Kutchi Gujarati. Next, in subsection 3.2, we establish the Kutchi Gujarati adverb pacho as a member of the family of AGAIN adverbs. Subsection 3.3 is dedicated to non-repetitive readings of pacho and will provide the crucial data in this paper. The analysis is given in 3.4, followed by a section summary.
3.1. Background on Kutchi Gujarati

Kutchi Gujarati is an Indo-Aryan language spoken in the Kutch district of the Gujarat state in North-West India. On a par with Marwari, Gujarati is generally assumed (cf. Tessitori 1913, 1914-16) to have evolved from Old Western Rajasthani (spoken approximately between 1000 CE and 1500 CE). Kutchi Gujarati transitive clauses exhibit a split agreement pattern triggered by aspect: in the imperfective, the verb agrees with the transitive subject, (28a), in the perfective it agrees with the transitive object, (28b). (In intransitives, (29), the verb always agrees with the subject.) Notably, as in Marwari (and in dialects of Italian, cf. D’Alessandro 2011), adverbs like pacho ‘again’ and velo ‘early’ also share the verbal agreement for gender and number (pacho ‘m.sg’, pachi ‘f.sg’, pachu ‘n.sg’, pacha ‘pl’), as shown in (29).

(28) a. Raj Maya-ne jo-t-o. / Maya Raj-ne jo-t-i.
   Raj Maya-acc see-ipfv-m / Maya Raj-acc see-ipfv-f
   ‘Raj used to watch Maya.’ ‘Maya used to watch Raj.’

b. Raj Maya-ne jo-i. / Maya Raj-ne jo-y-o.
   Raj Maya-acc see-pfv.f / Maya Raj-acc see-pfv-m
   ‘Raj saw Maya.’ ‘Maya saw Raj.’

(29) a. Ryan pach-o nach-y-o. / Maya pach-i nach-i.
   Ryan again-m dance-pfv-m / Maya again-f dance-pfv.f
   ‘Ryan danced again.’ ‘Maya danced again.’

b. Ryan vel-o nach-y-o. / Maya vel-i nach-i.
   Ryan early-m dance-pfv-m / Maya early-f dance-pfv.f
   ‘Ryan danced early.’ ‘Maya danced early.’

3.2. Basics: pacho is a repetitive adverb in the AGAIN family

We investigate Kutchi Gujarati pacho as the counterpart of English again. In (30)-(33), we begin with some basic examples, in which the predicate is an (undirected) activity, like dance in (30), or a state, like be in Bhuj in (31), so ambiguity plays no role in these examples.

(30) Valji pacho nachyo.
    Valji again danced
    ‘Valji danced again.’

(31) John Bhuj-ma pacho che.
    John Bhuj-in again is
    ‘John is in Bhuj again.’

As gloss and translation indicate, pacho serves to indicate repetition, just like again in the same sentences. Also, just like again, pacho’s contribution is presuppositional. The question in (32) is only appropriate if John was in Bhuj earlier; it inquires if John is in Bhuj now.
(32) John Bhuj-ma pacho che?
   John Bhuj-in again is ‘Is John in Bhuj again?’ (presupposes: John has been in Bhuj before.)

Similarly, (33) is only appropriate if John was in Bhuj earlier. It asserts that John is not in Bhuj now. Thus pacho can be viewed as the counterpart of again in Kutchi Gujarati.

(33) John pacho Bhuj-ma nathi.
   John again Bhuj-in is.not ‘John is not in Bhuj again.’ (presupposes: John has been in Bhuj before.)

3.3. Non-repetitive readings of pacho

In this subsection, we test if other readings besides the repetitive reading are possible (as in the case of English again and German wieder). We begin with an example inspired by the predicates from Gergel & Beck (to appear). The acceptability of (34a) in the context described in (35a) shows that a counterdirectional reading is available for pacho.

(34) a. Valji pachi baiman-ne phone kari only counterdirectional
   Valji again woman-acc phone did
   Lit.: ‘Valji phoned the woman again.’

b. Valji baiman-ne pachi phone kari only repetitive
   Valji woman-acc again phone did

(35) a. Counterdirectional reading:
   A woman phoned Valji and left a message for him. He does not know the woman
   or her number. Valji phoned the woman back.

b. Repetitive reading:
   Valji phoned a woman, but could not reach her. Valji phoned the woman again.

The predicate phone is similar to talk to in (25a). The combination with pacho allows two different readings, a counterdirectional reading, (35a), in addition to the expected repetitive reading, (35b). Interestingly, word order disambiguates in Kutchi Gujarati, as shown in (34a) vs (34b). We discuss word order effects in more detail in section 4.

In the following examples, we present pacho in combination with a predicate that allows us to see whether in addition to a counterdirectional reading a distinct restitutive reading is possible; our findings are affirmative. The predicate is ‘write a letter’ (inspired once more by the diachronic example ‘she wrote again to him’ in (25b)). Let us first take a closer look at English, in (36)-(37). The PDE example in (36) clearly has a repetitive reading, in (37a). In contrast to earlier stages of English, as in (25b), a counterdirectional reading is not accepted, cf. (37b). But note: the predicate is one that makes a result state available, namely that there is a letter in his possession, (37c). This reading differs from the counterdirectional reading; cf. Beck & Johnson (2004) for restitutive readings with creation verbs and double-object verbs.

(36) She wrote him a letter again.
(37) a. Once more, she wrote him a letter. (repetitive)
   b. #He had written to her, and she wrote a letter back to him. (counterdir.)
   c. Her writing caused him to come to once more have a letter. (restitutive)

The PDE example in (36) is two-way ambiguous, allowing for the readings in (37a) and (37b). We can now ask: What about Kutchi Gujarati? Remember that word order plays a role for the available interpretations. We can thus construct the three contexts in (38b-d) for a translation of English (38a), and test examples such as (39) and (40) in these contexts.

(38) a. ‘Valji wrote Maya a letter again.’
   
   b. **Context 1** (verifies repetitive PSP):
      Valji and Maya have been pen pals for years. They write to each other almost every week.
   
   c. **Context 2** (verifies counterdirectional PSP only):
      Maya met Valji at a film festival last week. She was very attracted to him. After hesitating for a few days, she wrote him a letter. Valji got it on Wednesday.
   
   d. **Context 3** (verifies restitutive PSP only):
      Maya is Valji’s little sister. Yesterday, she was playing post office. She used a letter from Aunt Odilia for her game, pretending to be sending it or receiving it all day long. But then she accidentally dropped the letter into the fire and it was destroyed. Maya was very disappointed.

What we find is that (39) is accepted in the contexts (38c) and (38d), i.e. it has a restitutive and a counterdirectional reading. In contrast, (40) is only acceptable in the context in (38c), i.e. it only has a counterdirectional reading. This tells us two things: (i) the two readings are truth-conditionally distinct for this predicate, and (ii) both readings exist in Kutchi Gujarati, in addition to the vanilla repetitive reading.

(39) **paacho** Valji Maya-ne kagar lakhyo. (**restitutive or ctrdir.**)
    
    again Valji Maya-Dat letter wrote
    ‘Valji wrote another letter for Maya.’ (= he brought one into existence again)
    ‘Valji wrote a letter to Maya in return.’ (= he wrote back)
    \[\Rightarrow \text{acceptable in Context 2, and acceptable in Context 3}\]

(40) Valji **paacho** Maya-ne kagar lakhyo. (**counterdirectional**)
    
    Valji again Maya-Dat letter wrote
    ‘Valji wrote a letter to Maya in return.’ (= he wrote back)
    \[\Rightarrow \text{acceptable in Context 2, but not acceptable in Context 3}\]

In addition to examples like ‘write a letter’, we can look at a creation predicate that does not make a directional interpretation plausible, such as ‘bake a cake’. By doing so, in example (41), we gather further evidence for the restitutive interpretation. Another example, in (42), which is adapted from Beck & Johnson (2004), corroborates the same observation; the idea...
here is that the original flag would not have been crocheted, so it is really just the result state ‘Pat has a flag’ that is repeated, as opposed to the event of crocheting it.

(41) a. pacho john cake banavyo (restitutive) again John cake baked ‘John baked a cake again.’

b. restitutive context:
John came into a temple. There was a cake on the table. He thought it was a prop and put his finger in it. The cake was destroyed. John baked a cake again.

(42) a. pachu Sandy Pat-maate dhaja kotar-y-u again Sandy Pat-for flag crochet-pfv-n ‘Sandy crocheted a flag for Pat again.’

b. restitutive context:
Pat has a tree house, which she loves. It had a flag, but last week’s storm tore the flag off and destroyed it. Pat was very sad. But then her neighbour Sandy crocheted Pat a flag again.

We conclude that Kutchi Gujarati pacho permits a repetitive reading, a counterdirectional reading and a restitutive reading. Before we move on to an analysis, note that in many examples, the latter two may be indistinguishable truth-conditionally (cf. section 2.3), e.g. in (43) below. In Kutchi Gujarati (just like in ME and EModE, but not PDE), this example would contain a vacuous ambiguity (the restitutive and counterdirectional analyses that lead to the same overall meaning).

(43) a. pacho Reena dharvajo kolyo restitutive/counterdirectional ? again Reena door opened.

b. Reena pacho dharvajo kolyo restitutive/counterdirectional ? Reena again door opened

c. Reena dharvajo pacho kolyo repetitive only Reena door again opened.

We will come back to this point when we discuss the effect of word order in section 4.

3.4. Analysis of basic data

In order to account for purely counterdirectional interpretations (e.g. with verbs like phone), Kutchi Gujarati must have a repetitive as well as a counterdirectional lexical entry for pacho, (44) and (45). That is, the lexical ambiguity analysis applies in this language.

(44) $$[[\text{pacho}_{rep}]] = \lambda P . \lambda e : \exists e' [e' < e \land P(e')] . P(e)$$
“Such an event has happened before.”

(45) $$[[\text{pacho}_{indis}]] = \lambda P . \lambda e : \exists e' [e' < e \land P_c(e')] . P(e)$$
“An event of the opposite kind has happened before.”
However, in order to account for the distinct restitutive reading as well (with predicates like *bake a cake, crochet a flag or write a letter*), the structural ambiguity analysis must also apply. That is, repetitive *pacho*, (44), must be able to modify a result state denoting SC as well as a VP. We provide the three Logical Forms below that denote the three available readings of Kutchi Gujarati ‘Valji wrote Maya a letter again’. We follow Beck & Johnson (2004) in their analysis of the two-object verb, in which the predicate contains a SC denoting possession. The connection between the verb and the SC is mediated by a CAUSE BECOME component. See the paper of Beck & Johnson for details. The LF for restitutive *pacho* is given in (46). As indicated, we assume that the surface structure does not reflect the scope relations at LF. Since for this reading, *pacho* has to modify the result state denoting SC, but occurs higher on the surface, it has to be reconstructed at LF and adjoined to SC.

\[
\begin{align*}
\text{(46)} & \quad \text{pacho Valji Maya-ne kagar lakhyo.} \\
& \quad \text{again Valji Maya-Dat letter wrote} \\
\text{Logical Form:} & \quad [\text{VP Valji [SC pacho rep [SC Maya HAVE a letter]] lakhyo}] \\
& \quad \text{‘Valji’s writing causes Maya to come to once more have a letter.’}
\end{align*}
\]

The LF for repetitive *pacho* is given in (47). In this reading, *pacho* modifies the VP. Subject and object are raised out of VP at the surface to produce the word order that we see. We have reconstructed them in the LF for transparency.

\[
\begin{align*}
\text{(47)} & \quad \text{Valji Maya-ne pacho kagar lakhyo.} \\
& \quad \text{Valji Maya-Dat again letter wrote} \\
\text{Logical Form:} & \quad [\text{VP pacho rep [VP Valji [SC Maya HAVE a letter]] lakhyo}] \\
& \quad \text{‘Once more, Valji’s writing causes Maya to come to have a letter.’}
\end{align*}
\]

Finally, the LF for counterdirectional *pacho* is given in (48). For the counterdirectional reading, also, *pacho* modifies the VP. Here also, we assume that the subject was raised overtly (and reconstructed at LF). If we suppose, as we should for consistency’s sake, that the object has also raised to a high position, then here, too, the adverb has to be reconstructed at LF to a lower position than it occupies in the surface syntax.

\[
\begin{align*}
\text{(48)} & \quad \text{Valji pacho Maya-ne kagar lakhyo.} \\
& \quad \text{Valji again Maya-Dat letter wrote} \\
\text{Logical Form:} & \quad [\text{VP pacho modir [VP Valji [SC Maya HAVE a letter]] lakhyo}] \\
& \quad \text{‘Valji wrote Maya a letter in return.’}
\end{align*}
\]

It is obvious that surface syntax does not match the Logical Form directly in Kutchi Gujarati according to this analysis. Derivation of the above LFs requires raising of argument NPs at the surface structure on the one hand. On the other hand, and more unusually, the adverb’s surface position is also not identical to its LF position. For the restitutive and counterdirectional readings it seems to require reconstruction to a lower position. We come back to this point in section 4 when we discuss word order in more detail.
3.5. Section summary

Sentences with *pacho* can have three distinct readings. (i) States and non-directed activities (*dance, be in Bhuj*) can only have the repetitive reading. (ii) Direction predicates can also have counterdirectional readings (*phone*). (iii) Accomplishment and achievement predicates can have result state modifying (i.e. restitutive) readings. Many of the latter can have both counterdirectional and restitutive readings (*write a letter, open the door*). We show below that the availability of all three readings depends on word order. The range of readings available for sentences with Kutchi Gujarati *pacho* can only be captured if we apply both the lexical and the structural theory at the same time. This is similar to what Gergel & Beck (to appear) claim to be the case for ME and EModE.

4. Further issues

Among the directions for further research opened up by the data and analysis in section 3 are diachronic considerations addressed in subsection 4.1 and the word order issue already visible above, which is addressed in subsection 4.2.

4.1. Other readings of *pacho*

One question for further research concerns the diachronic development of *pacho*, and which of the readings (*pacho*\textsubscript{rep} / *pacho*\textsubscript{ctrdir}) emerged first. Looking at Sanskrit, we observe that Sanskrit *punar* \(\text{(punār)}\) has also been argued (in dictionaries such as Monier-Williams 1872:71-72) to have both readings. Amongst other glosses, Monier-Williams gives the glosses ‘once more’ (again\textsubscript{rep}) and ‘in an opposite direction’ (again\textsubscript{ctrdir}) for *punar*. While it is not clear that *pacho* is derived from *punar*, this suggests that the phenomenon is more widespread in Indo-Aryan. Note that both the Kutchi Gujarati stem *pach-* and Sanskrit *punar* also appear to have a temporal use, meaning ‘then’ / ‘now’ / ‘after’; however, while a historical connection seems possible, this variant does not inflect in Kutchi Gujarati, appearing as *pache* ‘then, after’, cf. (50)-(51). It is unclear whether *pache* ‘then, after’ and *pacho* ‘again’ share a common meaning component; an alternative analysis, if they can indeed be shown to be historically connected rather than homonymous.

(49) Valji Bhuj pach-o g-y-o.
Valji Bhuj again-m go-pfv-m
‘Valji went to Bhuj again.’

(50) Pache Valji Bhuj g-y-o.
then Valji Bhuj go-pfv-m
‘Then Valji went to Bhuj.’

(51) Valji Mandvi pache Bhuj g-y-o.
Valji Mandvi after Bhuj go-pfv-m
‘Valji went to Bhuj after Mandvi.’
4.2. Word order affects the available interpretations

Let us now take a closer look at which positions of pacho give rise to which readings. We begin with data involving simple predicates, for which only the repetitive interpretation is available. (52) and (53) show that pacho has to occur after the subject for the sentences to be acceptable.

(52) a. *pacho Valji nachyo.  
   again Valji danced
   Valji again danced
   ‘Valji danced again’

b. Valji pacho nachyo
   repetitive
   Valji again danced

(53) a. *pacho John Bhuj-ma che.
   again John Bhuj-in is
   John again Bhuj-in is

b. John pacho Bhuj-ma che. repetitive
   John again Bhuj-in is

c. John Bhuj-ma pacho che.
   repetitive
   John Bhuj-in again is
   ‘John is in Bhuj again’

Next, we can consider an example with a directional predicate (e.g. phone). As shown in (54), pacho has to follow the subject and precede the object for the counterdirectional interpretation, and follow the object for the repetitive interpretation.

(54) a. *pachi Valji baiman-ne phone kari
   again Valji woman-acc phone did
   Valji again woman-acc phone did

b. Valji pachi baiman-ne phone kari counterdirectional
   Valji again woman-acc phone did

This is confirmed by our three-way ambiguous example, ‘write a letter’, in (55). Here, the variants where pacho follows the subject and the (indirect) object can only be repetitive, (55c-d). A counterdirectional reading is possible when pacho precedes the object and either follows or precedes the subject, as in (55a-b). A restitutive reading is possible only when pacho precedes the subject. This is a very surprising fact, since it is the opposite behaviour from German wieder ‘again’, whose behaviour in turn is what the structural analysis leads us to expect. As a consequence, pacho cannot be interpreted in its surface position in (55a) (see section 3.4).

\footnote{It is currently unclear to us why a counterdirectional reading is possible in (55a), but not in (54a). However, the distribution of pacho seems to interact with information structure, e.g. focus placement, which may affect examples of this type in ways that are currently not fully understood.}
Some open questions remain, but we arrive at roughly the following generalizations: (i) when *pacho* follows the object we get the repetitive reading only, (ii) when *pacho* precedes the subject we get a restitutive and a counterdirectional reading, and (iii) when *pacho* follows the subject but precedes the object we get a counterdirectional reading only. With this in mind, we can take another look at example (56). Assuming that the example conforms to the above generalizations, we narrow down possible readings as follows:

(56) a. *pacho* Reena dharvajo kolyo \(\text{counterdirectional or restitutive}\) 
again Reena door opened.

b. Reena *pacho* dharvajo kolyo \(\text{counterdirectional only}\) 
again Reena door opened.

c. Reena dharvajo *pacho* kolyo \(\text{repetitive only}\) 
again Reena door opened.

The schema in (57) summarizes our findings regarding word order. Clearly, *pacho* gives rise to a repetitive reading iff it is low in the structure, and to restitutive and counterdirectional readings when it is high. This is a challenge for all existing analyses of **AGAIN**.

(57) 

<table>
<thead>
<tr>
<th>subject</th>
<th>object</th>
<th>verb</th>
</tr>
</thead>
</table>

Looking at the restitutive and repetitive readings together, we observe the following connections between surface structure and Logical Form. Both subject and object move overtly out of VP, at least in the perfective (which we have used in all the relevant examples); for Hindi this has been argued for by Mahajan (1990) and Chandra (2007). Their test is replicated for Kutchi Gujarati in (58) and (59). The idea is that *jaldi* ‘quickly’ surfaces in its scope position. It can adjoin to the VP, in which case it indicates that the event/process occurred at a quick pace; however, it can also adjoin to the IP, in which case it conveys that the event was initiated at a quick pace. Crucially, if the direct object (here: *kam* ‘work’) precedes *jaldi* ‘quickly’, only the reading is possible in which *jaldi* is adjoined to the VP, (58). By contrast, if the direct object follows *jaldi* ‘quickly’, only the reading is possible in which *jaldi* is adjoined to the IP, (59). If we assume that *jaldi* surfaces in its scope position, this means that *kam* ‘work’ must be located in the same position, both in (58) and (59), i.e. in a position above VP and below IP. For convenience sake, we label this position SpecAgrOP, though nothing hinges on this label.
(58) Valji kam jaldi karyu.
    ‘Valji did the work quickly.’ (i.e. The work happened at a quick pace.)

(59) Valji jaldi kam karyu.
    ‘Quickly, Valji did the work.’ (i.e. It did not take long before Valji started the work.)

When pacho<sub>rep</sub> is adjoined to VP (for the repetitive reading), this gives us the surface word order. At LF, all of the movements of the NPs syntactically reconstruct, as in (60). (Note that this is not strictly necessary, as lambda conversion could yield the same interpretation, but we do it for transparency of the LF.)

(60) Reena dharvajo pacho kolyo <i>repetitive only</i>
    Reena door again opened.

    <i>Surface Structure:</i>
    \[
    [\text{IP} \text{Reena}_{\text{AgrOP}} \text{dharvajo}_{\text{VP}} [\text{pacho}_{\text{rep}} [\text{t}_{\text{subj}} \text{t}_{\text{obj}} [\text{SC} \text{t}_{\text{obj}} \text{t}_{\text{kolyo}}] [\gamma \emptyset + \text{kolyo}]])]
    \]

    <i>Logical Form:</i>
    \[
    [\text{IP} \text{Reena}_{\text{AgrOP}} [\text{pacho}_{\text{rep}} [\text{t}_{\text{subj}} \text{t}_{\text{obj}} [\text{SC} \text{dharvajo}_{\text{A}} \text{kolyo}] [\gamma \emptyset]})]
    \]
    ‘Once more, Reena does something that causes the door to come to be open.’

For the surface structure of the restitutive example, we assume for the sake of consistency that all the same movements occur. This entails that restitutive pacho occurs in a position that is structurally very high. We can only make sense of this if the adverb got moved to this high position and is reconstructed in the LF, as in (61).

(61) pacho Reena dharvajo kolyo <i>restitutive</i>
    again Reena door opened

    <i>Surface Structure:</i>
    \[
    [\text{pacho}_{\text{rep}} [\text{IP} \text{Reena}_{\text{AgrOP}} \text{dharvajo}_{\text{VP}} [\text{t}_{\text{subj}} \text{t}_{\text{obj}} [\text{SC} [\text{pacho}_{\text{rep}} [\text{SC} \text{dharvajo}_{\text{A}} \text{kolyo}] [\gamma \emptyset + \text{kolyo}]])]
    \]

    <i>Logical Form:</i>
    \[
    [\text{pacho}_{\text{rep}} [\text{IP} \text{Reena}_{\text{AgrOP}} [\text{t}_{\text{subj}} \text{t}_{\text{obj}} [\text{SC} \text{pacho}_{\text{rep}} [\text{SC} \text{dharvajo}_{\text{A}} \text{kolyo}] [\gamma \emptyset]})]
    \]
    ‘Reena does something that causes the door to come to be once more open.’

Considering counterdirectional pacho, we keep the assumptions made above constant and arrive at the derivation in (62).

(62) Valji pachi baiman phone kari <i>counterdirectional only</i>
    Valji again woman phone did
Surface Structure:
\[
[\text{IP Valji [ pacho\textsubscript{cdir} AgrOP baiman [VP -- [VP t\textsubscript{obj} t\textsubscript{obj} phone kari]]]]]
\]
\[\textit{pacho} \text{ Raises}\]

Logical Form:
\[
[\text{IP -- [ -- AgrOP -- [VP pacho\textsubscript{cdir} VP Valji baiman phone kari]]]]
\]

‘Valji phoned the woman in return.’

Both subject and object raise to their respective surface positions. \textit{Pacho\textsubscript{cdir}} needs to modify VP, hence cannot be interpreted in its surface position above AgrOP. We assume once more that it was raised at surface structure and is reconstructed at LF.

The analysis makes adverbs in Kutchi Gujarati an interesting illustration of crosslinguistic variation, when compared to German, where the adverb is interpreted in its surface position. In future research, we need to ask which grammatical property distinguishes adverbs in Kutchi Gujarati from adverbs in German to bring about this difference at the syntax/semantics interface. At the very least, the above analyses show what has to be the case in order for the facts to come out right. Needless to say, however, they raise quite a lot of general questions regarding the mapping between surface structure and Logical Form in Kutchi Gujarati. Some of these questions are independent of the issue of \textit{AGAIN}, e.g. raising of argument NPs. Others concern \textit{AGAIN}, but are part of more general ‘bigger’ questions, such as: What is the relation between surface and scope position of adverbs in this language? And what could motivate an adverb like \textit{pacho} to raise at surface structure? We leave these questions for future research.

### 5. Conclusions

In this paper, we have presented an investigation of \textit{pacho} ‘again’ in Kutchi Gujarati. We have observed that a counterdirectional reading of \textit{AGAIN} can be distinguished truth-conditionally from a restitutive reading if we use suitable predicates (namely directed creation verbs). Our comparison of Kutchi Gujarati, German and Present Day English has also shown that the availability of a ‘true’ counterdirectional reading is subject to crosslinguistic variation. Kutchi Gujarati thus confirms Gergel & Beck’s (to appear) view that restitutive and counterdirectional readings can be available simultaneously (previously claimed for Early Modern English). The present day adverb \textit{pacho} ‘again’ in Kutchi Gujarati exhibits the same interpretive possibilities as Early Modern English \textit{again}.

Open questions concern the word order facts. Kutchi Gujarati shows that the position of adverbs, and in particular \textit{AGAIN}, is not fixed in this language. They can raise, so that their surface position is not their scope position. Whether adverb positions are fixed or not is thus a question that needs to be investigated for each language individually. Here, it can be held responsible for the different word order facts in Kutchi Gujarati versus German. What we do not know at this point is what the formal source of this difference could be. Finally, it is also an open question how exactly \textit{pacho} ‘again’ has developed historically; specifically, future research needs to determine its etymological source and whether its meaning is diachronically related to meanings such as ‘after’, or ‘behind’.

References

Dreaming \textit{de re} and \textit{de se}: Experimental evidence for the Oneiric Reference Constraint

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\textbf{Abstract.} We present findings from three experiments investigating the interpretation of pronouns in dream reports and belief reports. Percus and Sauerland (2003a) discuss reports of dreams where the dreamer is someone other than who she actually is, and investigate the range of possible interpretations of pronouns in this environment. They claim that when two pronouns are embedded, a reading where the higher pronoun refers to the subject of \textit{dream (de re)} and the lower one to the ‘dream-self’ (\textit{de se}) is excluded. This observation motivates a theory that derives \textit{de se} interpretations via pronoun movement. The core judgment behind this idea is delicate, however, and Anand (2006) found that some of his informants were able to detect the reading in question. Moreover, he claimed that the \textit{de re + de se} reading is available when the embedding verb is \textit{believe}. We bring experimental evidence to bear on these issues in the form of a picture choice task. Our data support Percus and Sauerland’s claim that the \textit{de re + de se} reading is unavailable in dream reports, suggesting that the empirical basis of their theory of \textit{de se} is sound. In addition, we confirm Anand’s claim that this reading is available in belief reports.

\textbf{Keywords:} Experimental semantics; attitude reports; pronouns; \textit{de se/de re} distinction

1. \textbf{Introduction}

\begin{quote}
A \textit{de se} pronoun is one that is interpreted from the first personal perspective of an attitude holder, such as the subject of \textit{believe} in (1):

1. Pooh\textsubscript{i} believed that he\textsubscript{i} was a bear.

On its most salient reading, (1) reports a belief that Pooh might articulate by saying, ‘I am a bear’. But an embedded clause containing a pronoun co-indexed with an attitude holder need not report a first personal attitude – the pronoun may instead be construed \textit{de re}. To see this, consider the following story, told to us by A.A. Milne.\textsuperscript{1} One day, Winnie the Pooh found some footprints in the woods, and believing them to have been made by an animal called a Woozle, decided to follow the tracks to see where they would lead. What he did not realize was that he had been walking in circles: the footprints were left by no other animal but himself. It seems that in this situation, there is a reading of (2) upon which it is true:

2. \textit{Scenario: Pooh believed that the creature that had left the footprints was a Woozle, but in fact he had left the footprints himself.}
Pooh\textsubscript{i} believed that he\textsubscript{i} was a Woozle.

\textsuperscript{1} See Chapter 3 of A.A. Milne’s 1926 book, \textit{Winnie-the-Pooh}.\end{quote}
Of course, Pooh would not be disposed to say, ‘I am a Woozle’. This shows that there is an interpretation of the pronoun that differs from the de se one in that it does not require a first personal perspective. This is known as a de re reading.

Reports of dreams in which the dreamer is someone other than who she actually is are useful in shedding light on the de selde re distinction (Heim 1994, Percus and Sauerland 2003a, Anand 2006). In such environments, a pronoun picks out (has as its correlate) different individuals depending on whether it is construed de se or de re. Consider (3):

3. Pooh dreamed that he was Piglet and he was stealing his honey.

A plausible interpretation of (3) is that in the dream, Piglet steals Pooh’s honey. On this reading, the two pronouns are associated with the subject of dream, Pooh, although in distinct ways. The first pronoun picks out Pooh’s ‘dream-self’ Piglet, while the second pronoun picks out the dreamer himself, namely Pooh. The first pronoun is construed de se, and the second de re.

Percus and Sauerland (2003a; henceforth ‘P&S’) noticed that in principle, four interpretations should be available for a sentence like (3), corresponding to the four possible de selde re configurations of the two pronouns. They claim that only three of these are attested:

4. Pooh dreamed that he was Piglet and he was stealing his honey.

✓ Reading A: Piglet steals Piglet’s honey. (de se + de se)
✗ Reading B: Pooh steals Piglet’s honey. (de re + de se)
✓ Reading C: Piglet steals Pooh’s honey. (de se + de re)
✓ Reading D: Pooh steals Pooh’s honey (de re + de re)

They propose that Reading B is ruled out by a constraint against c-command of a de se pronoun by a corresponding de re pronoun. This so-called ‘Oneiric Reference Constraint’ is stated in (5):

5. The Oneiric Reference Constraint (ORC)
A sentence of the form X dreamed that … pronoun … allows a reading in which the pronoun has the dream-self as its correlate only when the following condition is met: some pronoun whose correlate is the dream-self on the reading in question must not be asymmetrically c-commanded by any pronoun whose correlate is X. [Percus and Sauerland (2003a): ex 14]

P&S take the ORC as evidence for a novel theory of de se pronouns whereby they bear a special diacritic * and must move to the left periphery of the embedded clause introduced by the attitude verb, resulting in insertion of a lambda abstractor that binds the trace. The embedded clause expresses a property rather than a proposition as with a traditional semantics for attitude reports (Hintikka 1969). Here is a sample LF and interpretation of the embedded clause:

6a. Pooh dreamed \([_{CP}he^* \lambda_1 [t_1 was eating honey]]\)
6b. \([_{CP}] = \lambda x. x is eating honey\)
(6a) is interpreted roughly as a report of a self-ascription by Pooh, in the form of a dream, of the property of eating honey. P&S reason that if the availability of de se construals is subject to movement constraints, then this would support the movement-based theory exemplified in (6). They argue that the impossibility of the de re + de se reading is due to this reading involving a configuration that violates Superiority: if a pronoun whose correlate is the subject of dream (a de re pronoun) c-commands a pronoun whose correlate is the dream-self (a de se pronoun), then the attraction of the de se pronoun to the left periphery of the clause requires it to cross a structurally closer pronoun with the potential to move to the same position.

The reader may have noticed, however, that this argument depends on very subtle judgments concerning a rather obscure scenario. Furthermore, it may be that the multiply ambiguous nature of these sentences makes it more difficult to isolate particular readings. In informal elicitation work we have found that native speakers have difficulty detecting whether or not Reading B is available. Moreover, Anand (2006) reports that only 15 of his 25 informants share the intuition reported by P&S. This paper reports a series of experiments designed to collect data from linguistically naïve native English speakers concerning the availability of the de re + de se interpretation. We found that the core judgment underlying P&S’s theory is indeed robust.

Several considerations argue for the importance of establishing the core facts in this domain. Firstly, P&S’s proposal has already been employed in theoretical analyses of several different phenomena, such as epithets (Patel-Grosz 2012) and obligatorily controlled PRO (Pearson 2013). These analyses would be undermined if it were found that the core judgment underlying the pronoun movement theory is not sound. We discuss these proposals in greater detail in section 5.

Secondly, P&S’s proposal has a key role to play in debates concerning the de se/de re distinction. Notice firstly that although P&S explicitly restrict their attention to dream reports, an elegant implementation of the theory would draw no distinction between the interpretation of pronouns in the scope of dream and that of pronouns in any other type of attitude report. Such a theory would apply the ‘*’ diacritic to all de se pronouns, such as that in the belief report in (1), with pronoun movement serving as the core mechanism responsible for deriving de se readings. This approach would amount to an implementation of the ‘property-view’, whose philosophical roots lie in David Lewis’ work (Lewis 1979). According to this view, reports of attitudes de se describe self-ascriptions of properties. Thus when Pooh believes (de se) that he is a bear, he self-ascribes the property of being a bear. This is not so for a de re construal: while it is true in Milne’s story that Pooh believes that he is a Woozle, it is false that he is disposed to self-ascribe the property of being a Woozle. Chierchia (1990) showed how this idea can be implemented formally by letting the LF of a report of an attitude de se incorporate a lambda abstractor inserted in the left periphery of the embedded clause, which binds the de se pronoun, as in (7):

7a. Pooh believes $\left[\text{CP} \lambda_i [\text{he}_i \text{ is a bear}]\right]$
7b. $\left[\text{CP}\right] = \lambda x. x \text{ is a bear}$
The pronoun movement proposal is in this tradition, with the core difference between it and Chierchia’s theory being that the property expressed by the embedded clause is derived by movement of the pronoun and binding of its trace rather than by binding in situ.

The main competitor to the property-view comes from Reinhart (1990), who argues that a de se construal of a pronoun is a special case of a de re construal, so that there is no need to posit a dedicated LF for the de se reading. De re expressions are traditionally taken to require some relation of acquaintance to hold between the attitude holder and the individual denoted by the nominal (Kaplan 1968). Roughly speaking, if an agent \( \alpha \) believes de re of some individual \( x \) that \( x \) is \( P \), then (i) there is some acquaintance relation \( R \) that holds between \( \alpha \) and \( x \) and (ii) \( \alpha \) believes that the individual to whom she bears \( R \) is \( P \). For example, the truth conditions of Pooh, believed that he, was a Woozle can be paraphrased as in (8).

8. There is some acquaintance relation \( R \) such that:
   (i) Pooh bears \( R \) to Pooh in the actual world \( w \), and
   (ii) For each of the worlds \( w' \) such that it is compatible with what Pooh believes in \( w \) for \( w' \) to be the actual world, the individual to whom Pooh bears \( R \) in \( w' \) is a Woozle in \( w' \).

In the scenario that we are considering, Pooh, believed that he, was a Woozle is true in virtue of the facts that (i) Pooh bears the relation ‘saw the footprints of’ to himself, and (ii) Pooh believes that the individual whose footprints he saw is a Woozle. But notice that the truth conditions in (8) leave open the question of which acquaintance relation witnesses the statement. We might suppose that ‘is identical to’ is also an acquaintance relation – it is that acquaintance relation that each of us bears to ourselves. Then Pooh, believed that he, was a Woozle would also be verified in a scenario where for each of Pooh’s belief worlds \( w' \), the individual to whom Pooh is identical in \( w' \) is a Woozle in \( w' \). Notice that in such a scenario, the relevant belief of Pooh’s is a belief de se: he ascribes Woozle-hood to the individual that his belief state designates as himself, which is just that individual that Pooh would be disposed to refer to using the first person pronoun. Reinhart argues that this shows that there is no syntactic ambiguity between de se and de re interpretations: we can get by with a single LF and its corresponding truth conditions, with the appearance of ambiguity being due to the underspecified nature of the acquaintance relation.

We thus have two possible analyses of the de se/de re distinction. All else being equal, one might think that Reinhart’s view should be preferred on parsimony grounds, since it gets by without positing structural ambiguity. If so, then the onus is on proponents of the property-view to provide evidence that there are dedicated de se LFs. If the line of argument pursued by P&S is correct, this constitutes one such piece of evidence. This is because Reinhart’s view has the consequence that in a dream report like (4) with two embedded pronouns, the array of de se/de re interpretations are in fact all generated by a single LF, with the locus of the action being the

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2 This proposal is subsequently taken up and built upon in Maier (2009).
3 Other pieces of evidence for dedicated de se LFs that have been discussed in the literature include the interpretation of de selde re pronouns bound by only (Percus and Sauerland 2003b) and the existence of expressions that are necessarily interpreted de se, such as obligatorily controlled PRO (Chierchia 1990).
contextual acquaintance relation supplied post-semantically. It would then be surprising that any one of the four combinations of de se/de re construals should be excluded.

The role of P&S’s proposal in debates concerning the de se/de re distinction is complicated further by the possibility that the constraint against c-command of a de se pronoun by a corresponding de re pronoun is confined to particular attitude verbs. Anand (2006) claims that when dream is replaced by believe, the de re + de se reading becomes available:

9. Pooh believed that he was Piglet and he was stealing his honey.
   ✓ Reading A: Piglet steals Piglet’s honey.  (de se + de se)
   ✓ Reading B: Pooh steals Piglet’s honey.  (de re + de se)
   ✓ Reading C: Piglet steals Pooh’s honey.  (de se + de re)
   ✓ Reading D: Pooh steals Pooh’s honey  (de re + de re)

If there is indeed a contrast between (9) and its counterpart with dream, this too has consequences for the theory of de se. Anand proposes that the contrast shows that there are at least two routes to a de se construal: one involving binding, and a second where the pronoun is construed de re under an acquaintance relation of identity. With a belief report, this second route allows a de re pronoun to c-command a de se pronoun without violating Superiority. Anand provides a semantics for dream that excludes the possibility of a pronoun that it embeds being construed de re under an acquaintance relation of identity, so that there is no alternative route to a de se construal that would circumvent the ORC. If this is correct, then there is a sense in which both Chierchia and Reinhart were right: there are dedicated de se LFs that yield a property-type interpretation for the embedded clause, but the grammar also makes available a second route whereby a de se construal is a special case of de re. Thus P&S’s proposal has a role to play in a more recent and more nuanced incarnation of the debate, where the question is not what the route to a de se interpretation is, but rather exactly how many such routes there are.

It seems then that a firmer grasp of the rather subtle judgments concerning de re blocking under dream and believe is a precondition for the development of theoretical understanding of the semantics of attitude reports. This paper is a contribution towards that goal. The structure of the paper is as follows. Section 2 describes the novel paradigm that we developed in order to establish whether de re + de se readings are available, and reports the findings of Experiment 1, which provides evidence that the grammar rules out the de re + de se reading for dream reports. Experiment 2 strengthens our case for this conclusion by providing evidence against an alternative explanation of the findings of Experiment 1; it is reported in section 3. Section 4 discusses our third experiment, which is just like Experiment 2 except for the use of believe instead of dream. This minimal change alters participants’ choices with respect to the de re + de se reading, providing evidence for the contrast observed by Anand between dream and believe. The general discussion appears in section 5, and section 6 concludes the paper.
2. Experiment 1

2.1 Logic of the experiment

Our experimental design is informed by the consideration that to introspect about dream and belief reports of the type that we are interested in is a difficult task. Typically, semantic judgments are obtained by asking speakers to evaluate whether a sentence is true or false relative to a given scenario, as described by Matthewson (2004). Our informal observation that even linguists have difficulty assigning a truth value to these sentences led us to believe that this task would be too complex for linguistically naïve participants. Using Amazon Mechanical Turk (AMT; Mason & Suri, 2012), we employed a novel paradigm that provides a more implicit measure of the interpretation assigned to a given sentence by asking participants to choose from a pair of pictures the one that matched the sentence best. This method has the additional advantage that participants do not have to reason about imagined scenarios, but rather about scenarios depicted visually, thereby further reducing task complexity.

In the critical condition, a picture corresponding to the de re + de se reading was pitted against one depicting the de se + de se reading. All things being equal, a preference for the latter over the former would constitute evidence only that the de re + de se reading is dispreferred, and not for the stronger claim that we are interested in – namely that it is ungrammatical. We therefore constructed items where the de se + de se reading described a possible but unlikely event. For example, while it is possible for an author to buy her own book, she is unlikely to have reason to do so. We assumed that such a reading is preferred relative to a more plausible reading that is not made available by the grammar, such as (by hypothesis) the de re + de se reading. We further assumed that a reading that describes a possible but unlikely event is dispreferred relative to a more plausible grammatical reading, such as the de se + de re reading. This latter type of comparison constituted the control condition, where participants had to choose between a picture depicting the de se + de se reading, and one depicting the de se + de re reading. It was expected that if the ORC holds, then (i) the de se + de se reading should be preferred to the de re + de se reading in the critical condition but (ii) the de se + de re reading should be preferred to the de se + de se reading in the control condition. If the ORC does not hold, then the de se + de se reading should be dispreferred in both conditions. Data confirming (i) and (ii) would therefore constitute evidence that the core judgment on which P&S’s theory is based is sound.

2.2 Materials

Discourses of the format in (10) were presented.

10. There were two authors, Carol and Sandra. Carol dreamt that she was Sandra and she was buying her book.

   Reading A: Sandra buys Sandra’s book.   (de se + de se)
   Reading B: Carol buys Sandra’s book.    (de re + de se)
   Reading C: Sandra buys Carol’s book.    (de se + de re)
   Reading D: Carol buys Carol’s book.     (de re + de re)
In order to ensure that Reading A involved an unlikely but possible event, we conducted two norming experiments. The first was a likelihood rating task run also on AMT. 102 participants used a 7-point Likert scale to judge the likelihood of a particular agent doing something to her own object, as in ‘How likely is it for an author to buy his own book?’ or ‘How likely is it for a thief to break into his own garage?’ Participants were instructed to use 1 for events they considered highly unlikely and 7 for events they thought highly likely; items rated 2.5 or higher were discarded. With the remaining items we conducted a possibility judgment task with AMT, where participants judged whether a situation where a particular agent does something with her own object is possible, as in ‘Is a situation where an author buys his own book possible?’ or ‘Is a situation where a thief breaks into his own garage possible?’ Items rated possible at least 65% of the time ($\mu = 84\%$) formed the basis for the experimental materials, thereby ensuring that the embedded clause described a possible but unlikely event on its $de \ se + de \ se$ reading.

2.3 Procedure

The discourse in (10) was presented in two steps. First, we presented the first sentence, followed by two coloured pictures introducing the characters, as shown below.

‘There were two authors, Carol and Sandra.’

Next, the second sentence was presented along with a pair of pictures corresponding to one of the following two comparison types:

11a. Comparison type 1: Reading A ($de \ se + de \ se$) vs. Reading B ($de \ re + de \ se$) \hspace{1cm} Critical
11b. Comparison type 2: Reading A ($de \ se + de \ se$) vs. Reading C ($de \ se + de \ re$) \hspace{1cm} Control

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4 Every ‘HIT’ cost $0.04 in the norming task and in the following three experiments.
Participants were presented with 18 discourse items and asked to click on the picture that better described the sentence. The comparison types were counterbalanced across two lists. Experimental items were interspersed with fillers (1:3 item:filler ratio); two-thirds of the fillers featured an unambiguous picture selection, enabling us to detect whether participants as a whole were paying attention to the task.

2.4 Predictions

If P&S are correct that a de se pronoun cannot be c-commanded by a corresponding de re pronoun in a dream report, then Reading B should be dispreferred relative to Reading A. If in addition Reading A is dispreferred to Reading C, this would constitute strong evidence that the de re + de se reading is unavailable: a picture depicting this reading is not chosen even when pitted against a picture depicting a reading that is otherwise dispreferred.

2.5 Results

In all three experiments reported in this paper, we only recruited participants who had IP addresses based in the United States. Additionally, we asked every participant whether they speak English natively, and discarded data from those who did not respond in the affirmative. The analyses we report below are from the data provided by the remaining participants.
Judgments from participants \((n=182)\) were analyzed using a binary logistic regression model with Comparison Type as a predictor. We predicted and confirmed a significant effect of comparison type \((p<0.0001)\): participants preferred Reading A when pitted against Reading B, but dispreferred Reading A when pitted against Reading C. T-tests probing the simple effects within comparison type revealed that while participants preferred Reading C \((65\%)\) over Reading A \((35\%)\) due to the fact that Reading A describes a possible yet unlikely event \((p=0.0001)\), participants preferred Reading A \((86\%)\) over Reading B \((14\%; p<0.0001)\), overwhelmingly preferring a reading that violates world knowledge constraints over an ORC-violating reading.

2.6 Discussion

The results of Experiment 1 are compatible with P&S’s claim that the \(de\ re + de\ se\) reading is ruled out in dream reports. However, the following alternative interpretation of our data is also possible.\(^5\) Suppose that in (10), the information that Carol dreamt that she was Sandra generates an expectation that Sandra will feature as an active participant in the dream. Reading B is the only reading that violates this expectation: on this reading, Sandra is the correlate of the final pronoun, as illustrated in the picture by the labeling of the book with her name. But the featuring of Sandra’s name rather than Sandra herself may be insufficient to satisfy the expectation that Sandra will participate in the event described by the embedded clause. If so, then Reading B would be predicted to be ruled out by considerations having nothing to do with the ORC. The goal of Experiment 2 is to rule out this alternative interpretation of our data.

3. Experiment 2

3.1 Motivation

A limitation of Experiment 1 is that in the critical condition, a reading where the dream-self features as an active participant (the \(de\ se + de\ se\) reading) is pitted against one where the dream-self is not an active participant (the \(de\ re + de\ se\) reading). Consequently, we cannot be sure on the basis of the results of this experiment whether the avoidance of the picture depicting Reading B reflects a failure of the grammar to generate this reading, or arises because Reading B violates narrative expectations pertaining to who will be talked about next. We therefore designed a follow-up experiment where the dream-self does not feature as an active participant in either of the readings made available for participants to choose from. This design removed presence or absence of the dream-self in the pictures as a possible confound affecting participants’ choices.

3.2 Method

The sentences from Experiment 1 were used in Experiment 2, so that the only difference between the two experiments lies in the pictures accompanying the items. All pictures depicting the \(de\ se + de\ se\) reading were replaced with pictures depicting the \(de\ re + de\ re\) reading, as shown below:

\(^5\) We thank Jeffrey Lidz for pointing out this alternative interpretation.
12a. Comparison type 1: Reading D (de re + de re) vs. Reading B (de re + de se)  
12b. Comparison type 2: Reading D (de re + de re) vs. Reading C (de se + de re)

‘Carol dreamed that she was Sandra and she was buying her book’ (Comparison type 1)

Notice that Reading D, like Reading A from Experiment 1, involves a possible but unlikely event such as buying one’s own book. This is because Reading D shares with reading A the property that it requires the two pronouns to be construed as having the same correlate.

3.3 Predictions

We predicted that if the avoidance of Reading B in Experiment 1 was due to the ORC, then the results of Experiment 2 should replicate those of Experiment 1: Reading D should be preferred with respect to Reading B, but dispreferred relative to Reading C. If instead Reading B was not chosen because it does not feature the dream-self as a participant in the dream, then Reading B should not be dispreferred with respect to Reading D, since both readings have this property.

3.4 Results

As in Experiment 1, judgments from participants (n=153) were analyzed using a binary logistic regression model with Comparison Type as a predictor. Again, we observed a significant effect of comparison type (p<0.001): participants still preferred Reading D when pitted against Reading B, but dispreferred Reading D when pitted against Reading C. The simple effects T-
tests revealed that Reading D (8%) is still dispreferred in comparison to Reading C (91%) due to Reading D describing a possible yet unlikely event \((p<0.0001)\), but participants still prefer Reading D (56%) over Reading B (43%; \(p=0.02\)), still selecting a reading that violates world knowledge over the ORC-violating reading. This result rules out the alternative possibility that participants may have selected the reading that accommodated narrative expectations that were created by reading the preceding clause.

3.5 Discussion

As in Experiment 1, participants prefer a reading that depicts a possible but unlikely event \((de \text{ re} + de \text{ re})\) to one that violates the ORC \((de \text{ re} + de \text{ se})\). Unlike in Experiment 1, the avoidance of the \(de \text{ re} + de \text{ se}\) reading cannot in this case be attributed to the absence of the dream-self as a participant in the dream, since this is also a feature of the \(de \text{ re} + de \text{ re}\) reading. We conclude that in dream reports, the \(de \text{ re} + de \text{ se}\) reading is indeed ruled out by the grammar.

4. Experiment 3

4.1 Motivation

Having established that the \(de \text{ re} + de \text{ se}\) reading is unavailable in dream reports, we conducted an experiment to test Anand’s claim that the constraint that excludes this reading can be circumvented when the embedded clause is introduced by believe. Here again introspection and informal elicitation seem to be too blunt an instrument to gather robust data concerning the alleged contrast between dream and believe.

4.2 Method

The materials, pictures and procedure were identical to those employed in Experiment 2, except that the verb dream was replaced with believe.

4.3 Predictions

If Anand is correct that the \(de \text{ re} + de \text{ se}\) reading is available with believe, then in the critical trials, this reading should not be dispreferred relative to the \(de \text{ re} + de \text{ re}\) reading. If instead the ORC applies to believe as well as dream, then the \(de \text{ re} + de \text{ re}\) reading should be preferred to the \(de \text{ re} + de \text{ se}\) reading as in Experiment 2.

4.4 Results

As with the previous experiments, judgments from participants \(n=196\) were analyzed using a binary logistic regression model with Comparison Type as a predictor. We observed a significant effect of comparison type \((p<0.0001)\). However, T-tests probing the simple effects within comparison types revealed different patterns of results when compared to the previous two experiments. Reading D (17%) is dispreferred when pitted against Reading C (82%), as expected.
(p<0.0001). However, unlike in Experiments 1 and 2, participants do not prefer Reading D (45%) when pitted against Reading B (54%). While this difference reaches marginal significance (p=0.08), it must be noted that the pattern of results is numerically trending towards a preference toward the ORC-violating reading. This result confirms Anand’s claim that the de re + de se reading is available with believe.

Additionally, in order to determine whether the pattern of results is indeed different as a function of the verb, we conducted an inter-experiment analysis of the data from Experiments 2 and 3. We combined the data from both experiments and conducted a binary logistic regression model with Comparison Type (within participants) and Experiment (between participants) as fixed predictors, as well as their interactions. We found a significant effect of the interaction between experiment and comparison type (p<0.0001) as well as a significant main effect of comparison type (p<0.0001), indicating that while participants’ responses varied as a function of comparison type in both experiments, the pattern of their results were different between experiments. A main effect of experiment was marginally significant (p=0.07). Overall, the results suggest that participants’ patterns of responses indeed differ as a function of the verb.

4.5 Discussion

Our results lend experimental support to Anand’s claim that the prohibition of c-command of a de se pronoun by a corresponding de re pronoun can be circumvented when the embedded clause is introduced by believe. In the critical trials, participants were almost at chance level between the two pictures. The results for the control condition replicate those for Experiment 2 in that the world knowledge violating de re + de re reading was dispreferred with respect to the grammatical and pragmatically felicitous de se + de re reading. One question that is raised by our data is why the strong dispreference for the de re + de re reading in the control condition was not also found in the critical trials, as might be expected if the de re + de se reading is indeed available in belief reports. It is possible that the effect of grammar constraints, plausibility, and narrative expectations on participants’ judgments may not be strictly additive, nor have equal importance. The most important point for our purposes is the significant interaction of experiment type with comparison type across Experiments 2 and 3, indicating that, as Anand claims, the choice of dream vs believe affects the availability of the de re + de se reading. We conclude from the fact that this reading is dispreferred in dream reports but not in belief reports that the constraint against c-command of a de se pronoun by a corresponding de re pronoun holds for clauses embedded by dream but not for those embedded by believe.

5. General discussion

5.1 Limitations of this study and directions for future work

Recall that the Oneiric Reference Constraint entails that a de re + de se reading is ruled out in a dream report just in case the de re pronoun c-commands the de se pronoun; according to Percus and Sauerland, a de re pronoun may linearly precede a corresponding de se pronoun as long as it does not c-command it. Thus a sentence like (13) is claimed to permit all four readings:
13. Pooh dreamed that he was Piglet and his honey was making him fat.
   ✓ Reading A: Piglet’s honey makes Piglet fat.  (de se + de se)
   ✓ Reading B: Pooh’s honey makes Piglet fat.  (de re + de se)
   ✓ Reading C: Piglet’s honey makes Pooh fat.  (de se + de re)
   ✓ Reading D: Pooh’s honey makes Pooh fat.  (de re + de re)

That the excluded reading should involve a c-command relationship between the two pronouns is crucial for P&S’s analysis: if there were no c-command, the exclusion of this reading could not be blamed on Superiority. It is important to bear in mind, therefore, that while we have established that the de re + de se reading is excluded in dream reports but not in belief reports, we have not shown that a c-command relationship between the two pronouns is a prerequisite for exclusion of this reading. We are currently conducting follow-up experiments to test this.

Secondly, while we have focused on P&S’s generalization concerning blocking of a de se construal by an intervening de re pronoun, we should note that subsequent authors have questioned the formulation that we cite here. As Anand (2006) points out, the appeal to Superiority derives only that the structurally highest de se pronoun must be ‘de re free’ (not c-commanded by a corresponding de re pronoun). This is because any lower de se pronouns will not move, but will be instead bound in situ, and hence not be subject to Superiority. Anand claims that this is too weak. Here is one of the examples that he offers in support of this claim.

14. Scenario: I am a guard at a local jail who is known for his harsh treatment of prisoners. One night, I am plagued (perhaps by a just God) with dreams that I am one of the prisoners, and I learn just how terrible I can be.
   ✗ I dreamed that I had to keep my mouth shut or I’d be liable to beat me.
   [Anand 2006: 44, ex 104a]

The reading indicated with subscripts in (14) is predicted to be available: the highest pronoun in the embedded clause is not c-commanded by a de re pronoun, and should therefore be able to move to the left edge of the complement of dream, resulting in insertion of binder for the trace, which is itself coindexed with the lowest pronoun. Anand claims that this reading is unavailable, and offers an alternative account of de re blocking that does not appeal to Superiority. The crucial judgments here are again very delicate, so that it would be a worthwhile goal for future work to investigate them experimentally.

5.2 Implications of our findings for the semantics of attitude reports

The evidence that we have found supporting P&S’s claim that the de re + de se reading is unavailable in dream reports lends weight to the view that there are dedicated LFs that give rise to de se interpretations. The proposal that de se pronouns move to the left edge of the clause in which they occur offers a ready account for the unavailability of this reading, based on the idea that a de re pronoun that c-commands a de se pronoun is an intervener for covert movement. By contrast, the view in Reinhart (1990) and Maier (2009) that there is no dedicated LF responsible for the de se construal presents no immediate answer to the question of what rules out the de re +
de se reading: if de se pronouns have no special status with respect to de re pronouns at LF, but are merely interpreted de re under an acquaintance relation of identity, then the existence of syntactically conditioned constraints on de se/de re configurations is unexpected.

Secondly, our findings confirm the legitimacy of using pronoun movement based approaches to various puzzles in the literature on attitude reports. We shall mention two examples here.

Patel-Grosz (2012) investigates an intricate array of constraints concerning possible antecedents for epithets such as the damn traitor. She notes that when an epithet appears in the complement of an attitude verb such as think, it may take the subject of the embedding verb as its antecedent if it is in object position, but not if it is in subject position:

15a. *Nero, thinks that [the damn traitor], will be invited to the reception.
15b. ✓Nero, thinks that they will invite [the damn traitor] to the reception.

Patel-Grosz proposes that epithets are null pronouns modified by a nominal appositive. When the epithet has an attitude holder as its antecedent, the null pronoun bears P&S’s ‘*’ diacritic. As such, it must move to the left periphery of the clausal complement of think. Following Demirdache and Percus (2011a, 2011b), she assumes that the appositive cannot be anchored to a trace, and that this renders (15a) ungrammatical. The grammaticality of (15b) is explained by positing covert movement of the damn traitor to the matrix clause, where it adjoins to the subject of think; this rescue strategy is unavailable for (15a), since subjects are islands for extraction.

A second application for P&S’s pronoun movement analysis is found in Pearson (2013). Pearson examines the logophoric pronoun yè in the Niger-Congo language Ewe. This is a pronoun that obligatorily occurs in the scope of an attitude verb, and must take the attitude holder as its antecedent. (16) is an example.

16. John say [CP \( \lambda x \) \( [yè] \) was clever].

The distribution of yè can be predicted by positing an individual abstractor in the left edge of the complement of the attitude verb that must bind the pronoun (Heim 2002, von Stechow 2003):

17a. John say \([\text{CP} \lambda x. x \text{ is clever}]\)
17b. \([\text{CP}] = \lambda x. x \text{ is clever}\)

This predicts that yè is obligatorily interpreted de se: (17) reports John’s self-ascription of the property of being clever. Pearson shows that this prediction is not borne out: (17) is judged true in a scenario where John did not say ‘I am clever’, but rather said ‘the author of this paper is clever’, not realizing (perhaps because he has a poor memory) that the author of the paper was himself. Pearson shows that this surprising finding can be accommodated in a theory that
accounts for the distribution of yè via obligatory binding by an abstractor introduced by an attitude verb. She assumes that the pronoun may be embedded within a covert constituent called a resP that yields a de re construal by introducing a function G from individuals to acquaintance-based concepts such as the concept associated with the description ‘the author of this paper’ (Percus and Sauerland 2003b). The proposed structure is illustrated schematically in (18):

18. John say \( [\text{CP} \lambda_5 \lambda_1 [\text{resP} G_5 yè_1 \text{ was clever}]] \)

This analysis raises the question of why there are any pronouns that are obligatorily interpreted de se, given the availability of the option of embedding a pronoun in a resP. For example, obligatorily controlled PRO is well known to be obligatorily construed de se (Morgan 1970, Chierchia 1990). (19) is false in the scenario that we have just been considering:

19. John claimed [PRO to be clever].

Suppose that PRO, like yè, is obligatorily bound by an abstractor in the left edge of the embedded clause (Chierchia 1990):

20. John claimed \( [\text{CP} \lambda_1 [\text{PRO}_1 \text{ to be clever}]] \)

What rules out the de re LF in (21)?

21. John claimed \( [\text{CP} \lambda_5 \lambda_1 [\text{resP} G_5 \text{PRO}_1 \text{ to be clever}]] \)

Pearson proposes that whereas yè is bound in situ, obligatorily controlled PRO bears Percus and Sauerland’s ‘*’ diacritic. Consequently, PRO must move to the left edge of the infinitive, resulting in insertion of a lambda abstractor that binds the trace:

22. John claimed \( [\text{CP} \text{PRO}^* \lambda_1 [t_1 \text{ to be clever}]] \)

Pearson argues that the obligatory nature of this movement precludes the possibility of embedding of PRO in a resP, which would result in a subextraction violation. While our results do not directly bear on the phenomena discussed in Patel-Grosz and Pearson’s work, they lend empirical support to the notion that de se pronouns undergo covert movement, thereby paving the way for theories such as Patel-Grosz’s and Pearson’s that appeal to such movement.

A characteristic of Patel-Grosz’s and Pearson’s approaches that is worth noting is that they extend the pronoun movement idea beyond the domain of dream reports that P&S originally focused on: Patel-Grosz investigates epithets in the scope of think and convince, while Pearson’s proposal is intended to apply to all attitude verbs that take control complements. Yet Experiment 3 shows that not all attitude verbs behave alike with respect to the de re blocking effect that P&S cite as evidence for pronoun movement: our data support Anand’s claim that the de re + de se reading is available with believe. Is it possible to resolve this tension while maintaining that de se pronouns undergo covert movement regardless of which attitude predicate embeds them?
Anand proposes that binding of a de se pronoun is constrained by locality, but that in the case of believe, the de re + de se reading can be derived by letting the de se pronoun be interpreted de re under an acquaintance relation of identity. This raises the question of why this option is not available for dream, which Anand responds to by providing a lexical entry that prevents dream from embedding a nominal that is construed de re under an identity-based acquaintance relation. This is obviously highly stipulative, however, and leaves open the question of whether a principled distinction can be drawn between predicates that permit the de re + de se reading, and those that do not. At the same time, a goal for future experimental work should be to collect more robust data demonstrating that some but not all attitude verbs tolerate the de re + de se reading, based on a larger range of predicates beyond the two that we have investigated so far.

The hypothesis that we are currently investigating in follow-up experiments is that attitude verbs whose complements are interpreted counterfactually with respect to the attitude holder’s belief state prohibit the de re + de se reading, while those with a non-counterfactual semantics can circumvent the ORC, thereby allowing all four possible combinations of de sel/de re construals. We take it that dream is a member of the former class, which also includes imagine, pretend, suppose and wish, while believe belongs to the latter class along with think, say and claim.

The notion that counterfactuality is the key factor determining the availability of the de re + de se reading is discussed in Pearson (2013). Pearson observes that the crucial difference between believing that one is someone other than who one actually is and dreaming or imagining that one is someone else, is that in the latter case, one is aware of the counterfactual nature of the supposition in question. This is seen, for instance, in the fact that if I believe that I am Napoleon then you are entitled to conclude that I am not in my right mind, whereas I can be in charge of my mental faculties and in command of the relevant factual information about myself while dreaming or imagining that I am Napoleon. Pearson argues that this means that in the scope of a counterfactual attitude, a pronoun that is construed de re under an acquaintance relation of identity does not pick out the same individual as a de se pronoun that moves and has its trace abstracted over. If Pooh dreams that he is Piglet, then a de se pronoun that undergoes LF movement will pick out Pooh’s dream-self – namely Piglet - while a de re pronoun construed under an identity-based acquaintance relation will pick out the individual that Pooh’s mental state designates as himself – under normal circumstances, Pooh himself. Contrary to Anand’s claim, the unavailability of the de re + de se reading in the scope of dream does not show that a pronoun in the scope of this verb cannot be construed de re under an acquaintance relation of identity. Rather, this route fails to produce the de re + de se reading, owing to the non-equivalence in this environment of de se via binding and de se as a special case of de re.

If this line of argumentation is correct, it has the following interesting consequence for the theory of de se. Contrary to Reinhart’s claim, a de se construal that arises via binding is not always

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6 Percus (2006) noticed that pretend patterns with dream rather than believe, and suggested that what the first two verbs have in common is that they can both describe processes of putting oneself in someone else’s shoes. Pearson’s proposal can be seen as a development of this idea, with the notion of ‘putting oneself in someone else’s shoes’ being implemented as a counterfactual supposition that one is someone other than who one actually is.
equivalent to a *de re* interpretation under an acquaintance relation of identity: the two can be teased apart in counterfactual attitude reports. If so, then the grammar generates both interpretations, which are in many cases equivalent but can be distinguished from one another in a principled manner in a circumscribed set of linguistic environments. The next step, therefore, is to bring experimental evidence to bear on the question of whether counterfactuality is a factor in determining the availability of the *de re + de se* reading. This paper has set the scene for that project by establishing a paradigm for the identification of (im)possible readings that does not appeal to truth value judgments, and applying that paradigm to two of the verbs of interest.

6. Conclusion

In this paper, we described a method for collecting semantic judgments in cases where introspection is difficult or leads to inconclusive results. We applied this method to the question of whether a particular reading is available in attitude reports. Experiments 1 and 2 provided evidence that the core judgment underlying P&S’s theory of *de se* is sound: in dream reports, the *de re + de se* reading is unavailable. Experiment 3 provided evidence for Anand’s claim that *believe* is unlike *dream* in that it permits the *de re + de se* reading. We discussed consequences of these findings for the analysis of attitude reports and indicated directions that we are currently pursuing in follow-up experiments. We should emphasize again that all of this is provisional on the assumption that the crucial factor in the exclusion of a *de re + de se* reading is *c*-command: if it were found that the *de re + de se* reading is also excluded when the *de re* pronoun precedes but does not *c*-command the *de se* pronoun, the case for Percus and Sauerland’s theory of *de se* would be undermined. The present paper should therefore be regarded merely as a status report, but we hope that it has at least been successful in making a case for the fruitfulness of investigating *de re* blocking effects from both an experimental and a theoretical point of view.

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**Acknowledgments**

For helpful comments at various stages of this research we are grateful to Manizeh Khan, Jeff Lidz, Jacopo Romoli, Uli Sauerland, Frank Sode, Stephanie Solt and audiences at the University of Maryland and Sinn und Bedeutung 18. Special thanks to Research Assistants Aila Bergob and Anja Ruisinger for their careful work on this project. This research was supported by the Bundesministerium für Bildung und Forschung (BMBF) (Grant Nr. 01UG0711).
The semantics of common nouns in Ga (Kwa, Niger-Congo) and their interaction with exclusive particles

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Abstract. This paper discusses the semantics of exclusive particles in Ga and their interaction with different types of common nouns. I argue that there are three, not two, types of common nouns in Ga: count nouns, mass nouns, and intermediate nouns with mixed properties. Crucially, the main evidence for the existence of the third, intermediate type of noun is its interaction with exclusive particles: *kome pe* and *kome too*.

Keywords: common nouns, exclusive particles, Ga language

1. Introduction

Common nouns and exclusive particles are both widely discussed in contemporary formal semantics. In this paper I present data from the Ga language (Kwa, Niger-Congo) that shed a new light on these topics by revealing unexpected interactions between both domains. It is impossible to understand the semantics of exclusive particles in Ga without prior understanding of the semantics of common nouns in Ga. Crucially, I claim that there are three, not two, types of common nouns in Ga: mass nouns, count nouns, and an intermediate type of noun with mixed properties. Moreover, there is also an unusual proliferation in the domain of exclusive particles in Ga. There are basic (*kome, too, pe*) and complex exclusives (*kome too, kome pe, kome too pe*) in the Ga language. Interestingly, the main evidence for the existence of the third intermediate type of noun in Ga comes from the interaction between different types of common nouns and complex exclusive particles.

The outline of the paper is as follows. First, I present the semantics of common nouns in Ga in Section 2 and I provide an overview of exclusives in Ga in Section 3. In Section 4 I present three puzzles which illustrate the interaction between common nouns and exclusive particles in Ga. In Section 5 I present the analysis of the basic (Subsection 5.1) and complex exclusives (Subsection 5.3). The solutions to the puzzles are given in Section 6, and Section 7 concludes.

Ga (Kwa, Niger-Congo) is a Ghanaian language spoken in The Greater Accra Region by about 600,000 speakers. It is an SVO, tonal language with two tones: Low and High. Ga belongs to the group of five government-supported languages. All data presented in this paper come from the author’s field trips to Accra in May 2012 and February 2013. The data was collected using the fieldwork methodology presented in Matthewson (2004) and Renans et al. (2011).

2. Common nouns in Ga

The data shows that a standard two-fold distinction for count and mass nouns is not sufficient for properly describing the semantics of common nouns in Ga. I argue that there are three, not two,
types of common nouns in Ga: singular and plural count nouns, mass nouns, and an intermediate type of noun. Whereas mass and count nouns in Ga show standard properties, the intermediate type of noun behaves in a non-standard way in exhibiting properties of both count and mass nouns.

2.1. Count nouns in Ga

As in other languages, count nouns in Ga can combine with numerals without the use of classifiers and they are obligatorily pluralized when they refer to a cumulation of NP-entities, as in (1).

(1) Kofi ye srbe-i enyo nyɛ.
K. eat eggplant-PL two yesterday
‘Kofi ate two eggplants yesterday.’

The following common nouns behave in the same way: wolọ — wojis (book — books), nyɛmi yoo — nyɛmi yei (sister — sisters), aduawa — aduawai (fruit — fruits), srbe — srbei (eggplant — eggplants).

I assume a standard mereological semantics for singular and plural count nouns in Ga (Link, 1983). Both of them denote sublattice structures: singular count nouns denote the set of all singular atomic entities, whereas plural count nouns denote the set of all plural individuals formed out of the underlying atomic entities. For example, the denotation of the Ga count noun srbe (eggplant) can be represented as follows:

(2) a. srbe-sg : \{a, b, c\}

b. srbe-pl : \{a+b, a+c, b+c, a⊙b⊙c\}

2.2. Mass nouns in Ga

Mass nouns in Ga, as in other languages, cannot combine with numerals without the use of classifiers, as in (3-a), and they are not pluralized when they refer to a cumulation of NP-entities, as in (3-b).
Further examples of mass nouns in Ga are the following: *nu (water), *fɔ (oil), *gari (a food made from cassava), *shika (money), *su (mud), *tawa (tobacco), *waŋ (gray hair).

I propose to model the denotation of mass nouns in Ga with the use of a free join-semilattice structure without atomic entities, which is in line with, e.g., Link (1983), Krifka (1995), Wilhelm (2008). For instance, the denotation of the Ga mass noun *yɔɔ (bean) is as in (4):

\[ yɔɔ: \{ f \oplus g, f \oplus h, g \oplus h, f \oplus g \oplus h \} \]

\[
\begin{array}{c}
\text{f} \oplus \text{g} \oplus \text{h} \\
\text{f} \oplus \text{g} \\
\text{f} \oplus \text{h} \\
\text{g} \oplus \text{h} \\
\end{array}
\]

2.3. Intermediate nouns in Ga

Intermediate nouns are neither purely count nor purely mass nouns. Like count nouns they can combine with numerals without the use of classifiers, but like mass nouns they must not be pluralized when referring to a cumulation of NP-entities, as in (5):

\[ a. \quad \text{Lisa ye atomo enyɔ nyɛ}. \\
\text{Lisa eat potato two yesterday} \\
\text{‘Lisa ate two potatoes yesterday.’} \\
\]

\[ b. \quad *\text{Lisa ye atomo-i enyɔ nyɛ}. \\
\text{Lisa eat potato-PL two yesterday} \\
\text{‘Lisa ate two potatoes yesterday.’} \\
\]

Moreover, intermediate nouns can refer both to singular and plural entities without any morphological changes. In this sense, Ga intermediate nouns are number-neutral. Compare (5-a) to (6):
Lisa ate one potato yesterday.

Consequently, from (7) it does not follow how many potatoes Lisa ate:

Lisa ate potato(es) yesterday.

The following Ga nouns can be classified as intermediate nouns: *loo* (fish), *bloodo* (bread), *amo* (tomato), *atomo* (potato), *kɔmi* (kenkey), *amadaa* (plantain), *abonua* (lemon), *waa* (snail), *kaa* (crab), *gaa* (crab).

Direct combination with the numerals suggests the presence of discrete atomic entities in the denotation of the intermediate nouns. Furthermore, number-neutrality suggests that their denotation contains not only atomic entities but also all the pluralities formed out of them. Hence, I propose to model the denotation of intermediate nouns as a free join-semilattice structure with atomic entities, which was originally proposed by Chierchia (1998a, 1998b) for the denotation of mass nouns. Example (8) shows the denotation of the intermediate noun *atomo* (potato):

\[ \{a, b, c, a \oplus b, b \oplus c, a \oplus c, a \oplus b \oplus c\} \]

Summing up, there are count, mass, and intermediate nouns in Ga which denote sublattice structures, a full join-semilattice structure without atomic entities, and a full join-semilattice structure with atomic entities, respectively. A summary of the syntactic properties of the different types of common nouns in Ga and the proposed structures for their denotations are presented in Table 1.

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1All nouns that have been identified as intermediate nouns thus far are food terms. Further fieldwork will clarify whether this is a coincidence or not.
3. Exclusive particles in Ga — an overview

The mere existence of exclusive particles in a language is not in itself surprising. There are many of them in English (e.g., *only*, *merely*, *exclusively*, *solely*, etc.), German (e.g., *nur*, *ausschließlich*), Polish (e.g., *jedynie*, *tylko*, *zaledwie*), among other languages. In Ga, however, there is an unusual proliferation of them, including basic and complex exclusives. Basic exclusives are *kome*, *too*, *pe*, *kêkê*, and *sɔɔ*. Complex exclusives are formed out of the basic ones, as shown in (9-b).

(9) a. **Basic exclusives:**
   
   *kome*, *too*, *pe*, *kêkê*, *sɔɔ*

   b. **Complex exclusives:**
   
   *kome too*, *kome pe*, *kome too pe*, *too pe*, *kêkê pe*, etc.

Ga exclusive particles differ in their distribution and semantics. *Kêkê* can be used only in typical scalar contexts like *He is only a plumber*, and in this respect it is similar to English *merely* (Beaver and Clark, 2008). *Sɔɔ*, on the other hand, can be paraphrased as *a lot of only something* and can be used, e.g., in the situation in which Mary ate only fish and the amount of fish that Mary ate was huge (cf. Eckardt (2006) on German *lauter*).

In this paper I am focusing on the semantics of *kome*, *too*, and *pe*. *Kome* clearly differs from *pe* and *too*. Sentences with *kome* are not exhaustive, and in this sense *kome* is not a full-blooded exclusive particle. It derives from *ekome* (*one*), and I claim that the cardinality one should be built into its lexical entry (see Section 5.1). From this point of view *kome* resembles English *sole* (Coppock and Beaver, 2011). On the other hand, it is very difficult to find any differences in the semantics of *too* and *pe*. Both of them are exhaustive and their distribution is alike. Yet divergences in their semantics become visible when they are part of the complex exclusives *kome pe* and *kome too*. In the next section I will present three puzzles regarding the semantics of *kome pe* and *kome too* which indirectly reveal the differences in the semantics of *pe* and *too*. Crucially, the discussion will illustrate how Ga exclusive particles interact with different types of common nouns providing
evidence for the existence of the third intermediate type of common noun.

4. Interaction of exclusive particles and common nouns

A very interesting fact about exclusives in Ga is that they interact in an unexpected way with the three types of common nouns. This is evidence that exclusives can play other roles apart from operating on the discourse structure (Beaver and Clark, 2008). In the following subsections I will present three puzzles arising in connection with the interaction of kome pe and kome too with count, mass, and intermediate nouns. Whereas both kome pe and kome too can modify singular count nouns, only kome too can modify plural count nouns (Puzzle 1). Kome pe cannot also modify mass nouns, whereas kome too can (Puzzle 2). Moreover, both kome pe and kome too can modify intermediate nouns although they produce different semantic effects: kome pe gives rise to the meaning only 1 NP, whereas kome too gives rise to the meaning only NP (Puzzle 3).

4.1. Puzzle 1: Interaction with count nouns

The behavior of kome pe and kome too differ when they modify plural count nouns:

(10) Priscilla he srīi ʰkome pe/ ʰkome too nyɛ.  
P. bought chairs PART  PART yesterday
‘Priscilla bought only chairs yesterday.’

In (10) the use of kome pe as the modifier of plural count noun srīi (chairs) was judged by the informants as ungrammatical, whereas the same sentence with kome too was judged as perfectly fine. The generalization of this data is that kome pe cannot modify plural count nouns, whereas kome too can.

4.2. Puzzle 2: Interaction with mass nouns

The interaction of kome pe and kome too with mass nouns is exemplified by (11):

(11) Kofi he yoɔ ʰkome pe/ ʰkome too nyɛ.  
Kofi bought bean PART  PART yesterday
‘Kofi bought only beans yesterday.’
Yɔɔ (bean) is a mass noun in Ga and, as illustrated in (11), it cannot by modified by kome pr, but it can be modified by kome too. This observation extends to other mass nouns in Ga leading to the generalization that whereas kome pr cannot modify mass nouns, kome too can.

4.3. Puzzle 3: Interaction with intermediate nouns

Both kome pr and kome too can modify intermediate nouns. However, they give rise to different semantic effects. Let us consider example (12):

(12) Kofi he atomo √ kome pr / √ kome too nyɛ.
    Kofi bought potato PART / PART yesterday
    ‘Kofi bought only 1 potato / only potato(es) yesterday.’

(12) with kome pr obtains the reading that the cardinality of the potatoes that Kofi ate was only one. On the contrary, (12) with kome too obtains the reading that Kofi ate only potato(es) (of unknown cardinality: he could have eaten one potato but he also could have eaten dozens of potatoes) and nothing else. It suggests that while kome pr singles out the singular atomic entities out of the denotation of intermediate nouns, kome too does not.

In this section I have presented three puzzles that can be summed up in the following three questions:

- **Puzzle 1**: Why can kome pr not modify plural count nouns, whereas kome too can?
- **Puzzle 2**: Why can kome pr not modify mass nouns, whereas kome too can?
- **Puzzle 3**: Why do kome pr and kome too give rise to different semantic effects when combined with intermediate nouns?

The aforementioned properties of kome pr and kome too are summarized in Table 2. For the sake of completeness I have also presented in Table 2 the properties of kome, too, and pr. Note that pr and too do not differ with respect to the three puzzles described above. Nonetheless, if one assumes that the semantics of kome does not vary with a change of the co-occurring particle, then the observed variations in the behavior of kome pr and kome too must be due to the underlying differences in the semantics of pr and too. The data shows that even though at a first glance pr and too seem alike, they are not. In the next section, I present the proposed analysis of kome, pr, and too.
Table 2: Exclusives in Ga and their interaction with three types of common nouns

<table>
<thead>
<tr>
<th>Type of Common Nouns</th>
<th>kome pE</th>
<th>kome too</th>
<th>kome too pE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 plural count nouns</td>
<td>–</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>2 mass nouns</td>
<td>–</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>3 intermediate nouns</td>
<td>only 1</td>
<td>only</td>
<td>one</td>
</tr>
</tbody>
</table>

5. Analysis

In order to provide solutions to the aforementioned puzzles it is necessary to explain the interaction between common nouns and exclusive particles. The first part of the analysis, the denotations of the common nouns in Ga, was presented in Section 2. The second part of the analysis, the semantics of exclusive particles in Ga, will be presented below. The interaction between the denotations of different types of common nouns and exclusive particles will be discussed in Section 6.

5.1. Basic exclusives in Ga

The idea in a nutshell is as follows. I propose to analyze *kome* as a choice function (CF), *pE* as a non-conservative generalized quantifier, and *too* as a particle that denotes Landman’s (1989) group-forming operator (↑). Furthermore, crucial for the analysis are the scopal relations between the three particles. Whereas *pE* scopes over *kome*, *too* is in the scope of *kome*. The motivation and the details of the analysis are given below.

5.1.1. *Kome*

On close inspection *kome* in isolation is not a real exclusive particle, as indicated by the fact that sentences with *kome* do not obtain exhaustive interpretation. This observation is illustrated by (13). If (13) had contained an exhaustive non-scalar exclusive particle, it would have been judged as infelicitous. Since (13) is judged as felicitous, this suggests that *kome* does not give rise to the exhaustive interpretation.

(13) Kofì kane adafitswawolo kome ke wolo kome nyɛ.
Kofi read newspaper PART and book PART yesterday.
‘Kofi read (one) newspaper and (one) book yesterday.’
#Kofi read only a newspaper and only a book yesterday.
Kome derives from ekome (one) and I argue that in order to obtain the desired semantics for kome and the complex exclusives containing kome (kome pE, kome too, kome too pE), the cardinality one must be built into its denotation. I propose to analyze kome as denoting a restricted CF of type \((\langle e, t \rangle, e)\). It takes as an input a set and returns one element out of this set (of type \(\langle e \rangle\)).

(14) a. A choice function is a function from sets of individuals that picks a unique individual from any non-empty set in its domain (Kratzer, 1998).
   b. The output of the CF must be an atomic element.

Note that in comparison with the definition of CF given by Kratzer (1998), there is an additional requirement imposed on the CF in (14-b). Crucial for my analysis, the output of the function as defined in (14) must be of cardinality one. I also argue that the CF denoted by kome should not be existentially bound, but following Kratzer (1998) and Matthewson (2001) I argue that it should be left for contextual binding.

Sentences with kome can obtain an exclusive interpretation as an effect of the scalar implicature triggered by kome.

(15) Kofi kane adafitswawolo kome nyè.
    K. read newspaper PART yesterday
    ‘Kofi read (one) newspaper yesterday.’

(15) asserts that Kofi read a newspaper yesterday and implicates that he did not read more than one newspaper yesterday.

5.1.2. pE

pE is the most general and the most frequently used exclusive particle in Ga. I propose analyzing it as a non-conservative generalized quantifier. There are two main approaches to modeling the denotation of quantifiers. The first one is a standard, English-like approach that was initiated by Barwise and Cooper (1981). In this approach quantifiers are of type \(\langle \langle e, t \rangle, \langle \langle e, t \rangle, t \rangle \rangle\): they take as an argument an NP of type \(\langle e, t \rangle\) and as a consequence one obtains a QP (generalized quantifier) of type \(\langle \langle e, t \rangle, t \rangle\). The second one is the Salish-like approach that was put forward by Matthewson (2001) as the denotation of quantifiers in St’át’imcets (a Lillooet Salish language spoken in British Columbia, Canada). In this approach quantifiers do not take as an argument an NP of type \(\langle e, t \rangle\) but a DP of type \(\langle e \rangle\) and therefore they are of type \(\langle e, \langle \langle e, t \rangle, t \rangle \rangle\). I am arguing that Ga exclusives can be adequately modeled with the use of a Salish-like approach to quantifiers (5.3). Thus I am claiming that pE takes an argument of type \(\langle e \rangle\) (not of type \(\langle e, t \rangle\)). Therefore, I propose the
following lexical entry for \( pE \):

\[
(16) \quad \llbracket pE \rrbracket = \lambda x\lambda Q.\forall y (Q(y) \rightarrow y = x)
\]

5.1.3. **Too**

Whereas the semantics of \( kome \) and \( pE \), as proposed above, is rather standard for the elements expressing a cardinality one and exclusive particles, the semantics of **too** is non-standard. I propose analyzing **too** (in isolation) not as an exclusive particle but as a particle that denotes Landman’s (1989) group-forming operator ('\( \uparrow \)’), which is a function from sums to atomic group individuals. The denotation of **too** is presented in (17):

\[
(17) \quad \llbracket too \rrbracket = \lambda P.\lambda r. \exists z \in P : r = \uparrow (z)
\]

**Too** is a function of type \( \langle e, t \rangle, \langle e, t \rangle \) that takes all the elements from the NP denotation (all atoms and sums belonging to the given semilattice structure) and maps them onto atomic group individuals. Crucially, there are no sums (plural individuals) in the NP denotation modified by **too**. For illustration, consider (18). The denotation of the intermediate noun **atomo** (**potato** is a full join-semilattice structure that contains all the atomic individuals which are potatoes and all the pluralities formed out of them.

\[
(18) \quad \llbracket atomo \rrbracket = \begin{array}{c}
\oplus \\
\oplus \\
\oplus \\
\end{array}
\]

\[
\begin{array}{c}
a \\
b \\
c \\
\end{array}
\]

**Too**, as defined in (17), maps all individuals (singular and plural) out of the denotation of **atomo** onto atomic group individuals. As a result, one obtains a structure that is comprised of atomic individuals only: pure atoms and impure atoms (groups).
Note that there is nothing in the denotation of *too*, as presented in (17), that would suggest that *too* is an exclusive particle. I am arguing that the exhaustive interpretation of the sentences with *too* (and *kome too*) comes from the covert exhaustive operator *pE* (covert only; see Section 5.3). Note also that some of the native speakers do not like sentences with *too* in isolation (without any further particles). It suggests that *NP too* is still functional and needs another operator in order to be combined with a *VP*. In my analysis *NP too* is type-shifted from ⟨*e, t*⟩ to ⟨*e*⟩ by the *CF* (covert or overt *kome*); see structures (25) and (27).

Summing up, I put forward the following lexical entries for the basic exclusives in Ga:

(20) a. [[kome]] = *CF*
b. [[pE]] = λxλQ∀y(Q(y) → y = x)
c. [[too]] = λP.λr.∃z ∈ P : r =↑ (z)

*Kome* denotes a *CF*, *pE* is a non-conservative generalized quantifier, and *too* is a particle which denotes Landman’s group-forming operator. In fact, only *pE* is a real exclusive particle. The exclusive meaning of *kome* is an effect of the scalar implicature generated by the marked structure, whereas *too* needs overt or covert *pE* in order to express the exhaustive meaning.

5.2. Scopal dependencies

The scopal dependencies between *kome*, *too*, and *pE* follow automatically from their types: *pE* (of type ⟨*e, ⟨*e, t*⟩, t⟩)) scopes over *kome* (of type ⟨⟨*e, t⟩⟩, *e⟩), whereas *too* (of type ⟨⟨*e, t⟩⟩, ⟨*e, t⟩⟩)) is in the scope of *kome*. Their scopal relations are presented schematically in (21):

(21) *pE* (kome (too (NP)))
5.3. Complex exclusives — syntax

There are two ways of modeling the denotation of generalized quantifiers: the English-like approach and the Salish-like approach. As was already written in 5.1.2, I argue that the Salish-like approach (Matthewson, 2001) models Ga data in a more adequate way. Matthewson (2001) claims that generalized quantifiers (both in St’át’ímcet and English) are formed in a two-step procedure. First, the domain of quantification is overtly restricted by the determiner, and then the quantifiers quantify over the parts of the resulting DP. Crucially for the Ga data, determiners in St’át’ímcet are analyzed by Matthewson (2001) as a choice function (CF) of type $\langle e, t, e \rangle$: they take an NP denotation of type $\langle e, t \rangle$ and return an individual of type $e$.

As a consequence, quantifiers in St’át’ímcet are not of type $\langle e, t, e \rangle$, $\langle e \rangle$, $\langle e, t \rangle$ but of type $\langle e, \langle e, t \rangle, e \rangle$:

$$
\begin{array}{c|c|c}
\text{pe} & \text{kome} & \text{too} \\
\hline
\langle e, \langle e, t \rangle, e \rangle & \langle \langle e, t \rangle, \langle e, t \rangle \rangle & \langle e, t \rangle \\
\langle e, t \rangle & \langle e \rangle & \langle e, t \rangle
\end{array}
$$

3 Note, however, that whereas the CF denoted by determiners in Salish is defined for sums (plural individuals), the CF denoted by kome in Ga is defined only for atoms (atomic individuals).

(22)

$$
\begin{array}{c}
\text{QP} \\
\langle e, t \rangle
\end{array}
\begin{array}{c}
\text{Q} \\
\langle e, \langle e, t \rangle, e \rangle
\end{array}
\begin{array}{c}
\text{DP} \\
\langle e \rangle
\end{array}
\begin{array}{c}
\text{D} \\
\langle e, t \rangle
\end{array}
\begin{array}{c}
\text{NP} \\
\langle e, t \rangle
\end{array}
$$

I argue that exclusives in Ga give rise to the same structure. Analogous to St’át’ímcet, the NP denotation is first restricted by the CF denoted by kome, and then the quantifier (pe) quantifies over the resulting DP:

---

3 Note, however, that whereas the CF denoted by determiners in Salish is defined for sums (plural individuals), the CF denoted by kome in Ga is defined only for atoms (atomic individuals).
(23) QP

\[
\langle \langle e, t \rangle, t \rangle \quad \langle e, \langle \langle e, t \rangle, t \rangle \rangle
\]

DP

\[
\langle e \rangle \quad \langle e, \langle e, t \rangle \rangle
\]

NP

\[
\langle e, t \rangle \quad \langle e, t \rangle
\]

atomo kome

\[
\lambda \text{Q}\forall y (Q(y) \rightarrow y = e)
\]

(24) a. \[[\text{atomo}]\] = \(\lambda s.\text{atomo}(s)\)
b. \[[\text{atomo kome}]\] = \([[[\text{kome}]] ([[[\text{atomo}]])]) = f(\lambda s.\text{atomo}(s))\)
c. \[[\text{atomo kome pe}]\] = \([[[\text{pe}]]) ([[[\text{atomo kome}]]) = 
\quad = \lambda r.\lambda Q\forall y (Q(y) \rightarrow y = e) [f(\lambda s.\text{atomo}(s))]\)
\quad = \lambda Q.\forall y (Q(y) \rightarrow y = f(\lambda s.\text{atomo}(s)))

On the other hand, when the NP is modified by \textit{kome too} one obtains the following structure:

(25) DP

\[
\langle e \rangle
\]

MP

\[
\langle e, t \rangle \quad \langle \langle e, t \rangle, e \rangle
\]

D

\[
\langle \langle e, t \rangle, \langle e, t \rangle \rangle \quad \langle e, \langle e, t \rangle \rangle
\]

NP

\[
\langle e, t \rangle \quad \langle e, t \rangle \quad \langle e, t \rangle
\]

MOD

\[
\langle e, \langle e, t \rangle, \langle e, t \rangle \rangle \quad \langle e, t \rangle
\]

atomo too

\[
\lambda \text{Q}\forall y (Q(y) \rightarrow y = e)
\]

(26) a. \[[\text{too}]\] = \(\lambda P.\lambda r.\exists z \in P : r = \uparrow (z)\)
b. \[[\text{atomo too}]\] = \([[[\text{too}]] ([[[\text{atomo}]])]) = 
\quad = \lambda P.\lambda r.\exists z \in P : r = \uparrow (z) [f(\lambda s.\text{atomo}(s))]\)
\quad = \lambda r.\exists z \in [[[\text{atomo}]]) : r = \uparrow (z)\)
c. \text{atomo kome too} = \[[\text{kome}]] ([[[\text{atomo too}]]) = 
\quad = f(\lambda r.\exists z \in [[[\text{atomo}]]) : r = \uparrow (z))
Recall that *kome too* alone does not give rise to the exhaustive interpretation. In 5.1.3 I proposed that the exhaustivity of the sentences with *kome too* comes from the covert *only* operator (pe). I argue that *NP kome too pe* is in fact a full overt spell out of *NP kome too*. Moreover, the scalar implicature triggered by *kome* (in isolation) is canceled when *kome* is part of the complex exclusive *kome too*.

(27) \[
\text{QP} \quad \langle \langle e, t \rangle , t \rangle
\]
\[
\text{DP} \quad \langle e \rangle
\]
\[
\text{Q} \quad \langle e, \langle \langle e, t \rangle , t \rangle \rangle
\]
\[
\text{MP} \quad \langle e, t \rangle
\]
\[
\text{D} \quad \langle e, t \rangle, e
\]
\[
\text{NP} \quad \langle e, t \rangle
\]
\[
\text{MOD} \quad \langle \langle e, t \rangle, \langle e, t \rangle \rangle
\]
\[
\text{atomo} \quad \text{too}
\]
\[
\text{pe}
\]

(28) \[
[[\text{atomo kome too pe}]] = [[\text{pe}]]([[\text{atomo kome too}]]) =
= [[\text{pe}]](f(\lambda r.\exists z \in [[\text{atomo}]] : r = \uparrow (z)))
= [\lambda x.\lambda Q.\forall y(Q(y) \rightarrow y = x)](f(\lambda r.\exists z \in [[\text{atomo}]] : r = \uparrow (z)))
= \lambda Q.\forall y(Q(y) \rightarrow y = f(\lambda r.\exists z \in [[\text{atomo}]] : r = \uparrow (z)))
\]

In this section I presented the syntactic representation of *NP kome pe*, *NP kome too* and *NP kome too pe*. In the next section, I will show solutions to the three puzzles presented in Section 4.

6. Solutions to the puzzles

In section 4 I presented three puzzles arising in connection with the interaction of exclusive particles and common nouns in Ga: (1) the interaction with plural count nouns, (2) the interaction with mass nouns, and (3) the interaction with intermediate nouns. In this section I present the solutions to the three aforementioned puzzles which are based on the analysis presented in sections 2 and 5.
6.1. Interaction with plural count nouns

As was shown in example (10), repeated as (29), *kome pe* cannot modify plural count nouns, whereas *kome too* can:

(29) Priscilla he seii *kome pe √ kome too nyɛ.
    Priscilla bought chairs PART PART yesterday
    ‘Priscilla bought only chairs yesterday.’

*Seii (chairs)* as the plural count noun denotes the following sublattice structure:

\[
[[\text{seii}]] = \begin{array}{ccc}
a \oplus b & & c \oplus d \\
\downarrow & | & \downarrow \\
a \oplus c & & b \oplus e
\end{array}
\]

In *kome pe*, *kome* is in the scope of *pe*. The sublattice structure denoted by *seii (chairs)* comprises only plural individuals. Since the *CF* denoted by *kome* is undefined for plural individuals as output and since in (30) there are no atomic individuals that can be picked up by the *CF* denoted by *kome*, the *CF* denoted by *kome* is undefined for the structure denoted be *seii*. Thus, *seii kome* is ungrammatical and so is *seii kome pe*.

In the case of *kome too*, *too* is in the scope of *kome*. *Too* maps all the plural individuals from the denotation of *seii* to the atomic group individuals and in consequence one obtains the structure in (31):

\[
[[\text{seii too}]] = \begin{array}{ccc}
\uparrow(a \oplus b \oplus c) & & \\
\downarrow & | & \downarrow \\
\uparrow(a \oplus b) & & \uparrow(a \oplus c) & & \uparrow(b \oplus c)
\end{array}
\]

Since the structure denoted by *seii too* is composed of atomic (group) individuals which are available to be picked up by the *CF* denoted by *kome*, *kome too* can modify plural count nouns.
6.2. Interaction with mass nouns

As is illustrated by (11), repeated as (32), mass nouns cannot be modified by \textit{kome p\textepsilon} but they can be modified by \textit{kome too}:

\begin{quote}
(32) Kofi he \textit{y\textepsilon\epsilon} *kome p\textepsilon/ \check{kome too n\textepsilon\epsilon}.
Kofi bought bean PART PART yesterday
‘Kofi bought only beans yesterday.’
\end{quote}

The way of reasoning is analogous to the one in Section 6.1. Mass nouns in Ga denote a full join-semillatice structure without the underlying atomic entities:

\begin{quote}
(33) \[[y\textepsilon\epsilon]] = \begin{tikzpicture}
\node (a) at (0,0) {$a \oplus b \oplus c$};
\node (b) at (1,-1) {$a \oplus b$};
\node (c) at (2,-1) {$a \oplus c$};
\node (d) at (3,-1) {$b \oplus c$};
\node (e) at (0,-2) {$[... ... ...]$};
\draw (a) -- (b);
\draw (a) -- (c);
\draw (a) -- (d);
\end{tikzpicture}
\end{quote}

In \textit{kome p\textepsilon}, \textit{p\textepsilon} scopes over \textit{kome}. The \textit{CF} denoted by \textit{kome} is undefined for mass nouns, because there are no atomic individuals in their denotation that could be picked up by the \textit{CF} denoted by \textit{kome}. \textit{p\textepsilon} scopes over \textit{kome}, and therefore \textit{kome p\textepsilon} cannot modify mass nouns either.

In \textit{kome too}, on the other hand, \textit{too} is in the scope of \textit{kome}. \textit{Too} maps all the plural individuals from the denotation of \textit{y\textepsilon\epsilon} to atomic group individuals:

\begin{quote}
(34) \[[y\textepsilon\epsilon \textit{too}]] = \begin{tikzpicture}
\node (a) at (0,0) {$\uparrow(a \oplus b \oplus c)$};
\node (b) at (1,-1) {$\uparrow(a \oplus b)$};
\node (c) at (2,-1) {$\uparrow(a \oplus c)$};
\node (d) at (3,-1) {$\uparrow(b \oplus c)$};
\node (e) at (0,-2) {$[... ... ...]$};
\draw (a) -- (b);
\draw (a) -- (c);
\draw (a) -- (d);
\end{tikzpicture}
\end{quote}

Since the above structure is composed of atomic (group) individuals, the \textit{CF} denoted by \textit{kome} can pick up any of them. Hence, \textit{kome too} can modify mass nouns.
6.3. Interaction with intermediate nouns

Both kome pe and kome too can modify intermediate nouns but they give rise to different semantic effects (see (12), repeated as (35)). Intermediate nouns with kome pe give rise to the meaning only one NP, whereas intermediate nouns with kome too give rise to the meaning only NP (of unknown cardinality).

(35) Kofi he atomo \( \check{\text{kome pe/}} \check{\text{kome too nyf}} \).
Kofi bought potato PART PART yesterday
‘Kofi bought only 1 potato/only potato(es) yesterday.’

Intermediate nouns in Ga denote a full join-semilattice structure with underlying atomic entities:

(36) \[ [\text{atomo}] = \begin{array}{c}
\text{a} \\
\text{a} \oplus \text{b} \\
\text{a} \oplus \text{c} \\
\text{b} \oplus \text{c} \\
\text{b} \\
\text{a} \oplus \text{b} \oplus \text{c} \\
\end{array} \]

Recall that in the case of kome pe, pe scopes over kome. The above structure contains atomic individuals that can be picked up by the CF denoted by kome. Hence, intermediate nouns can be modified by kome. Note, however, that the CF denoted by kome can pick up from (36) only pure atomic elements of cardinality one (from the bottom layer of the structure). Subsequently, by feeding the denotation of NP kome to the denotation of pe, one obtains the reading as in (35) that Kofi bought only one potato.

On the other hand, when intermediate nouns are modified by kome too, first too maps all the individuals from the denotation of atomo to atomic group individuals:

(37) \[ [\text{atomo too}] = \begin{array}{c}
\uparrow (\text{a} \oplus \text{b} \oplus \text{c}) \\
\uparrow (\text{a} \oplus \text{b}) \\
\uparrow (\text{a} \oplus \text{c}) \\
\uparrow (\text{b} \oplus \text{c}) \\
\text{a} \\
\text{b} \\
\text{c} \\
\end{array} \]
In consequence the above structure contains only atomic individuals. Thus, from such a structure the CF denoted by kome can pick up any individual: a pure atom (an atomic individual of cardinality one) or an impure atom (an atomic group individual of any cardinality). Therefore, it does not follow from (35) — with kome too — how many potatoes Kofi bought. He could have bought one potato but he could have also bought a group of potatoes of unknown cardinality.

The puzzles and solutions to them show that there is an intimate relation between exclusive particles and common nouns in Ga, and it is impossible to understand the semantics of exclusives in Ga without careful examination of their interaction with NP denotations.

7. Conclusions

In this paper it was argued that the standard distinction between count and mass nouns is not a sufficient tool for describing the semantics of common nouns in Ga. I argue that there are three, not two, types of common nouns in Ga: singular and plural count nouns, mass nouns, and intermediate nouns with mixed properties. Moreover, it was shown that one of the main pieces of evidence for the existence of the third intermediate type of noun is its interaction with exclusive particles.

References


A QUD account of German doch*
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Abstract. This paper proposes an analysis of the unfocused and focused discourse particle uses of doch in terms of questions under discussion. The particle doch is analyzed as signaling that a question under discussion was previously closed (i.e. answered or invalidated). Unfocused doch is used to re-answer this previously closed QUD in the same way as before; focused doch is used to re-answer this previously closed QUD in a new way. This account works for both contrastive and non-contrastive uses of doch. Even though, unlike most previous accounts, the analysis is not built directly on the notion of contrast, the relevant intuitions can be recovered from the account via highlighting. The formalism further allows us to distinguish two distinct flavors of contrast, where they arise. One type of contrast arises through propositional contrast between the sentence containing doch and a highlighted alternative. The other type of contrast arises through the switching of the QUD-answer (focused doch).

Keywords: question under discussion, doch, discourse particle, highlighting, proposal

1. Introduction

The analysis presented here unifies several use cases of the particle doch and provides a single meaning of doch in terms of questions under discussion — QUDs for short. By doing so, we situate the particle doch within the larger picture of QUD-navigating/QUD-negotiating discourse particles (McCready (2006); Eckardt (2007); Beaver and Clark (2008); Davis (2009); Kratzer and Matthewson (2009); Rojas-Esponda (2013, 2014)). The idea is that people communicate more effectively when they understand each other’s goals and strategy of inquiry. Intonation and discourse particles play an important role in the interactive coordination and negotiation of goals and QUDs (Roberts (1998); Büring (1999); Büring (2003); Rojas-Esponda (2013)). Discourse particles are employed particularly in unexpected or marked moves, where they prevent confusion and facilitate processing. For example, it follows from my account that the use of the particle doch is used to indicate a violation of the Maxim of Inquisitive Sincerity (Groenendijk and Roelofsen (2009)), which says that one should not raise a question if one knows the answer. More generally, through the existence of certain discourse particles but not others, we stand to learn something about what are the most felicitous or unmarked conversational moves.

A number of analyses of the German discourse particle doch analyze doch as signaling or presupposing an incompatibility at the propositional level (Grosz (2010); Egg and Zimmermann (2011); Abraham (1991); Bárány (2009); Doherty (1985); Örnelius-Sandblom (1997)). The idea is roughly that, in response to a proposition \( q \), one can utter \( doch(p) \) if \( p \) and \( q \) are incompatible.

*For helpful discussions, I thank Cleo Condoravdi, Donka Farkas, Jeroen Groenendijk, Dan Lassiter, and Floris Roelofsen, as well as the Stanford Semprag group and the audience and reviewers of Sinn und Bedeutung 18. Special thanks to Chris Potts.
The different accounts make distinct claims as to the status of the utterance \( q \), in some cases requiring it to be explicit (e.g. Egg and Zimmermann (2011)), in others allowing it to be merely salient in context (e.g. Grosz (2010)). However, it has been argued (Karagjosova (2004a, 2009)) and I argue in this paper, that propositional contrast, whether with an explicit or a salient proposition, need not arise. I will argue that these non-contrastive examples\(^1\) can be accounted for, along with the contrastive ones, by analyzing \textit{doch} as signaling that a question under discussion was previously closed. Karagjosova (2009) treats unfocused \textit{doch} as ambiguous between a reading with propositional contrast and a type of reminder reading, where the speaker signals a discrepancy between what he took the addressee to know and what the addressee seems to know. The QUD analysis proposed in this paper allows a treatment of unfocused and focused \textit{doch} that covers contrastive and non-contrastive cases, but does not require a stipulation of ambiguity. The various cases identified in Karagjosova (2009) fall out from the QUD analysis in conjunction with highlighting (Roelofsen and Van Gool (2010); Farkas and Roelofsen (2012)).

2. The uses of \textit{doch}

This paper deals with middle-field unaccented and accented \textit{doch}. In other words, it deals with what has been identified as the discourse particle uses of \textit{doch}. This means that I will not consider the uses of \textit{doch} as an answer particle. An answer particle use of \textit{doch} is shown below:

\begin{verbatim}
A: Kennst du ihn nicht?                     A: Don’t you know him? \\
B: DOCH.                                 B: Yes/I DO.
\end{verbatim}

(C1)

Since the answer particle \textit{doch} can be used in isolation, it must have truth-conditional import. The discourse particle uses of \textit{doch}, on the other hand, do not affect the truth conditions of the utterances they occur in. Therefore, I consider the discourse particle uses of \textit{doch} separately. For an analysis of the answer particle use of \textit{doch}, see Karagjosova (2006) or Krifka (2013).

2.1. The use of unfocused \textit{doch}

Conversation (C2) shows a fairly common use of unfocused \textit{doch}. The host utterance of \textit{doch} is incompatible with a salient proposition from the context, in this case the mentioned alternative of interlocutor B’s question.

\(^1\)Karagjosova (2009) calls all the examples contrastive. However, Karagjosova writes that, for some uses of unfocused \textit{doch}, the contrast lies just between what the speaker took the addressee to know and what the addressee seems to remember. I call these uses non-contrastive, as they lack propositional contrast.
A: Nadine ist in Italien.  
   [Some time later:]  

B: Geht Nadine heute Abend mit uns tanzen?  

   ‘No. You know Nadine is in Italy.’ 

(C2)

In (C2), A makes it known on Monday that Nadine is in Italy. A little later, B asks A if Nadine is going dancing with them. The option that B mentions in his polar question $Q = \{q, \neg q\}$ is the option $q = \text{Nadine is going dancing}$. The proposition $p = \text{Nadine is in Italy}$ is incompatible with $q$, under most normal circumstances. With her answer to B’s question, A conveys that $p$ was shared knowledge.

Example (C3) is of the same kind as (C2), in that the host utterance of doch contrasts with a salient proposition from the context.

A: Hat Peter die Suppe selbst gekocht?  
B: (Nein.) Peter kann doch nicht kochen.  
   ‘But remember Peter can’t cook.’

(C3)

In example (C3), speaker A asks a polar question that gives rise to two possibilities. One possibility is that Peter cooked the soup himself, the other possibility is that he didn’t. In formulating her question, speaker A chose to mention the positive possibility, i.e. that Peter cooked the soup himself. This mentioned possibility contrasts with the proposition that Peter cannot cook. That is, under some fairly common assumptions, the proposition that B cooked the soup himself is incompatible with B not being able to cook. In addition, by using doch, speaker B signals that she took the fact that Peter does not cook to be in the common ground.

What possibility is mentioned in a question has important discourse effects (Roelofsen et al. (2013)). The mentioned possibility is also referred to as the highlighted possibility. See Roelofsen and Van Gool (2010); Farkas and Roelofsen (2012) for an explanation of highlighting. For the purposes of this paper, it will suffice to know that the mentioned alternative in a polar question $\{p, \neg p\}$ is the highlighted alternative. For instance, in the question Is Lisa in her office? the alternative that Lisa is in her office is highlighted, while the alternative that she is not in her office is lowlighted.

In conversation (C4) below, the host utterance of doch is incompatible with the presupposition of the definite description in A’s question.
A: Ist der König von Frankreich hier?  
B: (Nein.) Frankreich hat doch keinen König.  

In conversation (C4), the question asked by A presupposes $q = \text{There is a king of France}$. B replies with $\text{doch}(p)$, where $p = \text{France has no king}$. The proposition $p$ from the utterance $\text{doch}(p)$ contrasts with the presupposition $q$ of A’s question, in the sense that they cannot both be true at the same time. As in (C2) and (C3), the $\text{doch}$ utterance in (C4) signals that the proposition that there is no king was already in the common ground (or rather that B thought it was already in the common ground).

Contrastiveness accounts of $\text{doch}$ are primarily based on contrastive-looking examples of the kind shown in (C2) to (C4). Grosz (2010), for instance, analyzes $\text{doch}$ as follows:

[simplified from Grosz (2010)]

1. $\text{doch}(p)$ is defined in a context $c$ if the speaker takes $p$ to be firmly established and assumes it is safe to discard $\neg p$.
2. There is a contextually salient proposition $q$, such that
   a. $q$ is a focus alternative of $p$
   b. the current context $c$ entails $\neg(p \land q)$

If defined, the denotation of $\text{doch}(p)$ equals the denotation of $p$.

For examples (C2) to (C4), the analysis of Grosz (2010) seems viable (though see the additional distributional requirements in 3.2 later). However, it turns out that we can turn each of the examples above into a non-contrastive one that is still felicitous. Below is a non-contrastive conversation based on (C3). This time, the proposition containing $\text{doch}$ is compatible with the mentioned alternative of A’s question.

A: Hat Peter die Suppe selbst gekocht?  
B: (Ja.) Peter hat doch den ganzen Abend daran gearbeitet.  

The mentioned alternative of A’s question is that Peter cooked the soup himself. B’s reply, that Peter worked on the soup all evening, is compatible with this mentioned alternative. What is conveyed by the use of $\text{doch}$ here is that the content of B’s utterance was commonly known. In other words, A’s question was superfluous, as the answer to it was known. Below is a minimal pair showing contrastive and non-contrastive uses of $\text{doch}$ side by side.
A: Kommst du mit in die Oper?
B: Nein, ich habe doch abgesagt. / Ja, ich habe doch zugesagt.

After A asks B whether she is joining them for the opera, B can felicitously respond with Yes, I *doch* confirmed or No, I *doch* canceled. That is, *doch* can be used in an utterance that is compatible with the highlighted alternative of the question and one that is incompatible with it. Both answers convey that the content of the *doch* utterance is common knowledge, but only the first answer is in contrast with the mentioned alternative in A’s question.

What then ties all the examples in this subsection together? In each case, the last speaker asserts *doch* (*p*), where *p* is such that it settles A’s question and where *p* is shared knowledge. But if *p* is shared knowledge, then this suggests that A’s question was solved before *Q* came up. For instance, in both cases in (C6), we can say that unfocused *doch* signals that the question *Q* asked by A was previously resolved.

2.2. The use of focused *doch*

Focused *doch* differs in a number of ways from its unfocused counterpart. For instance, when *doch* is focused, it does not signal shared knowledge. This is evidenced by the fact that one can use it in a question such as the following:

A: Habe ich dir schon gesagt, dass ich DOCH mitkomme?

This use of *doch* above is only felicitous if A had previously conveyed to the addressee that she would not be joining. The utterance with *doch* presents a revision of this previous information, and so constitutes new information rather than shared knowledge. The revision of previous information or a previous expectation is visible more explicitly in the following example:

A: Ist Anna zu deiner Geburtstagsparty gekommen?
B: Zuerst hat sie abgesagt, aber dann ist sie DOCH gekommen.

In conversation (C8), the first clause about canceling sets up the expectation that the question of Anna’s attendance will be resolved in the negative. The clause with *doch* changes this and resolves the question in the positive, i.e. conveys that Anna attended the party. Conversations (C7) and (C8) have in common that a question was previously resolved, and is then resolved in a new way. In (C7) the question of whether or not A is joining was previously resolved in the negative, and is now being resolved in the positive. In (C8), the question of whether or not Anna attended the party is first resolved (or at least biased towards) the negative, and then resolved positively. That the first
clause in (C8) is akin to a resolution of the question can be seen when we remove the second part of the utterance:

A: Ist Anna zu deiner Geburtstagsparty gekommen?  
B: Sie hat abgesagt.

A: Did Anna go to your birthday party?  
B: She canceled.  

(C9)

2.3. Summary and preview

I showed in 2.1 that unfocused *doch* signals shared/old knowledge and also signals that the question brought up by the other interlocutor was previously resolved. In section 2.2, I argued that focused *doch* conveys new/unshared knowledge, but that just like unfocused *doch*, it conveys that the question asked by the other interlocutor was previously resolved.

There are a number of finer-grained observations about the differences between unfocused and focused *doch*, which I will discuss in 3.2 after introducing the question formalism to be used.

In 4.2, we will touch on how to naturally expand the cases we have studied here, which all involved an explicit question, to cases where the utterances are all declaratives. This will involve the notion of proposal (Groenendijk and Roelofsen (2009); Farkas and Roelofsen (2012)).

3. The proposed analysis

3.1. Informal discussion

As mentioned in section 2, contrastiveness accounts analyze a proposition *doch*(*p*) as contrasting with or challenging a salient proposition *q*. This approach causes problems for non-contrastive uses of *doch* (see (C6)). I propose that an utterance *doch*(*p*) does not challenge a proposition, but instead challenges a question under discussion. This allows us to make sense of (C6). Whether B confirmed the opera visit or canceled, B’s *doch* utterance indicates that the question of whether or not B will attend was already settled before, i.e. closed. In one case, B answers that she confirmed the visit and indicates that this was previously known. In the other case, B answers that she canceled the visit and that this was already previously known. In both cases, the answer to the question of whether or not B would attend was known and so the question closed. Having a particle that signals that a question was closed is empirical support for the Maxim of Inquisitive Sincerity (Groenendijk and Roelofsen (2009)).

2The most direct application of this maxim occurs when we have an explicitly given question. In section 4.2, I explain how we can apply this maxim when we have only declaratives, by using the concept of proposal (Groenendijk and Roelofsen (2009); Farkas and Roelofsen (2012)).
If $\phi$ is a question, then the speaker [of that question] is, under normal circumstances, expected not to know the complete answer to that question. We will refer to this requirement as *inquisitive sincerity*.

If discourse particles signal moves in conversation, these should tend to be surprising or unconventional moves. It therefore seems natural that there is a particle, namely *doch*, that signals a breach of this maxim. Groenendijk and Roelofsen (2009) provide a caveat for the requirement of inquisitive sincerity: ‘It should be emphasized that inquisitive sincerity cannot be assumed in all circumstances. For instance, if $\phi$ is a rhetorical question or an exam question, it is not supposed to be inquisitive in the information state of the speaker [...]’ Interestingly, when answering exam questions, it would not be felicitous to use the particle *doch* to indicate that the writer of the exam question already knew the answer to the question.

As shown in section 2, there are important differences between the unfocused and focused versions of *doch*. One very important difference was that unfocused *doch* signals shared/known knowledge whereas focused *doch* signals unshared/new knowledge. I claim that unfocused *doch* is used to signal that a previously closed question is being re-answered in the same way as before; and that focused *doch* is used to signal that a previously closed question is being re-answered in a different way from before. In (C2), the question of whether or not Nadine would go dancing was previously settled in the negative. B indicates that Nadine is in Italy, thereby recalling what she thought was the previous resolution of the question. In (C7), on the other hand, B’s use of focused *doch* is felicitous only if A and B previously had the understanding that A would not join, and A is now revising this previous answer to a different answer, namely that he is coming along. This intuitive description is formalized and refined in 3.2.

3.2. Formal analysis

We are now ready for a formal analysis of *doch*. As the proposed analysis will involve questions under discussion, it will be practical to fix a question formalism to facilitate the discussion that is to follow.\(^3\)

Take a question $Q$ to be a symmetric and transitive binary relation on the set of worlds $W$. This corresponds to what Groenendijk and Stokhof (1984) call a *question relativized to an information set*, or later a *structured context* (Groenendijk (1999)). In the left picture, we have an example of a symmetric, transitive, reflexive binary relation, i.e. a partition of the entire world set $W$. In the right picture, there is a presupposition that the king of France exists. Thus, the relation is symmetric and transitive, but not reflexive, which corresponds to a partition on a proper subset of $W$.

\(^3\)There is no a priori reason for this choice of question formalism. The important thing is that we can represent presuppositions.
Let the presupposition of $Q$ be $\hat{Q} \equiv \{ v \in W | \langle v, v \rangle \in Q \}$. The question $Q$ gives rise to a partition of $W$ into cells

$$c_Q(w) = \begin{cases} 
\{ v \in W | \langle v, w \rangle \in Q \} & \text{if } w \in \hat{Q} \\
W \setminus \hat{Q} & \text{otherwise}
\end{cases}$$

Suppose $Q$ is the current QUD and $C \subseteq W$ is the common ground before update by $Q$ or answers to $Q$, where $C$ is from the perspective of the speaker of the doch utterance. Then the meaning component common to both focused and unfocused doch is provided below:

doche marks the current QUD $Q$ as previously closed in one of the following ways:

1. signals $Q$ was previously resolved ($C$ is contained within a single cell of $Q$)

$$\forall v, w \in W, (v \in C \land w \in C) \rightarrow \langle v, w \rangle \in Q$$

2. signals $Q$ was previously shown invalid (the presupposition of $Q$ does not hold)

$$C \cap \hat{Q} = \emptyset$$

In cases 1 and 2 of (B1), the QUD is closed because the common ground $C$ is contained in some individual cell $c_Q(w)$ for some $w \in W$. The difference is that in case 1 the cell pertained to the question proper, and in case 2 it was the cell corresponding to the excluded worlds, i.e. the set $W \setminus \hat{Q}$ on which the question is undefined, or equivalently where the presupposition does not hold true. These two cases are illustrated in figure 2 below:

So far, we have captured the core meaning of doch that is shared by both the unfocused and focused versions. But, as described in section 2, there are also some important differences between the unfocused and focused uses of doch. Roughly speaking, the difference is the following:
• Unfocused \textit{doch}(p) is used when a closed QUD gets re-answered in the same way as before.

• Focused \textit{DOCH}(p) is used when a closed QUD is re-answered in a new/different way.

We will formalize what we mean by ‘re-answering in the same way/in a different way.’ But before we do so, there are some additional restrictions with respect to answerhood that must be discussed. For instance, unfocused \textit{doch} is barred from direct answers to polar questions (that is, answers that pick out exactly one of the two cells of the question proper):

\begin{align*}
A: & \text{ Studiert Juliane in Berlin?} & A: & \text{ Does Juliane study in Berlin?} \\
B: & \# Ja, Juliane studiert \textit{doch} in Berlin. & B: & \# Yes, Juliane studies \textit{doch} in Berlin. \quad (C10)
\end{align*}

On the other hand, focused \textit{doch} is permitted in a direct answer to the same polar question. Speaker B can answer in the fashion below, using focused \textit{doch}, as long as A and B previously had the understanding that Juliane did \textit{not} study in Berlin.

\begin{align*}
A: & \text{ Studiert Juliane in Berlin?} & A: & \text{ Does Juliane study in Berlin?} \\
B: & \text{ Ja, Juliane studiert \textit{DOCH} in Berlin.} & B: & \text{ Yes, Juliane studies \textit{DOCH} in Berlin.} \quad (C11)
\end{align*}

Unfocused and focused \textit{doch} also differ with respect to whether they can be used in partial answers and in over-informative answers. Unfocused \textit{doch} cannot be used in partial answers to a question. It can also not be used in a direct, full answer to a question. The use of unfocused \textit{doch} only becomes felicitous once the response is turned into an over-answer, i.e. a proposition that picks out a proper subset of a question cell.

\begin{align*}
A: & \text{ Wer hat meinen Apfel gegessen?} & A: & \text{ Who ate my apple?} \\
B: & \# Susie oder Anna haben \textit{ihn} \textit{doch} gegessen. & B: & \# Susie or Anna ate it \textit{doch}. \quad (C12)
\end{align*}

\begin{align*}
B: & \# \text{ Susie hat \textit{ihn} \textit{doch} gegessen.} & B: & \# \text{ Susie ate it \textit{doch}.} \\
B: & \text{ Susie hat \textit{ihn} \textit{doch} gestern/vor deinen Augen/zum Frühstück gegessen.} & B: & \text{ Susie ate it \textit{doch} yesterday/in front of your eyes/for breakfast.}
\end{align*}

Focused \textit{doch} on the other hand, can only be used to pick out entire cells (that is, be used in propositions that correspond to unions of full cells of the question). It can be used in partial answers (i.e. answers that correspond to the union of at least two cells of the question):

\begin{align*}
A: & \text{ Wer kommt mit auf den Ausflug?} & A: & \text{ Who is coming to the excursion?} \\
B: & \text{ Susie \textit{kommt DOCH} \textit{nicht}.} & B: & \text{ Susie is \textit{DOCH} not coming.} \quad (C13)
\end{align*}

These types of observations are intimately linked with how the particle \textit{doch} engages the question under discussion.

The meaning components on which unfocused and focused \textit{doch} differ are given in (B2) below:
1. Unfocused $doch(p)$ is used when the cell containing $C$ properly contains $p$:

$$\forall w \in C [C \subseteq c_{Q}(w) \land p \subseteq c_{Q}(w)].$$

2. Focused $DOCH(p)$ is used when $C$ and $p$ pick out different cells:

$$p = \bigcup_{w \in S \subset \hat{Q}} c_{Q}(w) \text{ and } C \cap p = \emptyset.$$ 

(B2)

Suppose $C$, the common ground before $Q$ was re-raised, is contained within a single cell $c_{Q}(w)$ for some $w$. This means that the common ground before the re-raising of $Q$ was contained in either one of the cells of $Q$ proper, or that it was contained in the set of worlds on which $Q$ is not defined. Then unfocused $doch(p)$ is used when $p$ is properly contained in in $c_{Q}(w)$. Now, for the second case, suppose $p$ is either a direct full answer or a partial answer to $Q$. This means $p$ is a union of cells of the form $c_{Q}(w)$. Focused $doch$ is used when $p$ and $C$ are disjoint.

4. Some ramifications and further discussion

4.1. Correct predictions

According to the analysis in 3.2, unfocused $doch$ is used to re-answer a QUD in the same way. This is captured by (B1) along with (B2) part 1, by the fact that the common ground $C$ before update by the new QUD is contained in the same question cell as the statement $p$ from $doch(p)$. This is illustrated pictorially below, on the left for the case that $C$ is a cell of the question proper, on the right for the case that $C$ is contained in the complement $W \setminus \hat{Q}$.

![Diagram](image)

That $C$ and $p$ are contained in the same cell correctly predicts that there is a tendency for unfocused $doch$ to convey shared knowledge of its argument/target proposition (this would correspond to the case when the proposition $p$ is not just contained in the same question cell as $C$, but when $p$ is actually contained in $C$). However, it’s useful that this does not predict $p$ is always in the common ground. Consider the conversation below:
A: Kommt Jan mit auf die Wanderung?
A: Is Jan coming along for the hike?
B: Nein, er kann doch mit seinem schlechten Bein nicht so weit laufen.
B: No, he can *doch* not walk so far with his bad leg.

B’s utterance in (C14) is felicitous even if A did not know that Jan’s leg prevented him from walking far. For instance, it would be felicitous in a context where A knew that Jan had a bad leg, but did not know that this caused him problems for walking. This echoes a similar observation made about the German particle *ja*. Many analyses of *ja* claim that *ja*(*p*) signals that *p* is common knowledge (Helbig (1988); Franck (1980); Kaufmann (in preparation), among others), but Kratzer and Matthewson (2009) argue that the proper analysis has to do with whether or not *p* is on the table for discussion, rather than whether *p* is in the common ground.

The account in 3.2 analyzes focused *doch* as signaling the re-answering of a previously closed question in a new way. This is accounted for in (B1) and (B2) part 2, which requires *p* and *C* to pick out different cells. This is illustrated pictorially in figure 4 below:

\[
W = \hat{Q} \\
| p \subset cell_l | C | cell_r \supset C 
\]

Fig. 4

As mentioned before, *C* is the context set before update by *Q* and answers to *Q*, and *doch*(*p*) is uttered after *Q* is re-raised. Thus, as *C* and *p* are disjoint, the analysis predicts that focused *doch* does not have a shared knowledge component.

The analysis in 3.2 (in particular, (B2)) captures that unfocused *doch* can only be used in over-informative full answers. That is, answers that provide all the information to resolve a question fully, and some additional information (this corresponds to picking out a proper subset of a single cell of the question). It also captures that focused *doch* can only be used in answers corresponding to one or more full cells of the QUD. This is desirable in view of examples (C12) and (C13).

In cases where contrastiveness arises, the intuition can be recovered from the QUD account: namely, these are the cases where the *doch* utterance is incompatible with the highlighted alternative of the QUD. The rest of this subsection shows how different contrastiveness cases can be distinguished and recovered (see Karagjosova (2004b, 2009) for comprehensive discussions of the use cases of *doch*). Examples (a) through (f) illustrate two types of contrastiveness that can arise:

**propositional contrast**

The highlighted cell differs from the cell containing *p*. This can be seen in examples (a), (b) and (c) below.
**switch contrast**

The cells containing $C$ and $p$ are different (meaning that a question that was resolved one way is resolved in a new way via $p$). This is exemplified in examples (c) and (f) below, and generally all cases of focused *doch*.

---

**Unfocused**

(a) $W = \hat{Q}$

<table>
<thead>
<tr>
<th>cell$_l$</th>
<th>cell$_r$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$C$</td>
<td></td>
</tr>
</tbody>
</table>

**Focused**

(b) $W \supset \text{presupposition } \hat{Q}$

<table>
<thead>
<tr>
<th>cell$_l$</th>
<th>cell$_r$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$C$</td>
<td></td>
</tr>
</tbody>
</table>

(c) $W = \hat{Q}$

<table>
<thead>
<tr>
<th>cell$_l$</th>
<th>cell$_r$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$C$</td>
<td></td>
</tr>
</tbody>
</table>

**Examples**

A: *Hast Du das selbst gekocht?* ← $Q$
Did you cook this yourself?

B: *(Nein.) Ich kann doch nicht kochen.* ← $p$
(No.) I can *doch* not cook.

A: *Ist der König von Frankreich hier?*  
Is the King of France here?

B: *(Nein.) Frankreich hat doch keinen König.*  
(No.) France has *doch* no king.

A: *[Holst du mich ab?]*  
[Are you picking me up?]

B: *Es tut mir leid. Ich kann dich DOCH nicht abholen.*  
I am sorry. I can *DOCH* not pick you up.

---

The pictures in figure 5 above show the highlighted (mentioned) cells of the questions with bold lines. They also show the common ground $C$ (from the perspective of the speaker) before update by the current QUD and any answers to it. Lastly, they indicate which cell contains the proposition $p$ from the utterance *doch*($p$). In (a) and (b), $C$ and $p$ are contained in the same cell. This is always the case for unfocused *doch*. In (c), $C$ and $p$ are in different cells, as is always the case for focused *doch*.

Examples (a) and (b) exhibit propositional contrast whereas (c) exhibits switch contrast, because it involves the switching of an answer to a question to a different answer.
In examples (d) and (e) of figure 6 the highlighted cell corresponds to the cell that contains the proposition \( p \) from the utterance \( \text{doch}(p) \). Conversations (d) and (e) are examples of unfocused \( \text{doch} \), so the cell containing \( C \) is the same cell that contains \( p \). Thus, as always is the case for unfocused \( \text{doch} \), there is no switch contrast in (d) and (e). Furthermore, since in (d) and (e) the highlighted cell corresponds to the cell containing \( p \), there is no propositional contrast in (d) and (e) either. In example (f), there is no propositional contrast, but there is switch contrast. Switch contrast occurs in every instance of focused \( \text{doch} \). Figure 7 below summarizes the above data. It shows us that the two examples without any type of contrast are examples (d) and (e).

<table>
<thead>
<tr>
<th>example</th>
<th>focus</th>
<th>propositional contrast</th>
<th>switch contrast</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a)</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>(b)</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>(c)</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>(d)</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>(e)</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>(f)</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Figure 7
4.2. Questions and proposals

In 4.1, we saw examples of *doch* in question-answer discourse. In dialogues where the initial
utterance is a proposition instead of a question, we view this proposition as a *proposal* in the
sense of Farkas and Roelofsen (2012). According to Farkas and Roelofsen (2012) (who build on
Groenendijk and Roelofsen (2009)), the utterance of a proposition \( p \) has two effects. The first
is that the issue of whether or not \( p \) holds, i.e. \( \{p, \neg p\} \) is put on the conversational table. The second
is that the proposition \( p \) is offered as a solution of this issue of whether or not \( p \).

In (C15), speaker A makes the proposal \( q = \text{Sabine went jogging this morning} \) and raises the issue
\( Q = \{q, \neg q\} \). The use of *doch* in *doch*(\( p \)) signals that this issue was already previously resolved,
and that \( p \) then resolves it again in the same way (see 3.2). In (C15), \( p \) is incompatible with \( q = \text{Sabine woke up at 3pm} \). In other words, under normal circumstances, \( \neg (p \land q) \) holds. Thus, this
example exhibits propositional contrast.

\[
\begin{align*}
\text{A: } & \text{Sabine ist heute Morgen joggen gegangen.} \\
\text{B: } & \text{Sabine ist doch um drei Uhr heute Nachmittag aufgewacht.}
\end{align*}
\]

\( (C15) \)

In (C16), speaker A makes a proposal \( q = \text{Sabine went jogging this morning} \) and raises the issue
\( Q = \{q, \neg q\} \). Again, the use of *doch* in *doch*(\( p \)) signals that the issue was already previously resolved
and is being resolved again, in the same way. This time, the proposition \( p = \text{Sabine goes jogging every morning} \) is compatible with \( q \). Here, \( p \) and \( q \) are compatible; what speaker B
signals with the use of *doch* is that the issue \( Q \) was already previously resolved. In other words,
the utterance of A is signaled as superfluous or unnecessary. Here, no propositional contrast arises
(and no switch contrast can arise either, as this is a use of unfocused *doch*).

\[
\begin{align*}
\text{A: } & \text{Sabine ist heute Morgen joggen gegangen.} \\
\text{B: } & \text{Sabine geht doch jeden Morgen joggen.}
\end{align*}
\]

\( (C16) \)

\footnote{This might be a more flexible interpretation of *proposal* than the cited authors intended. For instance, Groenendijk and Roelofsen (2009) write: ‘Purely informative, non-inquisitive propositions do not invite other participants to choose between different alternatives. But still, they are proposals. They do not automatically establish a change of the common ground.’ The main point here is that the notion of proposal, or some generalization thereof, allows us to make sense of the proposed QUD analysis of *doch* in the absence of explicit questions.}
4.3. Focused *doch* and its triggers

The use of focused *doch* becomes particularly felicitous and easy to process when the previous (and different) resolution of the QUD is explicitly provided. An example is given by (C8), where the first clause of B’s answer essentially acts like a negative answer to A’s question (see (C9)) which is then revised in the clause containing focused *doch*.

Another frequent use of the focused particle *doch* occurs after negative statements or questions. Such uses are particularly good because, as in (C8), they provide an explicit bias towards a different answer to the QUD which then can be overwritten with focused *doch*.

A: Anna hat gesagt, sie kommt nicht zu dem Treffen. A: Anna said she won’t come to the meeting.
B: Ich glaube, sie kommt DOCH. B: I think she will come DOCH.

(C17)

In conversation (C17), A expresses that Anna said she won’t go to the meeting. That is, A is skewing the question of whether or not Anna will attend towards a negative answer. B’s reply then indicates that he thinks the answer is another one, namely that Anna will attend. Interestingly, B’s answer can be taken to convey not only that Anna will attend, but that Anna somehow changed her mind. That is, as in the examples in section 2.2, the change of question resolution conveyed by *doch* can have nontrivial extent over the time dimension. This is worth comparing with the answer particle use of focused *doch*, which we have left aside in this paper:

B: DOCH. B: DOCH.

(C18)

While in (C17) the utterance with the focused discourse particle *doch* can convey that Anna changed her mind, B’s reply in (C18), consisting of the answer particle *doch*, cannot convey that Anna changed her mind or that there has been a change over time in the resolution of the question of Anna’s attendance.

This seems to be a more general pattern: The focused particle *doch* (in the middle field) can be used to convey a re-settling of a question that extends over time (though it need not necessarily do so), whereas the answer particle *doch* appears to be restricted to concurrent disagreement that is simultaneous with the other answer resolution offered. This suggests, in addition to the arguments in section 2, that it is useful to consider the answer particle uses of *doch* separately from the discourse particle uses of *doch*.

However, a curious counter-example to the generalization just offered is given by the ‘agreeing’ use of *DOCH*, discussed in Karagjosova (2006). Below is the example from Karagjosova (2006), slightly adapted:

I thank Jeroen Groenendijk for a helpful discussion regarding some of the examples in this subsection.

---

5I thank Jeroen Groenendijk for a helpful discussion regarding some of the examples in this subsection.
A: Das war sehr freundlich von Arndt.
B: DOCH, das muss man sagen.

In conversation (C19), the use of doch by speaker B conveys that the speaker previously held another opinion regarding Arndt’s friendliness, and that this was known amongst both A and B. The utterance with doch, namely agreeing that Arndt is nice, represents a revision of this former position. This is therefore a counterexample to the tendency of the answer particle to behave as in (C18), where the change of question resolution must be construed as having no extent over time.

5. Conclusion

In this paper I argued for a QUD-based account of the German discourse particle doch. By characterizing doch as signaling the closedness of a QUD, this analysis brings together contrastive and non-contrastive uses of doch under one umbrella. Furthermore, the meanings provided for unfocused and focused doch are complementary in the following way: taking up any question for the second time will necessarily result in one of two cases. Either the answer matches the original resolution, or it doesn’t. The focused and unfocused variants of doch are thus two sides of the same coin. That the focused variant corresponds to the new resolution of the question (as opposed to the resolution that re-answers in the same way) is in line with the tendency of focused material corresponding to new material (Schwarzschild (1999)).

The particle doch fits within the larger picture of particles as signaling special moves in conversation (McCready (2006); Eckardt (2007); Beaver and Clark (2008); Davis (2009); Rojas-Esponda (2013, 2014)). Signaling conversational moves explicitly is especially useful when the moves are marked or unexpected. For instance, the German particle überhaupt can be used when an interlocutor deviates from a sequence of questions asked and shortcuts directly to answering or invalidating a higher question (Rojas-Esponda (2014)). The unfocused particle noch in declaratives can be used to add an additional element to a list of positive answers (Eckardt (2007)), overwriting an expectation of exhaustivity. The German particle ja and the St’át’imcets particle qa7, according to Kratzer and Matthewson (2009), signal that the proposition p in ja(p) or qa7(p) is not considered on the table for discussion, which seems to go against the expectation that people will not state material that is already uncontroversial. The particle doch is used when there is a breach of the Maxim of Inquisitive Sincerity (Groenendijk and Roelofsen (2009); see also the Maxim of Interactive Sincerity in Coppock and Brochhagen (2013)).

By studying particles like doch and the discourse moves they signal, we can learn more about how interlocutors negotiate and align their views of the conversation. For this reason, discourse particles provide a unique glimpse into pragmatics in action.
References


On the context-dependent pragmatic strategies of Japanese self-diminutive shift
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Abstract. In Japanese, the phonological shift from [s] to [ts] triggers an implicature that “a speaker is uttering like a baby” and, depending on context, it can further induce the speaker’s emotion of (i) solidarity or (ii) emotional dependence. I argue that the Japanese diminutive shift shifts the speaker’s degree of maturity to the bottom at the level of conventional implicature (CI) and that the speaker’s emotion is determined by to whom the sentence is uttered. If the addressee is an adult, the diminutive shift triggers an emotion of dependency, while if the addressee is a baby, the diminutive shift triggers an emotion of solidarity. This paper shows that there is a type, “interpersonal expressive,” whose emotive meanings are dependent on the hearer.

Keywords: Diminutive shift, context dependency, solidarity, emotional dependency, conventional implicature

1. Introduction

Studies of child language acquisition have shown that, in the early stages of acquisition of Japanese as a first language, babies have a tendency to pronounce [ts] (or [tʃ]) instead of [s] (e.g., Murata 1970). Interestingly, this phonological error committed by babies has been conventionalized in adult grammar as a device for creating a flavor of baby talk (e.g., Okazaki and Minami 2011). For example, when the performative honorific suffix desu in (1a) (Harada 1976; Potts and Kawahara 2005) becomes dechu, as in (1b), the sentence implies that the speaker is talking to the addressee in a polite way and that the speaker is behaving like a baby:

(1)  a. Kore-wa boku-no hon-desu.  (Normal polite speech)
    This-TOP I-GEN book-PERF.HON
    At-issue: This is my book.
    Implicature: I am talking to you in a polite way.

    b. Kore-wa boku-no hon-dechu.  (Baby polite speech)
    This-TOP I-GEN book-PERF.HON.DIM
    At-issue: This is my book.
    Implicature: I am talking to you in a polite way ∧ I am talking to you like a baby.

* I am very grateful to Karlos Arregi, Todor Koev, Susumu Kubo, Louise McNally, Harumi Sawada, Jun Sawada, and the audience of SuB 2013 for their valuable comments and discussions. Parts of this paper were also presented at the Third International Modality Workshop via Grant-in-Aid for Scientific Research held at Kansai Gaidai University in March 2013, and I also thank the audience for their helpful feedback. This work is supported by the Japan Society for the Promotion of Science (Grant-in-Aid for Young Scientists (B), No. 40598083). All remaining errors are of course mine.
Note that the diminutive shift from [s] to [ʃ] is fully productive or rule-based. We can create a diminutive form from any lexical items that contain the consonant [s], as shown in:

(2) a. juusu b. juuchu (Noun)
    juice juice.DIM
    ‘juice’ ‘juice’ (the speaker is uttering the word like a baby)

(3) a. asobu b. achobu (Verb)
    play play.DIM
    ‘to play’ ‘to play’ (the speaker is uttering the word like a baby)

(4) a. oishii b. oichii (Adjective)
    delicious delicious.DIM
    ‘delicious’ ‘delicious’ (the speaker is uttering the word like a baby)

(5) a. sosite b. chochite /sochite (Function word)
    and and.DIM / and.DIM
    ‘and then’ ‘and then’ (the speaker is uttering the word like a baby)

In terms of use, diminutive shifts can be used for one of the following two purposes/strategies:

(6) The pragmatic strategy of diminutive shifts
    a. To show the speaker’s emotion of solodality with the addressee
    b. To show the speaker’s emotional dependency toward the addressee

Typically, the first strategy is used when the speaker wants to show solidarity with a “baby” addressee. The second strategy is used when the speaker wants to show an emotional dependency toward an “adult” addressee. In principle, sentence (1) can be used in both situations if an appropriate context is set up.

However, not all diminutive utterances are appropriate for both pragmatic strategies. For example, the following sentence is only appropriate in the context of emotional dependency:

(7) Koohii-kudachai. (The context of emotional dependency)
    Coffee-give.POLITE.DIM
    ‘Please give me coffee.’

On the other hand, the following sentence seems only appropriate in the context of solidarity with a baby:

(8) Oichii-dechu-ka? (The context of solidarity with a baby)
    Delicious.DIM-PRED.POLITE.DIM-Q
    ‘Is it delicious?’
Furthermore, if the addressee is neither an adult nor a baby (such as a child of 10 years), it is not appropriate for an adult speaker to use the diminutive utterance. For example, (1b), (7), and (8) are all inappropriate in such a situation. The following questions will naturally arise from the above observations:

(9)  
   a. How can we analyze the meaning and use of diminutive shifts? 
   b. Where do the speaker’s emotions of solidarity and emotional dependency come from and how is the speaker’s emotion specified? 
   c. How can we explain an environment in which diminutive shifts can/cannot be used?

The purpose of this paper is to investigate the meaning and use of Japanese diminutive shifts and to try to answer these questions. My main arguments are as follows: I will first argue that the phonological shift from [s] to [ʧ] shifts the speaker’s degree of maturity to the bottom and conventionally implicates that the diminutivized speaker utters a given word or a given proposition. This will create a new context between the speaker and the addressee.

I will then argue that the speaker’s emotion is pragmatically determined by to whom the sentence is uttered: if the addressee is a baby, the utterance with a diminutive shift creates a pragmatic feeling of solidarity; if the addressee is an adult, the diminutive utterance creates a feeling of emotional dependency toward the addressee.

The important point is that there are cases in which the use of the diminutive shift is considered to be inappropriate. I will argue that the diminutive shift is sensitive to the preparatory condition of an at-issue speech act and the economy-oriented markedness principle: do not use a marked expression if there is no reason.

The theoretical implications of this paper are that the Japanese diminutive shift is a “context shifting operator” that enables the speaker to reconstruct a relative relationship with the addressee, and that there is a type, “interpersonal expressive,” in natural language whose emotive meanings are dependent on the hearer.

2. Self-diminutive shift and object-diminutive shift

Sawada (2013) claims that in Japanese there are two types of diminutivization (which has to do with the phonological shift from [s] to [ʧ]), a self-diminutive shift and an object-diminutive shift. Sawada (2013) argues that while self-diminutive shift is fully productive, the object diminutive shift only occurs in the name suffix san, as shown in (10):

(10)  
   a. Hanako-san  
       At-issue: Hanako 
       Implicature: I have a positive feeling toward Hanako. 
   b. Hanako-chan  
       At-issue: Hanako 
       Implicature: I have a positive feeling toward Hanako ∧ I am treating her like a child.
When *san* becomes *chan*, the speaker implies that he/she has a positive feeling toward Hanako and that he/she is treating **Hanako** like a child. This is significantly different from the diminutive shift in (1)–(8), where the phonological shift alters the degree of maturity of the speaker. Sawada (2013) then claims that the self-diminutive shift is productive/rule-based, whereas the object-diminutive shift is lexicalized.¹ In this paper we will solely focus on the self-diminutive shift.

### 3. The pragmatic status of the self-diminutive shift in Japanese

Before moving on to the formal analysis of the self-diminutive shift and its context-dependent properties, let us consider the semantic status of meaning triggered by diminutive shifts. I argue that the phonological shift from [s] to [ʃ] triggers a conventional implicature (CI) that “the speaker is uttering to you like a baby.” For example, if we use the diminutive performative honorific *dechu* instead of the ordinary performative honorific *desu*, it triggers the CI that the speaker is speaking like a baby:

(11) a. Kore-wa boku-no hon-desu. *(Normal polite talk)*

This-TOP I-GEN book-PERF.HON

At-issue: This is my book.

CI: I am talking to you in a polite way.

b. Kore-wa boku-no hon-dechu. *(Baby polite talk)*

This-TOP I-GEN book-PERF.HON.DIM

At-issue: This is my book.

CI: I am talking to you in a polite way ∧ I am talking to you like a baby.

Notice that the performative honorific *desu* also has a CI meaning: that the speaker is talking to the addressee in a polite way. I will discuss the compositionality of *dechu* in Section 4. Notice also that I am assuming that the pragmatic effect of solidarity or emotional dependency themselves are not part of the CI meaning of diminutive shifts. We will discuss the source of solidarity and emotional dependency in Section 7.

Let us now check whether the CI meaning triggered by a diminutive shift (i.e., the meaning “I am talking to you like a baby”) is really a CI. In the Gricean theory of meaning, CIs are

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¹ The fact that the self-diminutive shift can also be expressed by a shift from [s] to [ʃ] (e.g., Hamano 1998; Mester and Itō 1989) supports the idea that self-diminutivization is rule-based:

(i) Kore-wa hon-desu.* *(from [s] to [ʃ]; cf. desu)*

This-TOP book-PERF.HON.DIM

At-issue: This is a book.

CI: I am talking to you in a polite way ∧ I am talking to you like a baby.

Note that the phonological shift from [s] to [ʃ] does not apply to object diminutivization, at least in the case of Stand Japanese:

(ii) Hanako-shan *(from [s] to [ʃ]; cf. Hanako-chan)*

At-issue: Hanako

Intended CI: I have a positive feeling ∧ I am treating Hanako like a child.
considered to be part of the meaning of words, but these meanings are not part of “what is said” (e.g. Grice 1975; Potts 2005, 2007; Horn 2008, 2013; McCready 2009, 2010; Sawada 2010; Gutzmann 2011, 2012, 2013). Furthermore, it is often assumed that CIs have a semantic property of speaker-orientedness (by default) (Potts 2005, 2007).

Several pieces of evidence show that the meaning created by a diminutive shift is not part of “what is said.” First, the diminutive meaning cannot be challenged. For example, if we utter *iya, chigau-yo* “No, that’s false!” after (11b), the negative response can only target the at-issue part of the sentence.

Second, the meaning created by a diminutive shift cannot be in the scope of any logical operators, such as questions:

(12)  *Juu*ch  nomi-tai-no?  (cf. *juusu* ‘juice’)  (Question)
     Juice.DIM drink-want-Q
     At-issue: Do you want to drink juice?
     CI: I am uttering the word *juusu* ‘juice’ like a baby.

The fact that diminutive meaning does not interact with logical operators makes it similar to a presupposition. However, I argue that the meaning created by the diminutive shift is a CI rather than a presupposition. As we can see in (13), unlike presupposition, the diminutive meaning can project beyond presupposition plugs like *sinzi-teiru* ‘believe’:

(13)  Hanako-chan-wa  *[uchagi-wa tomodachi-da]-to* omo-teiru.
     Hanako-chan-TOP rabbit.DIM-TOP friend-PRED-that think-TEIRU
     At-issue: Hanako thinks that a rabbit is her friend.
     CI from *uchagi*: I am uttering the word *usagi* ‘rabbit’ like a baby.

Even though self-diminutivization is embedded under the presupposition plug *omou* ‘think’ (verbs of thinking), it can project to the matrix level. Although the status and the existence of CIs are under debate, based on the above discussions, I will take the position that the meaning triggered by diminutivization is a CI (see Schlenker 2012 and Potts 2013 for detailed discussions on the theoretical status of CIs and presuppositions).

4. The meaning of the diminutive shift in Japanese

4.1. Compositionality of the diminutive shift

Let us consider the meaning of the diminutive shift in a more theoretical way. The question is how the meanings of the two kinds of diminutivization are interpreted. Building on Mester and Itô’s (1989) analysis of mimetic palatalization, I will argue that diminutive forms are morphologically complex. Let us consider this idea based on the following example:

(14)  Kore-wa  hon-dechu.  (cf. *desu*)
This book

At issue: This is a book.

CI: I am talking to you in a polite way \(\land\) I am speaking to you like a baby.

In this approach, the form `dechu` in (14) is considered to be derived by lexical association from a diminutive morpheme `DIM`, which has a phonological feature of [+delay release]:

(15) a. [+delay release] \(\rightarrow\) DIMINUTIVE
    b. `desu`

The bearer of the DIM morpheme is the voiceless alveolar fricative \([s]\).

Then what is the meaning of the DIM morpheme? I propose that the main function of the diminutive morpheme is to shift a given context \(c\) to a new context \(c'\) such that the speaker’s maturity is extremely low at the level of conventional implicature (CI). More specifically, we can formalize the meaning of DIM in (16) as follows:

(16) \([\text{DIM}_{\text{PERF.HON}}]^{c} = \lambda F \lambda p. F(p) = 1 \land c' \text{ such that } \exists d [d < ! \text{STAND}_{\text{mature}} \land \text{mature}(sp) = d \land d < ! \text{the degree of sp’s maturity in } c] \land \text{sp utters } p\)

The symbol “<!” stands for “less than a standard by significant degree” (Kennedy and McNally 2005). The DIM morpheme in (16) conventionally implicates that: (i) there is a degree \(d\) such that the degree of maturity of the speaker (sp) is less than a contextual standard by a large amount; (ii) \(d\) is much lower than the speaker’s maturity in \(c\) (i.e., the sp’s actual degree of maturity); and (iii) the speaker utters \(p\). The second component diminutive state ensures that an (adult) speaker behaves like a baby.

The following figure visually shows the first and the second component of DIM:

(17)

degree in \(c'\)

\(\rightarrow\)

a scale of maturity

\[a \text{ large gap}\]

\[a \text{ large gap}\]

In the above figure, the actual degree is situated above the contextual standard of maturity. One might wonder whether the actual degree must always have to be situated above the standard. Intuitively, it seems possible for a child (e.g., a 10-year-old child) to use a diminutive shift. This suggests that if there is a large gap between the diminutivized degree of the speaker and the actual degree of the speaker, the speaker does not have to be mature.
Let us not consider how the diminutive morpheme DIM is combined with other elements in the sentence. In the case of (14), DIM will combine with the performative honorific desu, which will also induce a CI meaning. Regarding the meaning of the performative honorific desu, I will assume, following the discussion and analysis in Potts and Kawahara (2004), that it has a CI meaning in (18a). Thus, if DIM and desu are combined, we get the meaning shown in (18b):

(18)  
\( \text{(a)} \quad [[\text{desu}]] = \lambda p. c'' \text{ such that } sp \text{ utters } p \text{ in a polite way} \)  
\( \text{(b)} \quad [[\text{DIM}\text{PERF.HON}][[\text{desu}]](\lambda p. c'') \text{ such that } sp \text{ utters } p \text{ in a polite way} = 1 \land c' \text{ such that } \exists d[d < ! \text{STAND}_{\text{mature}} \land \text{mature}(sp) = d \land d < ! \text{the degree of sp’s maturity in } c] \land sp \text{ utters } p \)

Note that here an expressive (CI) applies to an expressive (CI). In order to distinguish this application from the ordinary semantic composition, I assume the following compositional rule (cf. McCready (2010) and Gutzmann (2011, 2012)):

(19) Pure expressive application
\[
\alpha (\beta): \tau^c
\]
\[
\alpha : <\sigma', \tau'> \quad \beta : \sigma'^c
\]

The superscript \( c \) stands for CI type. This rule says that \( \alpha \) that is of type \( <\sigma', \gamma'> \), takes a \( \beta \) of type \( \sigma'^c \), and returns \( \gamma'^c \). Dim(desu) is then combined with the at-issue proposition via a CI function application (Potts 2005) in (20):

(20) CI application
\[
\beta : \sigma'^a
\]
\[
\begin{array}{c}
\bullet \\
\alpha (\beta): \tau^c
\end{array}
\]
\[
\alpha : <\sigma', \tau'> \quad \beta : \sigma'^a
\]

The superscript \( a \) stands for at-issue type. The CI function application says that an \( \alpha \) that is of type \( <\sigma', \gamma'> \) takes a \( \beta \) of type \( \sigma'^a \) and returns \( \gamma'^c \). Notice that the at-issue argument \( \beta \) in (20) can

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\( ^2 \) Following Potts (2005), I assume the following type system for CI:
(i) \( e', f', s' \) are basic at-issue types for \( L_{CI} \).
(ii) \( e', f', s' \) are basic CI types for \( L_{CI} \).
(iii) If \( \sigma \) and \( r \) are at-issue types for \( L_{CI} \), then \( <\sigma, r> \) is an at-issue type for \( L_{CI} \).
(iv) If \( \sigma \) is an at-issue type for \( L_{CI} \) and \( r \) is a CI type for \( L_{CI} \), then \( <\sigma, r> \) is a CI type for \( L_{CI} \).
(v) If \( \sigma \) and \( r \) are at-issue types for \( L_{CI} \), then \( <\sigma \times r> \) is a product type for \( L_{CI} \).
(vi) The full set of types for \( L_{CI} \) is the union of the at-issue types and CI types for \( L_{CI} \).  

(Potts 2005: 55)
be consumed twice. This rule ensures that the at-issue dimension is always insensitive to the presence of adjoined CI operators (Potts 2005: 65).

Thus if we apply the above rules to the example (14), we get the logical structure:

(21)

```
Kore-wa hon: f''

DIM(desu)(this is a book): f'

<fr,fr>

kore-wa
' this-TOP'

hon
' book'

DIM
<fr,fr>, <fr,fr>

desu: <fr,fr>

PERF.HON
```

Note that morphologically, the diminutive form dechu combines with the noun hon. However, in the logical structure it takes a proposition as its argument.

4.2. The self-diminutive shift in other categories

Recall that the self-diminutive shift is productive:

(22)  a.  asobu                         b.  achobu (Verb)
     play                           play.DIM
     'to play'                     'to play' (the speaker is uttering the word like a baby)

(23)  a.  oishii                        b.  oichii (Adjective)
     delicious                    delicious.DIM
     'delicious'                  'delicious' (the speaker is uttering the word like a baby)

We can analyze the meaning of these examples basically in the same way as the case of the diminutive honorific dechu. We can assume that the diminutive forms in (22) and (23) are also morphologically complex. For example, oichii can be decomposed as DIM plus oishii. This means that we should consider that DIM morpheme is polymorphic as in (24):

(24)  a.  [[DIM_{ADJ}]]c = λG<e,d>. c' such that ∃d[d <!STAND\text{mature} ∧ \text{mature}(sp) = d ∧ d<! the degree of maturity of sp in c] ∧ sp utters G
    b.  [[DIM_{VERB.INTR}]]c = λP<e,f>. c' such that ∃d[d <!STAND\text{mature} ∧ \text{mature}(sp) = d ∧ d<! the degree of maturity of sp in c] ∧ sp utters P
Notice that because of the phonological component of DIM, the actual pronunciations of G and P are different (i.e., phonologically shifted). The crucial point here is that in non-honorific diminutive forms like (22) and (23), the meaning of diminutivization only scopes over a word. These diminutivizations are “metalinguistic” (e.g., Horn 1989) in the sense that the speaker only targets a particular word and pronounces it like a baby. This clearly contrasts with the case of diminutivization of the performative honorific.

5. Scope of self-diminutivization

We have so far considered cases where diminutivization occurs only once within a single utterance. However, as the following example shows, multiple occurrences of diminutive shifts can exist in a single sentence (Sawada 2013):

(25) Are-wa uchagi -dechu. (cf. usagi = ‘rabbit’)
    That-TOP rabbit.DIM-PERF.HON.DIM

At-issue: That is a rabbit.
CI: I am talking to you in a polite way and I am talking to you like a baby.

In (25), diminutivization occurs twice within the same sentence; i.e., in the noun usagi and in the performative honorific suffix desu. We can represent the logical structure of (25) as follows:

(26)

\[
\begin{array}{c}
\text{usagi}(\text{are}) \text{ ‘that is a rabbit’: } f^t \\
\bullet \\
\text{DIM}(\text{desu})(\text{usagi}(\text{are})): f^t \\
\end{array}
\]

\[
\begin{array}{c}
\text{usagi}(\text{are}): f^t \\
\bullet \\
\text{DIM}(\text{desu}): <f^t, f^t> \\
\end{array}
\]

\[
\begin{array}{c}
\text{Are-wa ‘that-TOP’}: e^a \\
\bullet \\
\text{DIM}(\text{usagi}): f^t \\
\end{array}
\]

Note, however, that we don’t have to always diminutivize every potential target within a sentence. Compare the following examples (for the sake of simplicity, here I neglect the politeness meaning of desu):

(27) a. Usagi-wa kawaii-dechu. b. ??Uchagi-wa kawaii-desu.
rabbit-TOP cute-PERF.HON.DIM rabbit.DIM-TOP cute-PERF.HON
At-issue: A rabbit is cute. At-issue: A rabbit is cute.
CI: The speaker is talking like a baby. CI: I am uttering the word usagi like a baby.
In the above examples, (27a) is natural baby talk but (27b) is not, because the diminutivization in the latter case only targets the noun part, while the entire mode of speaking is adult talk. Thus, an inconsistency or discrepancy exists in terms of the mode of speaking. On the other hand, (27a) is considered natural baby talk because diminutivization is achieved on a performative honorific, which affects the entire mode of speaking. Based on the above asymmetry, I propose the following generalization:

(28) The semantic scope of a diminutive shift can differ depending on where it arises.

6. An alternative view: the word-based approach

We have so far considered that diminutive forms are morphologically complex. However, there is also an alternative approach where the diminutivized word is a single word. In this approach, the diminutivied honorific dechu itself has a complex meaning:

(29) \[[dechu]\] : \(<e^a, t^a> = \lambda p. p = 1 \text{ and } I \text{ am uttering } p \text{ in a polite way} \land I \text{ am uttering } p \text{ like a baby.}\)

The important point is that, in this approach, the non-honorific diminutivized forms are considered to be “mixed content” (e.g., McCready 2010; Gutzmann 2011) in that they contain both an at-issue meaning and a CI meaning. For example, under the word-based approach, the meaning of achobu ‘play.diminutive’ and uchagi ‘rabbit. diminutive’ can be defined as follows:

(30) \[[achobu]\]: \(<e^a, t^a> \times t^b = \lambda x. \text{play}(x) \uparrow \text{I am talking like a baby} \quad (\text{cf. asobu ‘to play’})\)

(31) \[[uchagi]\]: \(<e^a, t^a> \times t^b = \lambda x. \text{rabbit}(x) \uparrow \text{I am talking like a baby} \quad (\text{cf. usagi ‘rabbit’})\)

The left side of \(\uparrow\) is the at-issue component and the right side of \(\uparrow\) is the CI component. In this view, achobu and uchagi themselves are not pure context-shifting operators. In order to compute these meanings, however, we need to introduce an additional compositional rule and type: mixed application and shunting type (McCready 2010):

(32) Mixed application

\[\alpha(\gamma) \uparrow \beta(\gamma): \gamma^a \times \nu^b\]

\[\alpha \uparrow \beta: <\sigma^a, \tau^a> \times <\sigma^a, \nu^b>\]

(McCready 2010: 20)
Superscript $s$ stands for a shunting type, which is used for resource-sensitive CI application. This rule is different from Potts’ CI application in that the at-issue argument does not pass up to the higher level. In the above rule, the at-issue argument of $\alpha \bullet \beta$ is shunted. Furthermore, following McCready (2010: 20), I assume that the following rule applies for the final interpretation of CI part of mixed content:

(33) Final interpretation rule: Interpret $\alpha \bullet \beta$: $\sigma^s \times \ell^s$ as follows:
- $\alpha$: $\sigma^s$
- $\beta$: $\ell^s$

Thus the word-based approach would analyze the meaning of (34) as in (35):

(34) Are-wa uchagi-dechu.
That-TOP rabbit.DIM-PRED.POL.DIM
At-issue: That is a rabbit.
CI: I am uttering like a baby. (via uchagi, dechu)

(35) rabbit(that): $\ell^s$
- dechu(rabbit(that)): $\ell^s$
- rabbit(that): $\ell^s$
- dechu: $\langle \ell^s, \ell^s \rangle$

I am talking like a baby: $\ell^s$

Are-wa ‘that-TOP’ uchagi
\[ \lambda x. \text{rabbit}(x) \] is I am uttering like a baby
\[ : \langle e^s, \ell^s \rangle \] to $\langle \ell^s \rangle$

---

3 Following McCready (2010), I assume the following type system for shunting types and mixed content:
(i) $e^s$, $\ell^s$, $\sigma^s$ are basic shunting types for $\mathcal{L}^{s,1}$.
(ii) If $\sigma$ is an at-issue type for $\mathcal{L}^{s,1}$ and $\tau$ is a shunting type for $\mathcal{L}^{s,1}$, then $\langle \sigma, \tau \rangle$ is a shunting type for $\mathcal{L}^{s,1}$.
(iii) If $\sigma$ is a shunting type for $\mathcal{L}^{s,1}$ and $\tau$ is a shunting type for $\mathcal{L}^{s,1}$, then $\langle \sigma, \tau \rangle$ is a shunting type for $\mathcal{L}^{s,1}$.

The following clauses are added to the $\mathcal{L}^{s,1}$:
(iv) If $\sigma$ and $\tau$ are at-issue types for $\mathcal{L}^{s,1}$, and $\zeta$ and $\nu$ are shunting types for $\mathcal{L}^{s,1}$, then $\sigma \times \zeta$, $\langle \sigma, \tau \rangle \times \zeta$, $\sigma \times \langle \zeta, \nu \rangle$ are mixed types for $\mathcal{L}^{s,1}$.
(v) If $\sigma$, $\tau$ and $\zeta$ are at-issue types for $\mathcal{L}^{s,1}$ and $\nu$ is a shunting type for $\mathcal{L}^{s,1}$, then $\langle \sigma, \tau \rangle \times \langle \zeta, \nu \rangle$ is a mixed type for $\mathcal{L}^{s,1}$.

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On the context-dependent pragmatic strategies of Japanese self-diminutive shift

Proceedings of Sinn und Bedeutung 18
Edited by Urtzi Etxeberria, Anamaria Fălăuş, Aritz Irurtzun & Bryan Leferman

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The question is which approach is better. Although the word-based approach also works, the decompositional approach seems to be more suitable for capturing the relationship between a phonological shift and a contextual shift. It will be necessary for the word-based approach to posit a phonological rule independently. Because of space, I will not go into the discussion on what each approach theoretically means. I would like to leave the issue for future research.


7.1. Two kinds of emotions

Based on the above discussions, let us now consider the context-dependent properties of the Japanese diminutive shift. The diminutive shift creates a new relationship between a speaker and an addressee, and in the actual conversation diminutive shift can be used for either expressing the emotion of solidarity or emotional dependence. I argue that the speaker’s emotion is automatically determined by to whom the sentence is uttered. If the addressee is a baby, the diminutive shift creates an emotion of solidarity as in (36a), and if the addressee is an adult, it creates an emotion of dependence, as shown in (36b):

(36) a. The degree of maturity

\[ \text{sp} \]

standard

\[ \text{sp} \]

Utter

b. The degree of maturity

\[ \text{sp} \]

standard

\[ \text{sp} \]

Utter

This means that the speaker’s emotion is purely context-dependent and it is based on the hearer.

7.2. Situation where the addressee is neither an adult nor a baby

An interesting point is that if the addressee is neither an adult nor a baby, the diminutive sentence sounds inappropriate. For example, we cannot utter (37) to a 10-year-old:

(37) Oichii-dechu-ka?

Delicious-PRED.POLITE.DIM-Q

At-issue: Is it delicious?

CI: The speaker is uttering the question like a baby.
In order to clarify the idea that the addressee cannot be a person who is neither an adult nor a baby, I conducted a brief survey regarding the acceptability of (37). In the questionnaire, I set up three kinds of situations where (i) an addressee = a baby (who can only talk a little), (ii) addressee = an infant (who can talk freely), and (iii) an addressee = a 1st grade elementary student. I then asked native speakers how natural the sentence would be in each situation. (Participants are all native speakers of Japanese (Age: 18–22). The following table shows the result of their judgments:

(38) Acceptability of (37), survey conducted on January 17th, 2013

<table>
<thead>
<tr>
<th></th>
<th>Very natural</th>
<th>Slightly natural</th>
<th>Can’t say</th>
<th>Slightly odd</th>
<th>Very odd</th>
</tr>
</thead>
<tbody>
<tr>
<td>A: An addressee =  a baby (who can only talk a little)</td>
<td>5</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B: An addressee =  an infant (who can talk freely)</td>
<td></td>
<td></td>
<td></td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>C: An addressee = a 1st grade elementary student</td>
<td></td>
<td></td>
<td>1</td>
<td>7</td>
<td></td>
</tr>
</tbody>
</table>

The following figure visualizes the above result:

(39)

The degree of maturity

sp

standard

?? (1st grade student)

? (Infant)

OK (Baby)

The above results clearly show that if (i) the addressee is slightly greater than a diminutivized speaker, the resulting diminutive utterance sounds odd. This situation fits neither (i) an emotional dependence nor (ii) solidarity. I would like to explain this based on the following economy-based M-Principle (cf. Levinson (2000)’s M-principle/Horn (1989)’s division of pragmatic labor):

(40) Economy-oriented M-Principle: Do not use a marked expression if there is no reason.
In the context of (37), there seem to be no special reason to use diminutive shift. (It neither fits the situation of solidarity nor the situation of emotional dependency. Thus, the economy-based M-Principle forces the speaker not to use a diminutive shift.

7.3. The diminutive utterance that only has an effect of emotional dependency

The following utterances can naturally be used to show the speaker’s emotional dependency toward the addressee, but they cannot be used for expressing solidarity to a baby:

(41) Koohii-kudachai.  (Request)
    Coffee-give.POLITE.DIM
    ‘Please give me coffee.’

(42) Koohii tuku-te kure-machu-ka?  (Indirect speech act, request)
    Coffee make-TE give-PRED.POL.DIM-Q
    ‘Can you make a coffee?’

This is because the utterances will violate the “preparatory” conditions of an at-issue speech act; i.e., request, if we posit a satiation that the addressee of the utterances is a baby. According to Searle (1969), the speech act of requesting has the following felicity condition:

(43) Felicity condition for request (Searle 1969: 62)
    [where S = speaker, H = hearer, A = the future action, P = the proposition expressed in the speech act, e = the linguistic expression]
    Preparatory 1: H is able to do A. S believes H is able to do A.
    2: It is not obvious to both S and H that H will do A in the normal course of events of his own accord.
    Sincerity S wants H to do A.
    Essential Counts as an attempt to get H to do A.

The crucial part is the preparatory condition 1. This condition forces us to assume that the addressee, who is a baby, can make coffee. However, this is inconsistent with our world knowledge: babies cannot make coffee by themselves. This suggests that the specification of pragmatic effects (solidarity, emotional dependence) is regulated by the felicity condition of an at-issue speech act.

7.4. The diminutive utterence that only has an effect of solidarity

Contrary to the examples in (41) and (42), the following sentences seem only appropriate in the context of solidarity with a baby:
I propose that this example cannot be used in the context of emotional dependency toward an addressee because they violate the proposed economy-oriented M-Principle. Intuitively, it does not make sense to warn the adult addressee based on the diminutive mode because there seems to be no reason to show emotional dependency in the context of warning. Typically, warning like (44) is uttered by the elderly or people who are superior to the addressee in terms of social relationship, and there seems to be no reason to reconstruct a relative relationship between the speaker and the addressee (although if we posit a special context, such reconstruction might be possible).

8. The difference with the context-dependency of other expressives

Let us now compare the context-dependent meaning of diminutive shift with that of other expressives like *bastard* and *man*. Potts (2007) and McCready (2009, 2012) claim that the meanings of *bastard* and *man* are context dependent in that their emotion can be either a positive emotion or a negative emotion, depending on context. Observe the following examples:

(45) a. Man, I got an A on my calculus test!! (positive)
    b. Man, I wrecked my ear this morning. (negative) (McCready 2009: 675)

McCready (2009) claims that when the content is something that is ordinarily understood as positive (such as getting an “A” on a test), *man* expresses a positive emotion, and when the content is negative, *man* expresses a negative emotion. McCready (2009) further argues that whether this attitude is understood as positive or negative is completely dependent on who utters the sentence. Observe the following example:

(46) Man, George Bush won again. (McCready 2009: 675)

McCready (2009) explains the above example as follows. If this sentence is uttered (in 2004) by a deep Republican supporter, then the use of *man* by such a speaker indicates that a positive attitude is held. On the other hand, if the speaker is a rabid Democrat, the attitude in question will be understood as negative.⁴

The context-dependency of Japanese diminutive shift is different from that of *man* in that the emotive meaning of diminutive shift is dependent on to whom a sentence is uttered, not on who utters the sentence. If the addressee is an adult, the diminutive shift triggers an emotion of dependency, while if the addressee is a baby, the diminutive shift triggers an emotion of solidarity. The diminutive shift in Japanese strongly suggests that there is a type, “interpersonal expressive,” whose emotive meaning is dependent on the hearer.

⁴ McCready (2009) claims that the meaning of *man* is also world-dependent.
9. Conclusions

In this paper, we have investigated the context-dependent properties of Japanese diminutive shift and claimed that the Japanese diminutive shift triggers a conventional implicature (CI) that “a speaker is uttering like a baby.” More specifically, I have argued that the main function of the Japanese diminutive shift is to shift a speaker’s degree of maturity to the bottom (at the level of CI), which then reconstructs the relative relationship between the speaker and the addressee.

I then focused on the context-dependent-dependent strategies of diminutives where diminutive shift can be used for conveying either a speaker’s emotion of (i) solidarity or (ii) emotional dependence, and argued that the speaker’s emotions of “solidarity” and “emotional dependence” are determined by who the addressee is.

We also consider the context in which the diminutive shift can and cannot be used, and claim that the use of the diminutive shift is sensitive to the preparatory condition of an at-issue speech act and the economy-oriented markedness principle: Do not use a marked expression if there is no reason.

The theoretical implications of this paper are that the Japanese diminutive shift is a “context shifting operator” that enables the speaker to reconstruct the relative relationship between a speaker and a hearer, and that there is a type, “interpersonal expressive,” whose emotive meanings are dependent on the hearer. I hope this paper provided new perspectives for the context-dependency of expressives, and the relationship between scalarity and a mode of speaking.

For future study, I would like to further investigate the following two points. First, this paper only focuses on the phonology-based diminutive, but many languages have diminutive morphemes/affixes (e.g., ino in Italian) and these morphemes tend to express various kinds of meanings, including small size, affection, approximation, intensification, imitation, politeness, etc. (e.g., Dressler and Merlina Barbaresi 1987, 1994; Wierzbicka 1991; Sifianou 1992; Jurafsky 1996; Mendoza 2005; Matsumoto 1985; Sawada 2010). For example, Dressler and Merlina Barbaresi (1987, 2001) claim that diminutive morphemes have both the semantic feature of [smallness] and a pragmatic feature of [non-seriousness]. They further argue that the pragmatic meaning is more basic than the semantic meaning of [smallness]. On the other hand, Jurafsky (1996), based on diachronic and synchronic data of various languages, proposes that diminutives arise from semantic or pragmatic links with children. It would be interesting to consider the similarities and differences between Japanese diminutive shifts and the phenomenon of diminutives in other languages.

Second, it would be worthwhile to consider the diminutive shift from a general phenomenon of context shifting or indexical shifting. It is widely known that there is a phenomenon of indexical shifting in natural language. For example, in some languages sentences with the form John said that I am hungry may report John’s self-report of hunger. Anand and Nevin (2004) account for
the indexical shifting phenomenon by assuming that indexical shifting is driven by “context-shifting operators,” which overwrite the context parameter of the interpretation function with the intentional index parameter. Although the Japanese diminutive shift does not trigger an indexical shifting in terms of a person, it still shifts the quality of the speaker (first person). There seems to be some similarity between a diminutive shift and indexical shifting.

References


Chinese Scope: an experimental investigation
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Abstract. The current study tests the status of Mandarin Chinese inverse scope by focusing on the interpretations available for sentences where the quantifier ‘one/a’ scopes over ‘every’ at surface structure. By comparing the responses from native speakers of Chinese and native speakers of English, we show that Chinese in fact does not allow inverse scope in doubly-quantified sentences (contra Zhou and Gao, 2009). Further, our results 1) suggest that the Chinese prohibition on inverse scope does not straightforwardly emerge from numeral semantics or bi-clausal structure, 2) demonstrate that in English the numeral one yields a strong specificity inference in subject position (cf. the Single Reference Principle of Kurtzman and MacDonald, 1993), and 3) confirm the permissibility of reconstruction in English relative clauses (cf. Aoun and Li, 2003), therefore providing support for a head-raising analysis of these constructions.

Keywords: quantifier scope, Chinese, relative clauses, reconstruction

1. Introduction

Quantifier scope ambiguities feature prominently in many theories of the syntax-semantics interface, owing to the direct translation from structure to meaning that generates the candidate readings. In English, doubly-quantified sentences, i.e., sentences with two quantifier phrases, readily admit such ambiguities (May, 1977, 1985). For instance, the sentence in (1) is ambiguous between a “surface” scope reading, (1-a), and an “inverse” scope reading, (1-b). In the former, the surface word order corresponds to the scope relation at Logical Form (LF), whereas in the latter the reading derives from inverting the LF scope of the subject and object quantifiers. A similar ambiguity is observed for (2), where the linear order of the two quantifiers is reversed. The inverse scope reading is attributed by May to QR, an operation occurring at the level of LF.¹

(1) Every shark attacked a pirate.
   a. Surface scope (every > a):
      for every shark there is a (possibly different) pirate that it attacked
   b. Inverse scope (a > every):
      there is one pirate that every shark attacked

¹A popular alternative approach to QR for the wide-scope behavior of indefinites is based on choice functions (Kratzer, 1998; Reinhart, 1997; Winter, 1997). For our purposes, the mechanisms deriving scope ambiguities are not directly relevant; we assume QR for perspicuity.
(2) A shark attacked every pirate.
   a. Surface scope (a > every):
      there is one shark that attacked every pirate
   b. Inverse scope (every > a):
      for every pirate there is a (possibly different) shark that attacked him

The two readings of (1) are not logically independent of each other. Reinhart (1976, 1997), Cooper (1979), and in particular (Ruys, 1992, ch. 1) point out that while the surface scope reading in (1-a) does not entail the inverse scope reading in (1-b), (1-b) does entail (1-a): if there is a single shark that every shark attacked, it is necessarily the case that every shark attacked a pirate, albeit the same one. In other words, a scenario with a single pirate being attacked is compatible with both readings of (1). A similar entailment pattern holds in the case of (2), but here it is the surface scope reading, (2-a), that entails the inverse scope, (2-b): if there is a single shark that attacked every pirate, it is trivially true that for every pirate there is a shark that attacked him. Thus, a scenario with a single shark is compatible with both scope interpretations of (2)\textsuperscript{2}.

Although QR and related scope phenomena are robustly attested in English, not all languages exhibit QR and the corresponding scope ambiguities. Of interest to our current study is the status of scope ambiguities in Chinese. It is widely held that sentences with more than one quantifier phrase in Chinese are generally unambiguous, admitting only a surface scope interpretation (Aoun and Li, 1989, 2003; Huang, 1982; Lee, 1986; Huang, 1981, but see Section 4 for a fuller discussion of the facts). The observed scope rigidity of quantifiers, i.e., the absence of inverse scope readings, finds a theoretical description in the Isomorphic Principle of Aoun and Li (1989):

(3) \textit{The Isomorphic Principle} (Aoun and Li, 1989, pg. 142):
Suppose A and B are quantifier phrases. Then if A c-commands B at S-Structure, A c-commands B at LF.

For a concrete example of the Isomorphic Principle at work, consider the sentence in (4)\textsuperscript{3}.

(4) you yi-tiao-shayu gongji-le mei(-yi)-ge-haidao
   exist one-CL-shark attack-PERF every(-one)-CL-pirate
   ‘One/a shark attacked every pirate.’

\textsuperscript{2}Uli Sauerland (p.c.) notes that without an existence presupposition on every there are scenarios where the entailment relation from every > a to a > every fails. In (1) and (2) such a scenario would feature no sharks and no pirates. With every taking wide scope the sentence would be vacuously true; with a taking scope the sentence would be false. This is a viable theoretical possibility but not one that was tested in our experimental study.

\textsuperscript{3}Sentence-initial numeral phrases like yi-tiao-shayu ‘one-CL-shark’ typically require the existential predicate you. We return to this point in our discussion of Experiment 1 below.
As discussed above, when an existential quantifier linearly precedes a universal quantifier like in (4), the surface scope reading entails the inverse scope reading. Thus, a scenario in which a single shark attacks the relevant pirates is compatible with both a surface and inverse interpretation of (4); such a scenario consequently gives no clues to the permissible scope relations in Chinese. However, a scenario in which there are multiple sharks attacking pirates corresponds only to the inverse interpretation of (4). This reading would result from QR of the object (‘every pirate’) over the subject (‘one/a shark’) at LF. But the Isomorphic Principle prohibits this operation: raising the object over the subject at LF would yield conflicting surface and LF scope relations. Assuming a constraint such as the Isomorphic Principle, we therefore predict that (4) cannot describe a multiple shark scenario. The Isomorphic Principle is absent in English, meaning that the English equivalent of (4) can describe a multiple shark scenario, signaling the availability of inverse scope.

Given the Isomorphic Principle and the theoretical literature that informs it, we have a clear prediction concerning the status of inverse scope in Chinese: it should not be allowed. Unfortunately, much of the work ostensibly investigating this prediction fails to take into account the entailment relations between surface and inverse scope interpretations (but see Lee, 1986, pg. 144). Whenever an inverse scope reading entails the corresponding surface scope reading, testing the availability of inverse scope fails: the scenario described by the inverse interpretation will always verify the surface interpretation. Thus, intuitions confirming the possibility of a superficially inverse reading in such a test can be explained by the surface reading alone. As we will see, the failure to consider these entailment patterns between readings leaves us without empirical foundations for either a prohibition on inverse scope or for its refutation.

In an attempt to empirically support the lack of inverse scope for doubly-quantified sentences in Chinese, Zhou and Gao (2009) used an offline judgment task to test Chinese speakers on the readings available for sentences such as (5).

\[ \text{(5) mei-ge-qiangdao dou qiang-le yi-ge-yinhang} \]
\[ \text{every-CL-robber DOU rob-PERF one-CL-bank} \]
\[ \text{‘Every robber robbed a bank.’} \]

Given their subjects’ willingness to have sentences like (5) describe inverse scope scenarios (in (5) such a scenario would have a single bank robbed), the authors conclude that inverse scope interpretations are in fact available (though dispreferred) in Chinese.\(^4\) It should be clear by now that Zhou and Gao’s conclusion does not follow from the results that they claim support it: the stimuli used in their judgment task all feature a universally quantified subject (e.g., ‘every robber’ in (5)) linearly preceding an existentially quantified object (e.g., ‘one/a bank’ in (5)). This configuration necessitates the inverse interpretation’s entailing of the surface one: whenever an inverse reading is true a surface reading follows. In (5), if there is a single bank that every robber robbed, for every

\(^4\)The authors also conducted an eye-tracking experiment, reaching the same conclusion that inverse scope is available in Chinese; see Zhou and Gao (2009) for the details of this study.
robber there is a bank that s/he robbed; whether or not this bank is the same across the robberies is irrelevant to the truth of the surface interpretation.

We are therefore left with uncertainty: in the theoretical literature on Chinese the general consensus is that inverse scope is unavailable (stemming from Huang, 1982), but the only quantitative study meant to empirically confirm or deny the availability of inverse scope in Chinese tests sentences wherein ‘every’ scopes over ‘one/a’ at surface. This ‘every’ over ‘one/a’ configuration cannot positively identify inverse scope readings due to the entailment patterns between the resulting surface and inverse interpretations.\(^5\) The crucial test case of inverse scope in such doubly-quantified sentences should feature ‘one/a’ scoping over ‘every’ at surface (as in (4)); these are the sentences that we experimentally investigate in this paper.

As we show, Chinese speakers do not allow inverse interpretations for ‘one/a’ over ‘every’ configurations. We interpret these results as a demonstration that Chinese does not allow inverse scope in doubly-quantified sentences, a finding consistent with the Isomorphic Principle. To further confirm this claim of a prohibition on inverse scope in Chinese, we compare the results of Chinese speakers with those of American English, a language uncontroversially assumed to allow inverse scope (e.g., May, 1977). We begin with the study of Chinese in the next section.

2. Experiment 1: Chinese scope

To settle the conflict surrounding the availability of inverse scope in Chinese, we presented speakers of Mandarin with audio sentence-picture pairs featuring a doubly-quantified sentence and an image consistent with either the surface or the inverse interpretation of the sentence. Subjects provided truth-value judgments.\(^6\) Assuming the soundness of Zhou and Gao’s conclusion that inverse scope is available in Chinese (in contrast to the theoretical consensus that precedes it; e.g., Aoun and Li, 1989; Huang, 1982), we expect to find that subjects judge sentences as true when they describe a scenario consistent only with an inverse interpretation.

2.1. Participants

We recruited 40 subjects through a combination of email chains and advertisements on Chinese social media websites.

\(^5\)In fact, Hornstein (1995) goes so far as to say that only sentences in which a precedes every (but not sentences in which every precedes a) are truly ambiguous.

\(^6\)In a separate experiment we asked Chinese subjects (N=132) to provide felicity judgments on a 1 to 7 scale; see Tsai et al. (2014) for the details of this study.
2.2. Stimuli

Stimuli consisted of 16 sentence-picture pairs. Sentences were recorded by an adult male native speaker of Chinese from Beijing and normed to ensure neutral intonation. Pictures came from the Scope Fieldwork Project (http://udel.edu/bruening/scopeproject/scopeproject.html). The 8 critical items featured doubly-quantified transitive sentences with the quantifiers *mei* ‘every’ and *yi* ‘one/a’ in subject or object position.

We manipulated two factors: the first, ORDER, corresponds to whether ‘every’ precedes (EO) or follows (OE) ‘one/a’ at surface. The second factor, SCOPE, corresponds to whether the picture co-occurring with the sentence matches an INVERSE or SURFACE interpretation. An example item is given in Fig. 1. For reasons mentioned above concerning the entailment patterns between the INVERSE and SURFACE interpretations of EO sentences, only responses to the OE INVERSE condition provide a test of inverse scope.

2.3. Design

Subjects took the experiment online using the web-based experiment platform ExperigenRT (Pillot et al., 2012; Becker and Levine, 2010). After filling out a short demographic questionnaire, subjects completed three training sequences to familiarize them with the experiment and to ensure that they could hear the sentences being played and read the Chinese instructions. The training also served to reinforce that the domain of quantification for a given sentence was depicted completely.

After training, each subject saw 16 sentence-picture pairs in a random order (8 critical items and 8 fillers). Subjects had to judge the sentence either TRUE or FALSE in the scenario displayed.

Only native speakers of Chinese (Mandarin) were included in the analysis. We evaluated nativeness on the basis of two demographic questions: *What was the first language you learned?* (Mandarin), and *What is the language you speak most at home?* (Mandarin). Data from 19 subjects was included in the analysis.

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7 We used neutral intonation in our audio stimuli to avoid possible prosodic cues for specific scope interpretations. However, even if the resulting intonation was not neutral in every case, Leddon et al. (2004) find that prosodic information does not provide reliable cues for disambiguating scope interpretations, at least in English.

8 The full list of items appears in Appendix A.
2.4. Results

Percentages of TRUE responses to each of the four conditions are given in Table 1. We fit a mixed logit model predicting response by ORDER and SCOPE, as well as their interaction; the model included random intercepts for subjects and items and random slopes for ORDER and SCOPE grouped by subject and item. We find a significant effect of SCOPE ($\chi^2(1) = 14.8, p<0.001$): INVERSE conditions received fewer TRUE responses than SURFACE. The OE INVERSE condition received no TRUE responses at all.
Table 1: Percent TRUE responses by condition for Experiment 1 (Chinese)

<table>
<thead>
<tr>
<th>ORDER</th>
<th>SCOPE</th>
<th>TRUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>EO</td>
<td>SURF.</td>
<td>100%</td>
</tr>
<tr>
<td>OE</td>
<td>SURF.</td>
<td>76%</td>
</tr>
<tr>
<td>EO</td>
<td>INV.</td>
<td>25%</td>
</tr>
<tr>
<td>OE</td>
<td>INV.</td>
<td>0%</td>
</tr>
</tbody>
</table>

2.5. Discussion

Consistent with previous reports on inverse scope interpretations in Chinese, INVERSE conditions receive fewer TRUE responses than their SURFACE counterparts. We also see a trend wherein Chinese speakers demonstrate a dispreference for ‘every’ in object position, which may be related to the fact that in Taiwanese, a closely related Chinese language widely spoken in Taiwan, definite expressions are degraded in the postverbal object position in certain constructions (James Huang, p.c.; see also Cheng et al., 1997; Teng, 1995, and references therein). In fact, when we split our results on the basis of whether subjects hail from Taiwan or mainland China, we see that the ORDER trend is driven primarily by speakers from Taiwan. For OE SURFACE conditions, mainland subjects judge the sentence true 80% of the time, whereas Taiwanese subjects judge the sentence true only 40% of the time.

Crucially, no subject judged the critical OE INVERSE condition as TRUE. Recall that this condition provides the unambiguous test case of the possibility for inverse scope, which means that no subject demonstrated the ability for inverse scope interpretations in Chinese. These results do not support the claim from Zhou and Gao (2009), who would predict a non-negligible proportion of TRUE responses to this condition. We therefore take these results to demonstrate that Chinese in fact does not allow inverse scope in doubly-quantified sentences, a finding consistent with much of the early literature on the topic.

Having found that Chinese does not allow inverse scope, we next ask why this should be the case. Here it bears noting two properties of the Chinese sentences we tested: the Chinese indefinite expression *yi* also doubles as the numeral ‘one’, and sentence-initial numeral phrases like *yi-tiao-shayu* ‘one/a shark’ require the predicate *you* to precede them. This requirement necessitates *you* at the beginning of the sentences in the OE conditions (Fig. 1). *You* ‘exist’ functions as an existential predicate elsewhere in Chinese. In fact, some analyses of *you* preceding the numeral ‘one’ (as in our OE stimuli) attribute to *you* the function of an existential main verb which takes an internal argument modified by a relative clause, hence participating in a bi-clausal structure (Fang and Lin, 2008; Fang, 2010; Huang, 1987; Li, 1990; Aoun and Li, 1989, fn. 3). Both properties – possible numeral semantics for the indefinite *yi* and sentence-initial *you* ‘exist’ – set the Chinese sentences
apart from their English counterparts, and thus potentially contribute to the lack of inverse scope in Chinese. To further confirm the current finding that inverse scope is disallowed in Chinese, and to better understand the source of this prohibition, in Experiment 2 we test the same materials in a language uncontroversially claimed to allow inverse scope: English.

3. Experiment 2: English scope

We ran the English equivalent of Experiment 1 on native speakers of American English. To evaluate the possible contribution of numeral semantics and the bi-clausal structure associated with existentials to the Chinese prohibition on inverse scope, we split Experiment 2 into 4 sub-experiments: English sentences featured either indefinite *a* or the numeral *one*, and sentences with *one* preceding *every* optionally included existential *there-be* constructions. The goals were two-fold: to see how speakers of a language with inverse scope behave with our experimental items in the default case, and to see if the patterns with *one* instead of *a* or with an existential construction align with the pattern observed in Experiment 1 for Chinese.

3.1. Participants

We recruited 30 subjects through Amazon.com’s Mechanical Turk Crowdsourcing Service. Subjects were compensated for their participation.

3.2. Stimuli

Stimuli consisted of the 16 sentence-picture pairs from Experiment 1 plus 5 additional fillers. As before, two factors were manipulated: ORDER (*one* precedes, OE, or follows, EO, *every*), and INVERSE, corresponding to whether the co-occurring image matches a SURFACE or INVERSE interpretation of the sentence. Sentences were translations of the Chinese into one of four possible frames split on whether they feature indefinite *a* or the numeral *one*, and whether the OE construction is embedded under existential *there-be*. Example OE sentences, the possible translations of the Chinese OE sentence in Fig. 1, appear in (6).9

<table>
<thead>
<tr>
<th>Sub-experiment</th>
<th>Example OE sentence</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. PLAIN</td>
<td>A shark attacked every pirate.</td>
</tr>
<tr>
<td>b. ONE</td>
<td>One shark attacked every pirate.</td>
</tr>
<tr>
<td>c. THERE</td>
<td>There is a shark that attacked every pirate.</td>
</tr>
<tr>
<td>d. THERE+ONE</td>
<td>There is one shark that attacked every pirate.</td>
</tr>
</tbody>
</table>

9A full list of items appears in Appendix B.
An adult male native speaker of American English recorded all of the sentences. Recordings were normed to ensure neutral intonation.

3.3. Design

Experiment 2 employed the same design as Experiment 1: subjects took the experiment online using ExperigenRT. After filling out a short demographic questionnaire and completing three training sequences, each subject saw 21 sentence-picture pairs in a random order (8 critical items and 13 fillers). Subjects judged the sentences either **TRUE** or **FALSE** in the scenarios depicted. Only native speakers of English were included in the analysis; data from 30 subjects was analyzed.

3.4. Results

We split responses by sub-experiment; percent **TRUE** responses to each of the four conditions is given in Table 2.

<table>
<thead>
<tr>
<th>ORDER SCOPE</th>
<th>PLAIN</th>
<th>ONE</th>
<th>THERE</th>
<th>THERE+ONE</th>
</tr>
</thead>
<tbody>
<tr>
<td>EO SURF.</td>
<td>93</td>
<td>100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OE SURF.</td>
<td>100</td>
<td>85</td>
<td>87</td>
<td>92</td>
</tr>
<tr>
<td>EO INV.</td>
<td>88</td>
<td>69</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OE INV.</td>
<td>56</td>
<td>28</td>
<td>50</td>
<td>11</td>
</tr>
</tbody>
</table>

We begin by analyzing responses to the **PLAIN** items, (6-a). We fit a mixed logit model predicting response by **ORDER** and **SCOPE**, as well as their interaction. We find a significant effect of effect of **SCOPE** ($\chi^2(1) = 5.50, p<0.05$) and an reliable interaction between **ORDER** and **SCOPE** ($\chi^2(1) = 8.14, p<0.01$): **INVERSE** conditions received fewer true responses than **SURFACE**, and the **OE INVERSE** condition received fewer **TRUE** responses than the other three conditions. A planned comparison between the English (**PLAIN**) and Chinese responses to the critical **OE INVERSE** conditions demonstrates that English speakers reliably provide more **TRUE** responses to this condition (0.0% Chinese vs. 56% English **PLAIN**; $\chi^2(1) = 8.78, p<0.01$).

Next, we analyze responses to the **ONE** items, (6-b). A mixed logit model predicting response by **ORDER** and **SCOPE**, as well as their interaction, reveals significant effects of both **ORDER** ($\chi^2(1)$)

---

10 As with Chinese in Experiment 1, we also ran the English study using 1 to 7 felicity ratings (N=130); see Tsai et al. (2014) for the details of this study.
= 6.04, p<0.05) and SCOPE (χ²(1) = 6.26, p<0.05): OE sentences received fewer TRUE responses than EO sentences, and INVERSE conditions received fewer TRUE responses than SURFACE. A planned comparison between the English (ONE) and Chinese responses to OE INVERSE conditions reveals a marginal effect of language such that English speakers provide more TRUE responses to this condition (0.0% Chinese vs. 28% English ONE; χ²(1) = 3.16, p = 0.076).

Turning to the THERE items, (6-c), the existential there-be construction only occurs in OE sentences where a precedes every at surface. We therefore have no ORDER manipulation within this sub-experiment. A mixed logit model predicting response by SCOPE reveals a significant effect of SCOPE (χ²(1) = 3.97, p<0.05): INVERSE conditions received fewer TRUE responses than SURFACE. A planned comparison between the English (THERE) and Chinese responses to OE INVERSE conditions reveals a significant effect of language such that English speakers provide more TRUE responses to this condition (0.0% Chinese vs. 50% English THERE; χ²(1) = 4.29, p<0.05).

As with the THERE items, there was no ORDER manipulation within the THERE+ONE sub-experiment: all sentences feature one linearly preceding every as in (6-c). A mixed logit model predicting response by SCOPE reveals a significant effect of SCOPE (χ²(1) = 17.9, p<0.001): INVERSE conditions received fewer TRUE responses than SURFACE. A planned comparison between the English (THERE+ONE) and Chinese responses to OE INVERSE conditions reveals a marginal effect of language such that English speakers provide more TRUE responses to this condition (0.0% Chinese vs. 11% English THERE+ONE; χ²(1) = 3.49, p = 0.062).

3.5. Discussion

Consistent with previous findings on English scope (e.g., Anderson, 2004; Tunstall, 1998), subjects demonstrated a dispreference for inverse interpretations: OE INVERSE sentences were judged particularly poorly. However, whereas no Chinese subjects judged OE INVERSE trials true, in the corresponding English PLAIN condition, (6-a), subjects judged the sentence true 56% of the time. This 56% OE INVERSE acceptance rate indicates the availability of inverse scope, a feature absent in Chinese.11 Crucially, planned comparisons between each of the four English OE INVERSE conditions and the corresponding Chinese condition demonstrate that in Chinese this prohibition does not emerge from numeral semantics or bi-clausal structure, but rather suggest a global prohibition on inverse scope such as the Isomorphic Principle (Aoun and Li, 1989; Huang, 1982).

Two other properties of the English data warrant further consideration. First, in the English ONE and THERE+ONE sub-experiments where the numeral one replaces indefinite a, (6-b,d), subjects were less willing to judge an INVERSE sentence true than they were with a: 56% (PLAIN) vs. 28% (ONE) and 11% (THERE+ONE). We might take this pattern to signal that numerals induce

---

11Anderson (2004) also finds a 50% acceptance rate for inverse scope in English, which means that our experimental design did not unduly depress the rate of acceptance.
scope freezing and therefore resist inverse scope altogether, perhaps contributing to the ban on inverse scope in Chinese. However, ongoing work investigating the possibility of English inverse scope with other numerals shows that this freezing effect is specific to one and vanishes with higher numerals (inverse scope is easier to get in sentences like two sharks attacked every pirate than in one shark attacked every pirate). Another possibility is that in English one competes with a and engenders a specificity inference incompatible with inverse scope in OE sentences, i.e., incompatible with a situation in which one corresponds to many (Fig. 2): the use of one instead of a would therefore signal that only a single referent is intended.\(^{12}\)

![A shark attacked every pirate.](image)

\(\checkmark\) A shark attacked every pirate.

\(\times\) One shark attacked every pirate.

Figure 2: An example of the multiple-shark scenario

If one is generally interpreted as specific along the lines sketched above, then we expect this specificity effect also in object position: subjects should resist many-referent uses of one and thus more readily accept inverse scope when every precedes one as in our EO conditions. Consider the responses for the EO INVERSE items from the PLAIN and ONE sub-experiments, exemplified in (7) when describing the situation in Fig. 2.

\begin{align*}
(7) & \quad \text{a. Every shark attacked a pirate.} & \quad \text{(EO INVERSE PLAIN; 88\% TRUE)} \\
& \quad \text{b. Every shark attacked one pirate.} & \quad \text{(EO INVERSE ONE; 69\% TRUE)}
\end{align*}

Were one interpreted with a specificity inference not attributed to indefinite a, (7-b) should receive more TRUE responses than (7-a). But we find a trend in the opposite direction: a more readily admits a specific interpretation in object position. The specificity effect associated with numeral one therefore applies only when one linearly precedes every, i.e., when it appears in subject position, as in the OE items. Instead of triggering a specificity inference in the general case, we suggest a

\(^{12}\) Ionin et al. (2011) find a similar pattern for one vs. a indefinites: a is much more acceptable in multiple-referent scenarios.
processing explanation along the lines of the Single Reference Principle (Kurtzman and MacDonal-
d, 1993): listeners build an online parse of the sentences they hear; when they encounter one at
the start of a sentence, they imagine just a single referent associated with it. This single-referent
parse is incompatible with a one-as-many scenario as in Fig. 2, accounting for participants’ un-
willingness to judge OE sentences with one as true in inverse, multi-referent scenarios. The Single
Reference Principle is also active with a (accounting for the 56% acceptance rate for OE INVERSE
sentences with a), but its effect is less strong, presumably because one is phonologically more
salient than a so the pressure to build an initial, single-referent parse with one is more noticeable.

The second feature of note in our English results concerns the high acceptance rate for inverse
scope across a relative clause boundary. In the THERE sub-experiment where OE sentences enter
into a bi-clausal existential construction, (6-c), subjects were as likely to accept inverse scope as
they were in the PLAIN version without the relative clause. The possibility of scope flexibility
in the THERE items is consistent with previous judgments on similar extractions (cf. Aoun and Li,
2003) and therefore supports a head-raising analysis of these constructions (over an operator move-
ment analysis; Bhatt, 2002; Bianchi, 2002; Zwart, 2000; Kayne, 1976; Vergnaud, 1974). Under a
head-raising analysis, (8-a), the NP shark reconstructs into the embedded clause where it interacts
scopally with the other quantified expression (every pirate).

(8)   a. [DP a [NP shark, [CP t_i [C' that [IP t_i attacked every pirate]]]]]  (head-raising)
b. [DP a [NP shark, [CP Op, [C' that [IP t_i attacked every pirate]]]]]  (operator movement)

Were one to adopt the analysis of English relative clauses in (8-b), the universal quantifier in the
relative clause island would not be able to raise above the relative clause head, and the nominal
head would not be able to reconstruct into the relative clause for interpretive purposes because it
originates outside of the island. We return to this point in the following section, which concludes.

4. General discussion

We began with the consensus that Chinese does not allow inverse scope for doubly-quantified sen-
tences (e.g., Aoun and Li, 1989, 2003; Huang, 1982; Lee, 1986; Huang, 1981, among others). But
the status of Chinese inverse scope, both why and whether it is disallowed, has come under recent
sentences and conclude that despite its dispreferred status, an inverse scope interpretation is in
fact available in Chinese. Their study and its results face a serious entailment problem, however,
because their doubly-quantified test sentences all feature ‘every’ preceding ‘one/a’ as in (5). This
configuration of quantifiers felicitously describes the supposed inverse interpretation solely on the
basis of surface scope: if one bank was robbed by every robber then it is trivially the case that for
every robber there is a bank that s/he robbed; onela > every entails every > onela. Hence Zhou
and Gao’s conclusion that Chinese has inverse scope is not well-founded.
The crucial test case for inverse interpretations of doubly-quantified sentences features ‘one/a’ preceding ‘every’; in this configuration the inverse interpretation does not entail the surface one. We therefore tested the possibility of inverse interpretations for these sentences. In Experiment 1, none of our Chinese subjects ever accepted an inverse interpretation. We take this result to suggest that inverse scope is disallowed for doubly-quantified sentences in Chinese, contrary to Zhou and Gao’s claim.

To better understand why Chinese should prohibit inverse scope, in Experiment 2 we tested speakers of American English on translations of the materials from Experiment 1. Direct translations of the Chinese proved problematic, owing to two properties of the Chinese sentences that potentially drive the observed prohibition on inverse scope: numeral semantics for the indefinite numeral expression and bi-clausal structure contributed by an existential construction. In every case, English speakers reliably accepted inverse interpretations more often than Chinese speakers. To repeat: Chinese speakers never accepted an inverse interpretation.

Comparing the results of our two experiments, we see that the Chinese prohibition on inverse scope in doubly-quantified sentences cannot straightforwardly emerge from numeral semantics or bi-clausal structure. Instead, the diverging pattern between each of our English paradigms and the paradigm in Chinese suggests a global prohibition on inverse scope such as the Isomorphic Principle (Huang, 1982; Aoun and Li, 1989).

Despite the consistency of our results with the Isomorphic Principle, we hesitate to conclude at this point that Chinese lacks inverse scope altogether. Aoun and Li (1989, 2003) suggest that passive sentences in Chinese may exhibit scope ambiguities; they give (9) and (10) as examples of such sentences (although native speakers’ judgments seem to vary):

(9) meige ren dou bei yi-ge nuren zhuazou le
every man DOU by one-CL woman arrest PERF
‘Everyone was arrested by a woman.’

(10) yaoshi liang-ge xiansuo bei mei-ge-ren zhaodao …
if two-CL clues by every-CL-person found
‘If two clues were found by everyone …’

Similarly, Jiang (2012) argues that Chinese numeral phrases can scope over the antecedent of a conditional, giving rise to a wide-scope (in addition to a narrow-scope) interpretation as in (11).
If you can bring one girl to my party...

- Wide scope: [one girl > if]
- Narrow scope: [if > one girl] (modified from Jiang, 2012, pg. 154)

While we believe that further study is required to determine what readings are available and how they arise for these cases, note that (9) runs into the entailment problem familiar from our discussion of Zhou and Gao’s materials: if there is one woman who arrested everyone, then it is indeed the case that everyone was arrested by a woman. Therefore (9) does not evidence true inverse scope. Still, sentences with conditionals like (10) and (11) do appear to allow inverse interpretations; for this reason, we limit the scope of our claim to just doubly-quantified sentences in Chinese.

In addition to the findings related to Chinese scope, our investigation of English revealed two ancillary facts. First, the numeral one in subject (but not object) position yields a strong specificity inference inconsistent with multiple-referent scenarios. We attribute this position-specific specificity inference to a processing pressure such as the Single Reference Principle (Kurtzman and MacDonald, 1993). Second, English existential sentences featuring relative clauses readily admit inverse interpretations. This observed ability for scope-bearing elements to interact across a relative clause boundary provides support for a head-raising analysis of these constructions under which the head may reconstrukt to a position internal to the relative clause. This lends new support to the idea from Aoun and Li (2003) that such reconstruction is possible in English quantified expressions. In arguing for the head-raising analysis of relative clauses, Aoun and Li use the following examples (from Bianchi, 1999), where the ambiguity of (12-c) is relevant for our discussion. Our results show that the same analysis can apply to bi-clausal there-be sentences.

An outstanding question here deals with the variability we observe: half of the English speakers find bi-clausal sentences with relative clauses ambiguous, but the other half do not. There are two possibilities. First, some speakers are simply less apt to see scope ambiguities, which would account for the latter group (and also for the similar ambiguity acceptance rate for sentences without relative clauses; cf. Table 2). The second option posits two different grammars of relativization in English (Hulsey and Sauerland, 2006): one that employs an operator movement strategy under which an ambiguity is not generated, and head-raising that generates the ambiguity. Assuming that English relative clauses are structurally ambiguous, it is then possible that some speakers apply the head-raising analysis whereas other speakers do not. If this hypothesis is on the right track, our results provide novel support for the structural ambiguity brought out by Hulsey and Sauerland.
Acknowledgements

We are grateful for the comments we received from Uli Sauerland and Li Julie Jiang, as well as from audiences at the Polinsky Language Sciences Lab, the University of Ottawa, and the Workshop on Information Structure and Word Order at Harvard University. Special thanks to the audience and organizers of *Sinn und Bedeutung 18*. This work was supported by a grant from the Center for Advanced Study of Language at the University of Maryland and by the National Science Foundation Grant BCS-1144223 to M. Polinsky. Any opinion, findings, conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the National Science Foundation, the United States Government, or the other agencies.

References


# Appendix A: Experiment 1 items (Chinese)

<table>
<thead>
<tr>
<th>ITEM</th>
<th>ORDER</th>
<th>SENTENCE</th>
</tr>
</thead>
</table>
| 1    | EO    | 每一个海盗都挨着一个木桶  
      |       | every-one-CL-pirate DOU lean-PROG one-CL-barrel |
|      | OE    | 有一个海盗挨着每一个木桶  
      |       | exist one-CL-pirate lean-PROG every-one-CL-barrel |
| 2    | EO    | 每一个海盗都钓走了一条鱼  
      |       | every-one-CL-pirate DOU catch-RES-PERF one-CL-fish |
|      | OE    | 有一个海盗钓走了每一条鱼  
      |       | exist one-CL-pirate catch-RES-PERF every-one-CL-fish |
| 3    | EO    | 每一个海盗都握着一枝鱼竿  
      |       | every-one-CL-pirate DOU hold-PROG one-CL-fishing-pole |
|      | OE    | 有一个海盗握着每一枝鱼竿  
      |       | have one-CL-pirate hold-PROG every-one-CL-fishing-pole |
| 4    | EO    | 每一个海盗都喂了一条鲨鱼  
      |       | every-one-CL-pirate DOU feed-PERF one-CL-shark |
|      | OE    | 有一个海盗喂了每一条鲨鱼  
      |       | have one-CL-pirate feed-PERF every-one-CL-shark |
| 5    | EO    | 每一个海盗都握着一瓶酒  
      |       | every-one-CL-pirate DOU hold-PROG one-CL-alcohol |
|      | OE    | 有一个海盗握着每一瓶酒  
      |       | have one-CL-pirate hold-PROG every-one-CL-alcohol |
| 6    | EO    | 每一条鲨鱼都咬住了一条鱼  
      |       | every-one-CL-shark DOU bite-RES-PERF one-CL-fish |
|      | OE    | 有一条鲨鱼咬住了每一条鱼  
      |       | have one-CL-shark bite-RES-PERF every-one-CL-fish |
| 7    | EO    | 每一条鲨鱼都攻击了一个海盗  
      |       | every-one-CL-shark DOU attack-PERF one-CL-pirate |
|      | OE    | 有一条鲨鱼攻击了每一个海盗  
      |       | have one-CL-shark attack-PERF every-one-CL-pirate |
| 8    | EO    | 每一个女孩都轻拍了一只狗几下  
      |       | every-one-CL-girl DOU light-pat-PERF one-CL-dog few-times |
|      | OE    | 有一个女孩轻拍了每一只狗几下  
      |       | have one-CL-girl light-pat-PERF every-one-CL-dog few-times |
### Appendix B: Experiment 2 items (English)

<table>
<thead>
<tr>
<th>ITEM</th>
<th>SUB-EXPT.</th>
<th>ORDER</th>
<th>SENTENCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>PLAIN</td>
<td>EO</td>
<td>Every pirate is leaning on a barrel</td>
</tr>
<tr>
<td></td>
<td>ONE</td>
<td></td>
<td>Every pirate is leaning on one barrel</td>
</tr>
<tr>
<td></td>
<td>PLAIN</td>
<td>OE</td>
<td>A pirate is leaning on every barrel</td>
</tr>
<tr>
<td></td>
<td>ONE</td>
<td></td>
<td>One pirate is leaning on every barrel</td>
</tr>
<tr>
<td></td>
<td>THERE</td>
<td>OE</td>
<td>There is a pirate who is leaning on every barrel</td>
</tr>
<tr>
<td></td>
<td>THERE+ONE</td>
<td></td>
<td>There is one pirate who is leaning on every barrel</td>
</tr>
<tr>
<td>2</td>
<td>PLAIN</td>
<td>EO</td>
<td>Every pirate caught a fish</td>
</tr>
<tr>
<td></td>
<td></td>
<td>OE</td>
<td>A pirate caught every fish</td>
</tr>
<tr>
<td>3</td>
<td>PLAIN</td>
<td>EO</td>
<td>Every pirate is holding a fishing pole</td>
</tr>
<tr>
<td></td>
<td></td>
<td>OE</td>
<td>A pirate is holding every fishing pole</td>
</tr>
<tr>
<td>4</td>
<td>PLAIN</td>
<td>EO</td>
<td>Every pirate fed a shark</td>
</tr>
<tr>
<td></td>
<td></td>
<td>OE</td>
<td>A pirate fed every shark</td>
</tr>
<tr>
<td>5</td>
<td>PLAIN</td>
<td>EO</td>
<td>Every pirate is holding a bottle</td>
</tr>
<tr>
<td></td>
<td></td>
<td>OE</td>
<td>A pirate is holding every bottle</td>
</tr>
<tr>
<td>6</td>
<td>PLAIN</td>
<td>EO</td>
<td>Every shark is biting a fish</td>
</tr>
<tr>
<td></td>
<td></td>
<td>OE</td>
<td>A shark is biting every fish</td>
</tr>
<tr>
<td>7</td>
<td>PLAIN</td>
<td>EO</td>
<td>Every shark attacked a pirate</td>
</tr>
<tr>
<td></td>
<td></td>
<td>OE</td>
<td>A shark attacked every pirate</td>
</tr>
<tr>
<td>8</td>
<td>PLAIN</td>
<td>EO</td>
<td>Every girl is petting a dog</td>
</tr>
<tr>
<td></td>
<td></td>
<td>OE</td>
<td>A girl petted every dog</td>
</tr>
</tbody>
</table>
Vacuous and Non-Vacuous Behaviors of the Present Tense in English

Laine STRANAHAN — Harvard University

Abstract.
The present tense behaves vacuously when modifying nominals expressing intervals like “last Tuesday” but not when modifying nominals expressing individuals like “John.” Under a presuppositional theory of tense, I show that if the present tense is vacuous then the difference in behavior can be reduced to a difference in the relative scopes of presupposition maximization and distributivity, and that in turn the scope difference can be explained by a general principle of utterance strength maximization.

1. Introduction

The presuppositions of the present tense in English appear to project above conjunction, pluralization, and universal quantification when subjects are individuals, but not when they are intervals:

(1) (John F. Kennedy is dead and Joe Kennedy is alive:) #John F. Kennedy and Joe Kennedy are tall.
(2) (Some of my uncles are dead and some are alive:) #My uncles are blond.
(3) (Some American presidents are dead and some are alive:) #All of the American presidents are male.
(4) (John is dead and Bill is alive:) #John and Bill are both very handsome. (Mittwoch, 2008)
(5) (Uttered in 2013): 2012 and 2016 are leap years.
(6) (Uttered in the middle of the week:) The even-numbered days this week are school days.
(7) (Uttered in the middle of the semester:) Every Friday this semester is a holiday.
(8) (Uttered in the middle of the month:) Every Tuesday this month I fast. (Sauerland, 2002)

Theories in which the present tense is not vacuous (e.g. Reichenbach, 1947; Ogihara, 1996; Abusch, 1997) account for (1-4) but not (5-8). Sauerland’s (2002) vacuous present tense semantics, on the other hand, accounts for (5-8), but not for (1-4). In this paper I attempt to modify Sauerland’s proposal to account for non-vacuous behaviors of the present tense. I suggest that the observed differential behavior of the present is predicted by scope ambiguity between covert presupposition maximization and distributivity, disambiguated systematically according to a specialized version of the Strongest Meaning Hypothesis (Dalrymple, et al., 1998; Winter, 2001; Chierchia, et al. 2008) sensitive to the difference between individuals and intervals.

1 I thank Isabelle Chamavel, Chrissy Zlogar, and audiences at Harvard University, Sinn und Bedeutung 18, and the 25th European Summer School for Logic, Language and Information for their valuable input. I am especially indebted to Uli Sauerland for many fruitful discussions and crucial insights.
In Section 2 I provide some background, first presenting a basic semantics of tense (2.1), then discussing lifetime inference (2.2), which I will argue plays a crucial role in the disambiguation process. Next, I propose a formalization of the difference between individuals and intervals (2.3), and introduce presupposition maximization (2.4) and distributivity (2.5). In Section 3, I show how different scope relations between the two generate different projection behaviors of the present tense, and in Section 4 I explain how a general principle of utterance strength maximization forces the scope relations that result in precisely the two projection behaviors observed.

2. Background

2.1 Tense


\[
\begin{align*}
\text{(9)} & \quad \llbracket \text{PRESENT} \rrbracket = \lambda t : t \supseteq t_0 . t \\
\text{(10)} & \quad \llbracket \text{PAST} \rrbracket = \lambda t : t < t_0 . t
\end{align*}
\]

The past and present tenses display presuppositions with singular subjects and conjoined individual subjects, but with conjoined interval subjects, the presupposition of the present tense seems to disappear:

\[
\begin{align*}
\text{(11)} & \quad \text{Christopher Columbus was/is tall.} \\
\text{(12)} & \quad \text{Yesterday was/is Tuesday.} \\
\text{(13)} & \quad \text{(In 2016:) 2012 and 2016 are leap years.} \\
\text{(14)} & \quad \text{Christopher Columbus and Barack Obama were/are tall.}
\end{align*}
\]

To account for this, Sauerland (2002) analyzes the present tense as semantically vacuous, i.e., as a total identity function over intervals with no presupposition:

\[
\text{(15)} \quad \llbracket \text{PRESENT} \rrbracket = \lambda t . t
\]

On this analysis, sentences like (13) are felicitous with the present tense simply because the present

\footnotesize
2 An interval is a set of points in time with the property that any point that lies between two points in the set is also a member of the set. I assume that points in time form a set totally ordered with respect to a relation of temporal precedence.
3 Worlds or situations are probably necessary to account for intensional phenomena; I abstract away from intensionality in the present paper.
4 The account formulated here only addresses only the non-past aspects of the meaning of the present tense.
tense makes no presuppositions on the interval it modifies. Sauerland accounts for the infelicity of the present tense in basic sentences with singular non-present subjects like (11) and (12) by appealing to a presupposition exhaustification mechanism:

(16) Presupposition Exhaustification: For any utterance U with truth-conditionally equivalent alternatives ALT(U), the listener may negate the presuppositions of any members of ALT(U) whose presuppositions are stronger than those of U.

The present tense is infelicitous when the interval or individual modified is past because the listener computes a negated presupposition, or antipresupposition, that the individual or interval is not past:

(17) a. U = “John is asleep.”
    b. “John was asleep.” ∈ ALT(U)
    c. “John is asleep.” ~ The presuppositions of “John was asleep” do not hold.

Meanwhile, since one of the subject referents in (13) does not satisfy the presuppositions of the past, the past is blocked; furthermore, since the present tense is vacuous, its presuppositions are trivially satisfied.

(13) (In 2016:) 2012 and 2016 were/are leap years.

Without further modification, however, Sauerland’s (2002) theory fails to account for the non-vacuous behavior of the present tense observed in sentences with plural, conjoined, or universally quantified individual subjects:

(1) #John F. Kennedy and Joe Kennedy are tall.
(2) (Some of my uncles are dead and some are alive:) #My uncles are blond.
(3) #All of the American presidents are male.
(4) (John is dead, Bill is alive:) #John and Bill are both very handsome. (Mittwoch, 2008)

In the following sections, I attempt to derive the differences in the behavior of the present tense with interval and individual subjects from a theory on which the present tense is vacuous by taking into account differences between the nature and amount of new information derivable from each type of sentence.

2.2 Lifetime Inference

Predicates expressing tendentially permanent properties (I-level predicates) behave differently from those expressing tendentially temporary properties (S-level predicates), both syntactically and semantically. For example, S-level but not I-level predicates co-occur with temporal adverbs (Chierchia, 1995), with existential “there” (Milsark, 1974), and in “when”-clauses (Kratzer, 1995),
and I-level but not S-level predicates force generic interpretations of sentences with bare plural subjects (Carlson, 1977).

(18) I-Level Predicates: (be) blond, (be) tall, (be) intelligent, (be) a linguist
(19) S-Level Predicates: (be) asleep, (be) available, (be) drunk

The difference between predicates of the two classes with respect to permanence can be captured by a pair of rules expressing the typical duration of the properties they encode:

(20) $\forall I \in \{1\text{-level predicates}\} [\forall x(\exists t_1 (I(x, t_1)) \rightarrow \forall t_2 (\text{Alive}(x, t_2) \rightarrow I(x, t_2))]$
(21) $\forall S \in \{S\text{-level predicates}\} [\forall x(\exists t_1 (S(x, t_1)) \rightarrow \neg \forall t_2 (\text{Alive}(x, t_2) \rightarrow S(x, t_2))]$

In words, if the property expressed by an I-level predicate holds of an individual at any time, then it holds of that individual at every other time at which that individual is alive. A property expressed by an S-level predicate, however, if it holds of an individual at some time, does not hold of that individual at every other time at which that individual is alive. This logical formalization of permanence/temporariness accounts for another important difference between I- and S-level predicates: I-level predicates give rise to lifetime inferences when predicated of individual subjects in the past tense (Musan, 1997; Mittwoch, 2008).

(22) John was blond. $\sim$ John is no longer alive.

I call inferences of this form canonical lifetime inferences in light of their central status in theories of temporal implicature (e.g., Musan, 1997; Mittwoch, 2008). Other inferences about individuals’ lifetimes follow from other combinations of predicate type and tense:

(23) John is blonde. $\sim$ John is alive. (I-level predicate + present tense)
(24) John was asleep. $\sim$ John was alive at the time he was asleep. (S-level predicate + past tense)
(25) John is asleep. $\sim$ John is alive. (S-level predicate + present tense)

Any inference about when the individual denoted by the subject is or was alive, whether present-oriented (as in x is alive or x is no longer alive) or past-oriented (as in x was alive at the time he was asleep), I call a general lifetime inference. While the status of canonical lifetime inferences as entailments, presuppositions, or implicatures has been disputed (Kratzer, 1995; Musan, 1997; Mittwoch, 2008), I adopt a variant of Musan’s (1997) implicature-based analysis because its lexical encoding of aliveness straightforwardly accounts for general lifetime inferences:

(26) $[\text{blond}] = \lambda x \lambda t. x \text{ is blond at } t \text{ and } x \text{ is alive at } t$
(27) $[\text{asleep}] = \lambda x \lambda t. x \text{ is asleep at } t \text{ and } x \text{ is alive at } t$

---

5 There are exceptions to the generalization that predicates expressing tendentially permanent properties license canonical lifetime inferences, e.g., “famous”: 

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Proceedings of Sinn und Bedeutung 18
Edited by Urtzi Etxeberria, Anamaria Fălăuș, Aritz Irurtzun & Bryan Leferman
Thus any time an aliveness-encoding predicate is applied to an individual, it straightforwardly follows that the individual must be alive at the time the predicate holds. While canonical lifetime inferences remain implicatures on such an account, the other three types of general lifetime inference are simply entailments ($t_0 = \text{utterance time}$; following Sauerland (2008), I use fractional notation in which the assertory content of an utterance is in the numerator position and its presuppositions are in the denominator position): 6

(28) \[ \text{[John was asleep.]} \]
\[ = \text{ existence}\text{[John]} \]
\[ = \exists t ( \exists \lambda z (z \text{ is asleep at } t \land z \text{ is alive at } t) (\lambda t: t < t_0) (j)) \]
\[ = \exists t ( \exists \lambda x ( \lambda z: z \text{ is asleep at } t \land x \text{ is alive at } t) (\lambda t: t < t_0) (j)) \]
\[ = \exists t ( \lambda x: \text{ is asleep at } t \land x \text{ is alive at } t) (\lambda t: t < t_0) (j) \]
\[ \rightarrow \text{ John was alive at the time he was asleep. (General Lifetime Inference) } \]

(29) \[ \text{[John was blond.]} \]
\[ = \text{ existence}\text{[John]} \]
\[ = \exists t ( \exists \lambda z (z \text{ is blond at } t \land z \text{ is alive at } t) (\lambda t: t < t_0) (j)) \]
\[ = \exists t ( \lambda z: z \text{ is blond at } t \land z \text{ is alive at } t) (\lambda t: t < t_0) (j) \]
\[ \rightarrow \text{ John was alive at the time he was blond. } \sim \text{ John is no longer alive. (Canonical Lifetime Inference) } \]

How does the listener get from the simple entailment that John was alive at the time he was blond in (29) to the canonical lifetime inference that he is no longer alive? The additional information provided by the permanence of the property expressed by the I-level predicate allows the listener to

(i) Marilyn Monroe is blond. \rightarrow Marilyn Monroe is alive.
(ii) Marilyn Monroe is famous. \rightarrow Marilyn Monroe is alive.

This behavior can be explained by the absence of the aliveness clause in the lexical entries of exceptional predicates:

(iii) \[ \text{[blond]} = \lambda x \lambda t: x \text{ is blond at } t \land x \text{ is alive at } t \]
(iv) \[ \text{[famous]} = \lambda x \lambda t: x \text{ is famous at } t \]

6 While I remain agnostic on the question of the ultimate status of tense as referential (Enc, 1986, 1987; Heim, 1994) or quantificational (Kusumoto, 1999), for the purpose of exposition I use a quantificational semantics on which existential quantification introduced by tense takes narrow scope with respect to distributivity. In principle, either approach should be compatible with the present analysis.
compute an implicature using a Gricean maxim of informativeness that John must no longer be alive (Musan, 1997):

(30) i. Listener hears speaker utter “John was blond.”
ii. Listener knows that “John is blond” would have been more informative with respect to the duration of John’s blondness, and thus that the speaker would have uttered it if he/she believed it to be true.
iii. Assuming speaker to be cooperative, listener assumes speaker must not believe “John is blond” is true.
iv. Assuming speaker to be opinionated, listener concludes that “John is blond” is false.
v. Listener reasons that since “blond” expresses a permanent property (a property which, if it holds of someone at any time it holds of them at every other time at which they are alive; cf. (20)), since it held of John in the past, it must hold of John for every time at which he is alive.
vi. Listener concludes that if John were alive at the time of utterance, he would be blond at the time of utterance.
vii. Listener concludes, by contraposition, that if John is not blond at the time of utterance, then he must not be alive at the time of utterance.

In sum, general lifetime inferences are computable from any combination of I- or S-level predicate and past or present tense, and relate an individual’s lifetime either to the utterance time, the time of the property holding, or both. General lifetime inferences are entailments; canonical lifetime inferences (e.g. “John was blond” ↆ John is no longer alive) are derived using Gricean reasoning in conjunction with the permanence of the property expressed by the I-level predicate.

2.3 Individuals vs. Intervals

Individuals and intervals differ with respect to the kind of information they carry: Individuals are atemporal entities, but they can be temporally modified with information derived from speech about their lifetimes (e.g. via lifetime inference). Intervals, on the other hand, are inherently temporally-specified, and in turn do not allow such temporal modification. Based on this intuition, I suggest that individuals have parameters which encode their lifetimes (or restrictions thereon), which I call individual lifetime parameters (denoted by subscripts)\(^7\):

\(^7\) Inanimate individuals (e.g. buildings and television shows) also participate in lifetime inference, and pattern with animate individuals in the individual/interval split with respect to the behavior of the present tense:

(i) “Breaking Bad was an excellent show.” ↆ Breaking Bad is no longer airing.
(ii) “The new World Trade Center building and the old World Trade Center building both #had/#have over 100 floors.”
(31) (Bill is alive) \[\text{[Bill]} = b_t, \text{ where } t \supseteq t_0\]
(32) (John has died) \[\text{[John]} = j_t, \text{ where } t < t_0\]

Individual lifetime parameters may be updated based on information asserted by an utterance, or by the presuppositions or implicatures of an utterance, e.g. lifetime inferences:

(33) \[\text{[Mildred Manning]} = m_t, \text{ [Betty White]} = b_u, \text{ [John]} = j_v\]
(34) “Mildred Manning served as a nurse in World War Two.” \[\rightarrow t \supseteq \text{WWII}\]
(35) “Betty White is blond.” \[\rightarrow u \supseteq t_0\]
(36) “John was handsome.” \[\rightarrow \text{John is no longer alive} \rightarrow v < t_0\]

In sum, I suggest that individuals crucially differ from intervals in that the former have lifetime parameters which may be updated with information derived from speech, while the latter are inherently fully temporally specified and lack such parameters.

2.4 Maximize Presupposition

In general, when two utterances have the same truth conditions but differ in presuppositional strength, there is pressure for speakers to choose the utterance with the strongest presupposition:

(37) The/#a sun is shining. (Hawkins, 1991)
(38) Both/#all of John’s eyes are blue. (Percus, 2006)
(39) John knows/#thinks that Paris is in France. (Singh, 2011)

A pragmatic quantity principle stating roughly “make your contribution presuppose as much as possible” (Heim, 1991), called Maximize Presupposition (MP), has been proposed to explain these data (Percus, 2006; Sauerland, 2008; Singh, 2011; Schlenker, 2012; i.a.). MP was originally proposed as a principle operative at the level of the speech act, but there is evidence that it sometimes operates with respect to local contexts (Percus, 2006; Singh, 2011):

(40) Everyone with exactly two students assigned the same exercise to both/#all of his students.
(41) If John has exactly two students and he assigned the same exercise to both/#all of them, then I’m sure he’ll be happy.
(42) Mary believes that John has exactly two students and that he assigned the same exercise to both/#all of them.

The question of the locality of MP can be seen as parallel to the question of the locality of the exhaustification operation responsible for scalar implicatures: Chierchia (2006), Fox (2007), and

Based on these facts I conclude that all individuals, animate or not, have individual lifetime parameters, though in the case of inanimate individuals they might more appropriately be called *individual existence time parameters.*
Chierchia, et al. (2008), among others, in arguing for a grammatical theory of scalar implicatures, have proposed a covert exhaustification operator in the syntax which may take a variety of scopes and interact with other scopal elements. It may be that covert grammatical exhaustification and MP, an analogous operation differing only in that exhaustification is relative to presuppositions rather than assertions, result from the same underlying mechanism. Following the treatment of exhaustivity in Chierchia, et al. (2008), I formalize MP as a covert exhaustification operator over presuppositions computable with respect to an alternative set.8

\[ (43) \text{ Maximize Presupposition (MP): } MP_{\text{ALT}} = \left( \frac{[s \ldots X \ldots]}{P([s \ldots Y \ldots])} \right) \]

\[ \text{where } ALT(X) = \{Y: [s \ldots Y \ldots] \text{ presupposes more than } [s \ldots X \ldots] \} \text{ and } P(S) = \text{presupposition of } S. \]

To illustrate, consider the effects of MP on the interpretation of a simple present tense sentence:

\[ (44) \]

To illustrate, consider the effects of MP on the interpretation of a simple present tense sentence:

\[ \text{Prior to the application of MP, the sentence has no presupposition; afterwards, the negated presupposition of the past tense is linked to the time of John’s being alive and asleep, resulting in the antipresupposition that that time must not be prior to the utterance time. (In the simplified system with only two tenses used here, it therefore must be present.)} \]

In summary, the mechanism responsible for the presupposition exhaustification process which explains the typical presentness of the present tense in simple singular sentences on the present tense vacuity hypothesis is formalized as MP, a grammatical operator (or placeholder for a non-grammatical pragmatic operation) which computes, relative to a definite scope, antipresuppositions from weak presuppositional elements with presuppositionally stronger alternatives.

\[ ^8 \text{ I do not argue for this grammatical treatment of MP on independent grounds; If a non-grammatical account of local exhaustification phenomena turns out to be correct, the grammatical formalization used here may perhaps be interpreted as indicating the scope of a pragmatic or discourse-level operation.} \]
2.5 Distributivity

Sentences with plural or conjoined subjects often give rise to multiple readings, including distributive readings (on which the property expressed by a predicate independently holds of each of the individuals constituting the set, group or plurality expressed by the subject), and collective readings (on which the property holds of the subject referents considered as a plurality, set, or group):

(45) Distributive: John and Mary are tall.
(46) Collective: John and Mary are a couple.

All of the predicates involved in the present tense sentences with plural or conjoined subjects displaying the paradoxical behavior noted above introduce distributive readings:

(47) John and Bill are both very handsome. → Handsome(John) ∧ Handsome(Bill)
(48) #All the American presidents are male. → Male(Barack Obama) ∧ Male(George W. Bush)
      ∧ ...  
(49) 2012 and 2016 are leap years. → Leap-Year(2012) ∧ Leap-Year(2016)
(50) Every Friday this semester is a holiday. → Holiday(Friday₁) ∧ Holiday(Friday₂) ∧ ... 

Following Link (1987), Lasersohn (1998), and others, I analyze distributivity as a covert operator (D) which encodes universal quantification over members of collections of entities denoted by a plural or conjoined nominal phrase:

(51) \[ [D] = \lambda S. \lambda P. \forall x \in S[P(x)], \text{ where } S \text{ is the set of entities denoted by the plural or conjoined nominal phrase} \]

The distributivity operator introduces universal quantification to the present tense sentences with conjoined subjects:

(52) \[ [\text{John and Bill are tall}] = [[D](\text{John and Bill})]][\text{tall}][\text{PRESENT}(t)] \]
    = \[ [\lambda S. \lambda P. \forall x \in S[P(x)]][\text{tall}][\text{PRESENT}(t)] \]
    = \[ \lambda P. \forall x \in \{(j, b)\}[\lambda x, s \text{ is tall at } t \land s \text{ is alive at } t](i) \]
    = \[ \exists t_1 [j \text{ is tall at } t \land j \text{ is alive at } t_1] \land \exists t_2 [b \text{ is tall at } t \land b \text{ is alive at } t_2] \]

Crucially, the universal quantification introduced by D may now enter into scope relations with MP. In the next section I will explore the consequences of each possible scope relation on the truth and felicity conditions of sentences with conjoined individual and interval subjects, showing that D>MP scope in sentences with individual subjects but MP>D scope in sentences with interval
subjects predicts exactly the pattern of vacuous and non-vacuous behaviors of the present tense observed above.

3. Scope Ambiguity

In any sentence with a covert distributivity operator and a covert presupposition maximization operator (MP), a crucial scope ambiguity arises:

(53) \[ D[MP[\ldots \ X \ldots]] \]
(54) \[ MP[D[\ldots \ X \ldots]] \]

A different behavior is predicted by each of the two possible scope relations. If MP occurs inside the scope of a the distributivity operator in a sentence with a plural subject featuring a weak presuppositional element X with presuppositionally stronger alternatives, one antipresupposition will be computed for each element in the domain of quantification (e.g., for each referent of the plural subject). On the other hand, if MP occurs outside the scope of distributivity, at most one antipresupposition will be computed for the entire sentence:

(55) \[ D[MP[\ldots \ X \ldots]]: \]
\[ = \forall x \ldots [MP[\ldots \ X \ldots \ x \ldots]] \]
\[ = MP[\ldots \ X \ldots \ x_1 \ldots] \land MP[\ldots \ X \ldots \ x_2 \ldots] \land MP[\ldots \ X \ldots \ x_3 \ldots] \]
\[ = \neg P(\{x \ldots y \ldots x_1 \ldots\}) \land \neg P(\{x \ldots y \ldots x_2 \ldots\}) \land \neg P(\{x \ldots y \ldots x_3 \ldots\}) \]

(56) \[ MP[D[\ldots \ X \ldots]]: \]
\[ = MP[\forall x[\ldots \ X \ldots \ x \ldots]] \]
\[ = MP[\{x \ldots x_1 \ldots\} \land \{x \ldots x_2 \ldots\} \land \{x \ldots x_3 \ldots\}] \]
\[ = \neg P(\{x \ldots y \ldots x_1 \ldots\} \land \{x \ldots y \ldots x_2 \ldots\} \land \{x \ldots y \ldots x_3 \ldots\}) \]

In case the presuppositionally weak element involved is the present tense, the present antipresupposition is predicted to project above conjunction (as observed in sentences with plural or conjoined individual subjects) when D scopes over MP, but not to project (as observed in sentences with plural or conjoined interval subjects) when MP scopes over D:

(57) (John is dead, Bill is alive:) \#John and Bill are tall.
(5) (Uttered in 2013:) 2012 and 2016 are leap years.

To illustrate, consider the derivation of the truth and felicity conditions of (58), in which D scoping over MP results in two antipresuppositions: one for each individual in the set of subject referents. Such an interpretation corresponds to a discourse context in which it is presupposed that the time of John’s being tall and alive is not in the past and additionally that the time of Bill’s being tall and alive is not in the past—in other words, both John and Bill are alive and tall at the time of utterance:

\[ (58) \text{In case the presuppositionally weak element involved is the present tense, the present antipresupposition is predicted to project above conjunction (as observed in sentences with plural or conjoined individual subjects) when D scopes over MP, } \]
\[ \text{but not to project (as observed in sentences with plural or conjoined interval subjects) when MP scopes over D:} \]
\[ (57) \text{\#John and Bill are tall.} \]
\[ (5) \text{2012 and 2016 are leap years.} \]
(58) \[
[[\text{John and Bill are tall.}]] = [[[D]([[\text{John and Bill}]])(\text{tall})[[\text{PRESENT}](t)])]

\] = \[[\lambda S.\lambda P. \forall x \in S(P(x))][\{j, b\}][\text{MP}_{\text{ALT}}(\text{tall})[[\lambda t \text{.} \forall x \text{ is tall at } t \wedge x \text{ is alive at } t][t])]\)

\]

\[
= [\lambda P. \forall x \in \{j, b\} ] ([\text{MP}_{\text{ALT}}(\text{tall})[[\lambda t \text{.} \forall x \text{ is tall at } t \wedge x \text{ is alive at } t] t)])

\]

\[
= [\lambda P. \forall x \in \{j, b\} ] [\exists t \text{.} \forall x \text{ is tall at } t \wedge x \text{ is alive at } t]

\]

\[
\forall x \in \{j, b\} (\exists t \text{.} \forall x \text{ is tall at } t \wedge x \text{ is alive at } t)

\]

\[
\exists t_1 \text{.} j \text{ is tall at } t \wedge j \text{ is alive at } t_1 \wedge \exists t_2 \text{.} b \text{ is tall at } t \wedge b \text{ is alive at } t_2

\]

\[
\nonumber = \exists t_1 \text{.} j \text{ is tall at } t \wedge j \text{ is alive at } t_1 \wedge \exists t_2 \text{.} b \text{ is tall at } t \wedge b \text{ is alive at } t_2

\]

Based on the two general lifetime inferences resulting from the derivation, both John’s and Bill’s individual lifetime parameters can be updated to reflect the new information that John and Bill are each alive at the time of utterance:

(59) \[ j_1 \rightarrow j, \text{ where } t < t_0 \]

(60) \[ b_u \rightarrow b_u, \text{ where } u < t_0 \]

This interpretation correctly predicts that if either John or Bill (or both) is not alive at the time of utterance, the sentence will be infelicitous. An interpretation on which MP scopes over D, on the other hand, results in a single antipresupposition (the negation of the conjunction of two separate past presuppositions) and corresponds to a discourse context in which it is presupposed that it is not the case that both the time at which John is tall and alive is past and the time at which Bill is tall and alive is past—in other words, either Bill is tall and alive at the time of utterance, or John is, or they both are (but, critically, both need not be):

(61) \[
[[\text{John and Bill are tall.}]] = \text{MP}_{\text{ALT}}([[[D]([[\text{John and Bill}]])(\text{tall})[[\text{PRESENT}](t)])])

\]

\[
= \text{MP}_{\text{ALT}}([[[\lambda S.\lambda P. \forall x \in S(P(x))][\{j, b\}][\text{MP}_{\text{ALT}}(\text{tall})[[\lambda t \text{.} \forall x \text{ is tall at } t \wedge x \text{ is alive at } t][t]]])])

\]

\[
= \text{MP}_{\text{ALT}}([[[\lambda P. \forall x \in \{j, b\} ] ([\text{MP}_{\text{ALT}}(\text{tall})[[\lambda t \text{.} \forall x \text{ is tall at } t \wedge x \text{ is alive at } t] t]])])

\]

\[
= \text{MP}_{\text{ALT}}([[[\lambda P. \forall x \in \{j, b\} ] ([\lambda P. \forall x \in \{j, b\} ] ([\text{MP}_{\text{ALT}}(\text{tall})[[\lambda t \text{.} \forall x \text{ is tall at } t \wedge x \text{ is alive at } t] t])))])

\]

\[
= \text{MP}_{\text{ALT}}([[[\exists t_1 \text{.} j \text{ is tall at } t \wedge j \text{ is alive at } t_1 \wedge \exists t_2 \text{.} b \text{ is tall at } t \wedge b \text{ is alive at } t_2]])]

\]

Since it is indeterminate based on the truth conditions and presuppositions generated by this interpretation exactly which of John and Bill (if either) has his aliveness not located in the past, no general lifetime inferences can be made. In other words, since all that is derivable is a general restriction on the pair of times at which John and Bill are alive respectively, we cannot decisively conclude about either John or Bill that he is alive at the utterance time, and consequently, no updates to individual lifetime parameters are licensed.
The corresponding interpretation of a sentence with a plural or conjoined interval subject with MP scoped over D, however, generates just one antipresupposition, namely, that not all of the intervals denoted by the subject are past:

\[
\begin{align*}
(62) & \quad [2012 \text{ and } 2016 \text{ are leap years.}] \\
& = \text{MP}_{\text{ALT(PRESENT)}}([D]([2012 \text{ and } 2016]))(\text{leap-year}([\text{PRESENT}](t))) \\
& \quad \Rightarrow \exists [t_1 \text{ is a leap year at } t_1] \land \exists [t_2 \text{ is a leap year at } t_2] \\
& \quad \land \neg (t_1 < t_0 \land t_2 < t_0)
\end{align*}
\]

This interpretation corresponds to a discourse context in which it is presupposed merely that it is not the case that both 2012 and 2016 are past—predicting the sentence to be felicitous when uttered in 2013, which is observed. On the other hand, the interpretation with D scoping over MP predicts two separate antipresuppositions, one for each year, resulting in truth and felicity conditions satisfiable only in a context in which both 2012 and 2016 are past:

\[
\begin{align*}
(63) & \quad [2012 \text{ and } 2016 \text{ are leap years.}] \\
& = ([D]([2012 \text{ and } 2016]))(\text{MP}_{\text{ALT(PRESENT)}}([\text{leap-year}([\text{PRESENT}](t))])) \\
& \quad \Rightarrow \exists [t_1 \text{ is a leap year at } t_1] \land \exists [t_2 \text{ is a leap year at } t_2] \\
& \quad \land \exists [t_3 \text{ is a leap year at } t_3] \land \neg (t_1 < t_0 \land t_2 < t_0 \land t_3 < t_0)
\end{align*}
\]

Moreover, since intervals are temporally unenrichable, the two interpretations of the sentence with a conjoined (or plural or universally quantified) interval subject, unlike the two interpretations of the sentence with a conjoined (or plural or universally quantified) individual subject, do not differ with respect to the number of parameter updates they license.

In summary, D>MP scope generates interpretations in which the present antipresupposition projects above subject pluralization, conjunction, or universal quantification. Such presupposition projection is observed in sentences with plural, conjoined, or universally quantified individual subjects, suggesting distributivity scopes over presupposition maximization in sentences with individual subjects. On the other hand, MP>D scope generates interpretations in which the present antipresupposition does not project. Lack of projection is observed in sentences with plural, conjoined, or universally quantified interval subjects, suggesting presupposition maximization scopes over distributivity in sentences with interval subjects. D>MP scope results in two individual lifetime parameter updates, and MP>D scope results in none, when subjects are individuals. Neither scope results in parameter updates when subjects are intervals.

4. The Strongest Meaning Hypothesis

In sentences with individual subjects, the scopal structure which makes the correct predictions about the projection of the present antipresupposition above plurality/conjunction is the one which results in the greatest number of individual lifetime parameter updates. In general, the scope of
covert operators is ambiguous; I suggest that a principle of meaning strengthening sensitive to parameter updates forces the scope relation between D and MP which results in the greatest number of updates. In sentences with interval subjects, however, the scopal structure which makes the correct predictions with respect to present antipresupposition projection is the one in which MP is closest to the clause root.

There are independent reasons to suspect that a preferential interpretation principle sensitive to something like informativity is operational in natural language. Dalrymple, et al. (1998) show that the diversity of meanings attributed to reciprocal predicates can be reduced to a simple tendency for predicates to be interpreted with the strongest possible logical meaning consistent with the lexical semantics of the non-reciprocal component of the predicate. Winter (2001) observes that the various interpretations of plural predication which seem to wildly differ in logical strength can be attributed to a slightly more general principle requiring that the strongest possible meaning consistent with the lexical properties of the predicate in question be selected for interpretation. Chierchia, et al. (2008) invoke an analogous principle to account for apparently freely mobile covert exhaustivity operators, suggesting that interpreters are compelled to posit such operators wherever they result in the strongest possible proposition.

I propose that a specialized version of the general principle alluded to above, called the Strongest Meaning Hypothesis (SMH), is responsible for disambiguating scope relations in order to maximize the number of individual lifetime parameter updates:

(64) Strongest Meaning Hypothesis (Specialized Version): If a sentence S is ambiguous between two or more interpretations resulting in different numbers of individual lifetime parameter updates, the interpretation resulting in the greatest number of updates is preferred.

Since sentences with plural or conjoined individual subjects result in multiple present antipresuppositions and thus multiple parameter updates when interpreted with D scoping over MP but only one present antipresupposition and no parameter updates with MP scoping over D, the former interpretation is preferred and the present tense is compatible only with subjects whose referents are all alive at the time of utterance. On the other hand, since sentences with plural or conjoined interval subjects result in no parameter updates regardless of the location of MP and D, maximization is performed in a default root position, resulting in the compatibility of the present tense with subjects at least some of whose referents (but not all) must be non-past.

<table>
<thead>
<tr>
<th></th>
<th>D &gt; MP</th>
<th>MP &gt; D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Individual</td>
<td>2</td>
<td>0</td>
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<tr>
<td>Interval</td>
<td>0</td>
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</tbody>
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In summary, the scope relation between the two covert operators D (distributivity) and MP (presupposition maximization) is ambiguous. A strengthening principle based on the Strongest Meaning Hypothesis forces the listener to choose the scope relation which results in the greatest number of individual lifetime parameter updates. In sentences with plural individual subjects, since D>MP results in more parameter updates than MP>D, the former scope is preferred, while sentences with plural interval subjects never yield parameter updates and thus are interpreted with MP in its default clause-root position.

5. Summary & Conclusion

Sauerland’s (2002) present tense vacuity hypothesis explains some vacuous behaviors of the present tense, but it fails to predict the infelicity of the present tense with mixed past and non-past individual subjects. I maintain that the present tense is vacuous and that the infelicity of the present in sentences with plural or conjoined individual subjects is due to the interaction of an individual lifetime parameter on individuals with a principle of preferential interpretation analogous to the Strongest Meaning Hypothesis.

While intervals are inherently temporally specified, individuals are inherently temporally underspecified but enrichable on the basis of new information, including lifetime inferences. I suggest that attached to the semantic representation of each individual is a parameter consisting of an interval or a restriction on intervals which reflects speaker knowledge about the interval over which the individual is alive:

(65) \[ \text{John} = j, \text{Bill} = b_u \]

The Strongest Meaning Hypothesis has been independently proposed to account for data suggesting that when a listener can assign a sentence more than one meaning, the logically strongest one must be chosen. I propose an analogous principle sensitive to parameter updates: An utterance compatible with two or more interpretations must be interpreted as expressing the

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9 In past tense sentences with plural or conjoined individual subjects, MP is inactive since there is no weak presuppositional element from which to compute tense antipresuppositions. Since the past tense directly presupposes the priority of the predication time to the time of utterance, both wide-scope and narrow-scope MP interpretations result in one lifetime inference and one individual lifetime parameter update for each subject referent; as a result of the stalemate with respect to the Strongest Meaning Hypothesis, MP is interpreted in its default clause-root position.

Similarly, since intervals do not have lifetime parameters, the specialized version of the Strongest Meaning Hypothesis is indifferent with respect to the narrow-scope and wide-scope MP interpretations of a sentence with a plural or conjoined interval subject, and again MP is interpreted in its default clause-root position.
proposition which results in the greatest number of parameter updates. Since interpretations of sentences with plural or conjoined individual subjects which result in multiple present antipresuppositions generate the greatest number of parameter updates, the present tense is compatible only with subjects whose referents are all alive at the time of utterance. Due to the presence of mandatorily updated lifetime parameters on all individuals, this version of the Strongest Meaning Hypothesis forces D=MP readings of present-tense plural-individual-subject sentences. The computation of a present antipresupposition for each subject referent results in non-vacuous behavior of the present tense.

(57) (John is dead, Bill is alive:) #John and Bill are tall.
(2) (Only some of my uncles are alive:) #All of my uncles are blonde.

In contrast, since intervals lack lifetime parameters, the Strongest Meaning Hypothesis is inactive and MP is interpreted in its default global position in sentences with plural interval subjects. The computation of a single present antipresupposition over the conjunction of all subject referents results in vacuous behavior of the present tense.

(5) (Uttered in 2013:) 2012 and 2016 are leap years.
(66) (Uttered in the middle of the week:) Every day this week is a holiday.

The main contribution of the present paper is to point out a systematic difference between sentences in which the present tense behaves vacuously and those in which it does not: In sentences about individuals with lifetimes, the present tense tends to display non-vacuous behavior, and in sentences about time intervals, the present tense tends to display vacuous behavior. I have shown that the apparent irreconcilability of the two behaviors with both traditional theories and theories on which the present tense is vacuous can be resolved by admitting a formal realization of the distinction between intervals and individuals based on lifetimes and, with some assumptions about the status of distributivity and presupposition maximization as covert operators with flexible scope, looking more closely at the effects of scope on a particular type of informativity. Whether those assumptions are correct remains to be seen, but any theory of the present tense in English must account for the robust correlations between interval and individual subjects and vacuous and non-vacuous behaviors of the present tense, respectively.

Finally, while I have maintained the vacuity of the present tense and explained its non-vacuous behaviors as resulting from a complex set of interactions among a set of independent facts and principles, the opposite approach has been taken: Namely, to maintain the traditional meaning of the present tense and explain its vacuous behaviors as resulting from independent principles and facts. In particular, Thomas (2012) suggests that the sentences displaying vacuous behaviors of the present tense which Sauerland’s (2002) proposal is intended to explain can in fact be analyzed as futurates or habituals, where futurate and habitual constructions include aspectual operators which introduce vacuous-like (but not actually vacuous) temporal meanings.
References


Circumstantial modality and the diversity condition*
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Abstract. Condoravdi (2002) observed that the perfect cannot scope below metaphysical modals. She argued that this is a consequence of a constraint on the use of modal operators, the diversity condition (see also Werner, 2003). Recently, Abusch (2012) challenged Condoravdi’s analysis by identifying instances of circumstantial modals that cannot scope over the perfect but that cannot be analysed as metaphysical modals either. In this paper, I show that the diversity condition can be exploited to derive the ban on low percents with non priority circumstantial modals (Portner, 2009), and I explain why priority circumstantial modals are not subject to this constraint.

Keywords: Metaphysical modality, circumstantial modality, diversity condition.

1. Condoravdi’s analysis and Abusch’s critique

1.1. The diversity condition

In this subsection I will review Condoravdi’s (2002) observations about the temporal orientation of modals, and her account of the absence of percents in the scope of metaphysical modals. Following Kratzer (1977, 1981, 1991), modals are analysed with respect to conversational backgrounds, i.e. functions which map a world of evaluation to a set of propositions. A modal base is a type of conversational background that defines the domain of quantification of a modal operator, namely the intersection of the propositions in the modal base. A second type of conversational background, an ordering source, may be used to impose an order on this set of worlds.

When discussing the temporal interpretation of modal statements, i.e. statements consisting of a proposition embedded under a modal operator, it is useful to distinguish the temporal perspective of the modal from its temporal orientation. The temporal perspective of the modal statement is the time with respect to which the modal base is defined. In (1), it is the time at which the obligation holds, namely the time of utterance. The temporal perspective of a modal may be analysed as a parameter of its modal base, which is then analysed as a function from worlds to times to sets of propositions. The temporal orientation of a modal statement is the time of evaluation of its prejacent. In (1), the temporal orientation lies in the future of the temporal perspective.

(1) John must pay his rent tomorrow.

*Thanks to Vincent Homer, Alda Mari, Lisa Matthewson, Philippe Schlenker, Benjamin Spector and the audience at the conference How do we know what happens at the ENS and at Sinn und Bedeutung 18 at the University of the Basque Country.
Condoravdi (2002) made a series of observations that relate the availability of epistemic versus metaphysical interpretations of modal operators, to the relations between the temporal perspective and orientation of these operators. Her observations concern polysemous modals, such as *might* in sentence (2). This sentence is ambiguous. It has two interpretations which are selected by appropriate continuations in (3) and (4). In (3), the modal *might* is interpreted epistemically. (3) is an assertion that John’s having won the game is compatible with the speaker’s information state at the time of utterance. In (4), the modal *might* is interpreted metaphysically. (4) is an assertion that John’s winning the game was a possible continuation of the world of evaluation at some time in the past of the time of utterance.

(2) John might have won the game.
(3) John might have won the game, but it is also possible that he lost it.
(4) John might have won the game, but in the end he didn’t.

Following Condoravdi (2002) and Thomason (1970), we say that a world $w'$ is metaphysically accessible from $w$ at a time $t$ iff $w$ and $w'$ have the same history up to $t$. The historical equivalence relation between worlds defined in (5) allows us to define metaphysical modal bases:

(5) **Historical equivalence relation**

The historical equivalence relation is that relation which holds between two worlds $w$ and $w'$ at a time $t$ iff the histories of $w$ and $w'$ are identical up to $t$. It is written $w \approx_t w'$.

(6) **Metaphysical modal base**

A metaphysical modal base is a function from a world $w$ to a time $t$ to the singleton set containing the characteristic function of the set of worlds $w'$ that are historically equivalent to $w$ at $t$, i.e. $\lambda w. \lambda t. \{ p : p = \lambda w'. w \approx_t w' \}$

Condoravdi (2002) first observes that the temporal orientation of polysemous (epistemic and metaphysical) modal auxiliaries depends on the aktionsart of their complement: they have a present orientation (i.e. the temporal orientation is identical to the temporal perspective) with stative predicates and progressive predicates but they have a future orientation (i.e. the temporal orientation lies in the future of the temporal perspective) with non-progressive eventive predicates. Importantly, they never have a past orientation. Let us call this phenomenon the **non-past orientation** of epistemic and metaphysical modals.

(7) Anna might be sick.
(8) Anna might win the game.
Secondly, she observes that a perfect aspect cannot scope below a metaphysical modal operator. Examples (9) to (11) show that the perfect can scope below a modal operator. (9) shows that while *already* has a sortal restriction against non-perfect eventive predicates, this restriction does not apply to perfect forms. Condoravdi takes this as an indication that *already* scopes over the perfect in (9). By the same reasoning, the contrast between (10) and (11) indicates that the perfect has scope below *already* in (10), and therefore that it has scope below the modal operator. Finally, (12) shows that *still* is in complementary distribution with the perfect in a minimal clausal domain.

(9) He *(has) already returned.
(10) He might have already returned.
(11) He might (*already) return.
(12) He has (*still) won.

These diagnostics allow Condoravdi to correlate the scope of the perfect with the epistemic or metaphysical interpretation of polysemous modal auxiliaries. The acceptability of the continuations in (13) and (14) shows that the modal auxiliary is interpreted epistemically in the former but not in the later, i.e. *might* is interpreted metaphysically in (14) but not in (13). The use of *already* and *still* indicates that the perfect has scope below *might* in (13), while it has wide scope in (14). In sum, the metaphysical interpretation of *might* and other polysemous modals is unattested when the perfect scopes below the modal operator. Let us call this the ban on low perfects (with metaphysical modals).

(13) Anna might have won already, # but in the end she didn’t.
(14) At that point, Anna might still have won, ✓ but in the end she didn’t.

Condoravdi (2002) explains the non-past orientation of epistemic and metaphysical modals by building a non-past temporal operator in the denotation of modal auxiliaries, and she derives the ban on low perfects by resorting to a constraint on the use of modal bases, the diversity condition (a similar analysis was proposed independently by Werner, 2003). Both aspects of Condoravdi’s analysis have been criticized (see e.g. Abusch, 2012; Matthewson, 2012). In this paper, I will only be concerned with her analysis of the ban on low perfects. She argues that this restriction is due to the following diversity condition (which differs in minor respects from Condoravdi’s original formulation):

(15) **Diversity condition**
A context $c$ with context set $CS$, can assign a modal base $M$ to a modal operator with a temporal perspective $t$ and a prejacent $P$ only if there is a world $w$ in $CS$ and there are
When the perfect is in the scope of a modal operator interpreted metaphysically, the diversity condition is violated. Consider for instance sentence (16-a) with the logical form in (16-b). Assume the semantic derivation in (17). If $M$ is a metaphysical modal base, the prejacent of the modal operator is true in every world in $\bigcap M(w)(t_c)$, since by definition every world in $\bigcap M(w)(t_c)$ is identical up to $t_c$ and the truth of the prejacent only depends on facts that precede $t_c$.

(16)  
\begin{enumerate}
  \item Anna might have won.
  \item \[\text{PRES} \ [\text{might} \ [\text{PERF} \ [\text{Anna}]]]]\]
\end{enumerate}

(17)  
\begin{enumerate}
  \item \[\text{PRES} \ [\text{might} \ [\text{PERF} \ [\text{Anna}]]]]\]
  \item \[\lambda P. \lambda t. \lambda w. \lambda t'. [t' < t \land P(w)(t')]]\]
  \item \[\lambda P. \lambda t. \lambda w. \lambda t'. [w' \in \bigcap M(w)(t) \land P(w')(t)]\]
  \item \[\lambda t. \lambda w. \lambda t'. [t' < t_c \land w \in \bigcap M(w)(t) \land P(w')(t)]\]
  \item \[\lambda P. [\text{PRES} \ [\text{might} \ [\text{PERF} \ [\text{Anna}]]]]\]
\end{enumerate}

1.2. Abusch’s rejection of metaphysical modality

Abusch (2012) argues that some uses of might and could to which Condoravdi would assign a metaphysical modal base should rather be analysed with a non-metaphysical circumstantial modal base. This result challenges Condoravdi’s account of the ban on low perfects with the non-epistemic interpretation of these modals (cf. Matthewson, 2012), since her account relies on a characteristic property of metaphysical modality, namely that the domain of quantification consists of worlds that are identical up to the temporal perspective of the modal.

I will only discuss one of Abusch’s (2012) arguments, which I think is representative of her general line of reasoning. Consider example (18) in the context given in (19).

(18) In week 11 of the football season, mathematically, Buffalo could still have reached the playoffs.

(19) In evaluating sentences like these, one pays attention only to the history of play in $w_0$ up to the reference time $t_1$, the league schedule in $w_0$, and the league regulations in $w_0$. Other facts about $w_0$ are stipulated to be irrelevant. Suppose for instance that in week 11, all of the Buffalo players had broken legs, so that it was impossible for Buffalo to win any more games [...] Facts such as these are irrelevant to assessing the truth of (18). (Abusch, 2012, renumbered)
The issue with this example is that if the modal base of *could* was metaphysical, every fact of the world of evaluation that precedes week 11 of the football season should hold in the metaphysical alternatives, and therefore the players would have broken legs in all alternatives, preventing them to play any further game and reach the playoffs. That such facts are not taken into account when evaluating the truth of (18) suggests that the modal base is not metaphysical but only circumstantial: only certain facts of the world of evaluation matter, namely those that are described by the adverb *mathematically*, i.e. facts such as the number of games that had been played and won by Buffalo at the time of evaluation, and the schedule of the rest of the season at that time. The same point can be made with ambiguous modals like *might*:

(20) At that point, Buffalo might still have reached the playoffs.

What are the consequences of Abusch’s observation for Condoravdi’s account of the ban on low perfects? The unattested non-epistemic interpretation of *might* in (21) is supposed to be blocked by the diversity condition. If the modal base is metaphysical, then every world in its intersection is identical to the evaluation world up to the temporal perspective of the modal. Since the truth of the prejacent depends on facts that precede the temporal perspective of the modal, the prejacent is homogeneously true or false in the intersection of the modal base. The issue if the modal base is circumstantial but not metaphysical is that the history of the worlds in the intersection of the modal base may differ from that of the evaluation world even before the temporal perspective. Therefore, without any further restriction on the modal base, there may be two worlds in its intersection that assign a different truth value to the prejacent, in which case the diversity condition would be satisfied.

(21) Buffalo might have reached the playoffs already.

The objective of this paper is to convince the reader that there are indeed restrictions on circumstantial modal bases that prevent such a situation from arising, i.e. that Abusch’s observation, even if it is correct, does not jeopardize Condoravdi’s (2002) account on the ban on low perfects with would-be metaphysical modals.

2. The diversity condition without metaphysical modality

2.1. Pure circumstantial modals

In order to rule out infelicitous uses of polysemous modals with a past orientation as a violation of the diversity condition, it is sufficient to make sure that these modals are subject to the following conditions:
1. The modal base is a set of propositions that describe certain facts of the evaluation world at the temporal perspective.

2. If the prejacent describes an event that does not follow the temporal perspective, the modal base entails the prejacent or its negation.

Assigning a metaphysical modal base to these modals is one way to ensure the satisfaction of these conditions. But what if the modal base is circumstantial and not metaphysical? Circumstantial modal bases are sets of propositions that describe relevant facts of the world of evaluation. Therefore, we must ensure that whenever the prejacent of a modal that is subject to the ban on low perfects describes an event that precedes the temporal perspective, that event should count as a relevant fact described by the modal base. In this section I will argue that this is the case with pure circumstantial modals.

I call pure circumstantial modals these circumstantial modal operators that are not relative to a preference inducing ordering source, such as the law, some agent’s desires or goals, etc. In other words, they are a subset of circumstantial modals that complement the set of what Portner (2009) calls *priority modals*, i.e. deontic, bouletic and teleological modals. I will assume that they have an empty or a stereotypical ordering source. (22) and (23) are examples of pure circumstantial modals.

(22) Hydrangeas can grow here.
(23) At that point, Mary may still have won the game.

I define circumstantial modal bases as in (24). This definition is incomplete, insofar as it does not state what facts or propositions that describe facts are, and it does not state what the criterion of relevance $c$ is. I try to complete this definition in what follows.
A circumstantial modal base is a function from a world $w$ to a time $t$ to the set of propositions that describe facts of $w$ at $t$ that are relevant according to some criterion $c$.

I wish to show that whenever the prejacent of a pure circumstantial modal describes an event that does not follow the temporal perspective of the modal, the prejacent is part of the circumstantial modal base. To do so, I will use three auxiliary assumptions. The first of these is that there is no future fact. More precisely, I define propositions that describe facts as in (25). Note that I do not define facts themselves. I hope that I can evade this notoriously complicated philosophical problem (see Casati and Varzi, 2010; Mulligan and Correia, 2013, and references therein) and that the definition in (25) will be precise enough to support a reasonably predictive theory of circumstantial modal bases.

A proposition $\phi$ describes a fact $f$ at a time $t$ if and only if there is some event $e$ such that for every world $w$, $\phi(w)$ is true iff $e$ happens in $w$ and the runtime of $e$ does not follow $t$.

The second assumption specifies the relevance criterion used in the computation of modal bases of pure circumstantial modals:

The facts that are described by the modal base of a pure circumstantial modal operator $O$ are all the facts $f$ such that knowing whether $f$ obtains is relevant to assessing the truth of the prejacent of $O$.

(26) states that propositions that describe facts but that are not relevant to assessing the truth of the prejacent are not included in the modal base of pure circumstantial modals. The infelicity of (27) supports this claim, where the adverbial clauses conveys that the fact that I was born in 1981 is described by some proposition in the circumstantial modal base.

#Given the fact that I was born in 1981, hydrangeas can grow here.

(26) also states that all proposition that describe facts and that are relevant to assessing the truth of the prejacent are included in the modal base of pure circumstantial modals. This claim is supported by Nauze’s (2008) observation that the (pure) circumstantial statement (28-a) is infelicitous in the

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1Here I assume that an event can exist in different worlds. If the reader does not share this philosophical belief, she may reformulate (25) using counterparts of events.
context described in (29), contrary to the epistemic statement (28-b). This shows that if it is necessary for the prejacent to be true that a certain fact \( f \) obtain, the omission of \( f \)'s description from the modal base (in this case due to incomplete knowledge) makes a pure circumstantial statement infelicitous.

(28) a. Hydrangeas can grow here.
    b. There might be hydrangeas growing here.

(29) Suppose this time the climate in this faraway country is very much like home (temperate) but I do not know about the soil (at home the soil is alkaline, but on this piece of land I do not know whether it is alkaline or acid). As a matter of fact, I know that pilgrims had hydrangea seeds with them when they discovered this piece of land. Suppose finally that I know that hydrangeas need a temperate climate and an alkaline soil to grow. In this situation, sentence (28-b) is true. It is possible that the soil is alkaline, that the pilgrims planted some hydrangeas and thus that they still grow in the region. However, sentence (28-a) is not true in the present situation (as would follow in the standard framework); it is not false either but it is undecided awaiting for further knowledge about the soil’s pH.

(Nauze, 2008, renumbered)

Finally, the third and last assumption is that knowing whether a proposition \( \phi \) is true is always relevant to assessing the truth of \( \phi \). I think that this assumption is trivial and does not require independent support.

(30) **Principle of self-relevance**

Knowing whether \( \phi \) is true is relevant to assessing the truth of \( \phi \).

As a consequence of these three assumptions, a pure circumstantial modal whose prejacent describes an eventuality that is ongoing at or precedes its temporal perspective violates the diversity condition. Consider for instance (31). The temporal perspective of the modal is the utterance time. Assume that *might* is interpreted as a circumstantial modal – we want to explain why the sentence is infelicitous under this interpretation. Since the prejacent of the modal is the proposition \( \phi \) that there is an event of Anna winning the game that precedes the utterance time, either this proposition or its negation is a member of the modal base, by principles (26) and (30). Indeed, if there was an event of Anna winning the game in the world of evaluation before the time of utterance, then \( \phi \) is in the modal base, which entails that there was such an event before the time of utterance in every circumstantial alternative. On the other hand, if there was no event of Anna winning the game in the world of evaluation before the time of utterance, then the negation of \( \phi \) is in the modal base, which entails that there is no such event in any circumstantial alternative. In both cases, the diversity condition is violated, since the prejacent is either homogeneously true or homogeneously false across the circumstantial alternatives.
The same reasoning can be applied to other types of pure circumstantial modals, such as ability modals. In French, *pouvoir* can be interpreted as an ability modal, e.g. (32), or as an epistemic modal. However, when a perfect auxiliary scopes below *pouvoir*, the ability interpretation is unavailable, as illustrated in (33) which only has an epistemic reading. Note that the ability interpretation resurfaces when the perfect has wide scope, as in (34) (in addition, (34) triggers an actuality inference, see Bhatt, 1999; Hacquard, 2006; Homer, 2010).

(32) Michel peut soulever 100 kg d’un seul bras.
‘Michel can lift 100 kg with one arm.’

(33) Michel peut avoir soulevé 100 kg d’un seul bras.
‘Michel might have lifted 100 kg with one arm.’

(34) Michel a pu soulever 100 kg d’un seul bras.
‘Michel could lift 100 kg with one arm.’

2.2. Other circumstantial modals

Not all circumstantial modals are subject to the ban on low perfects. In particular, the perfect may scope below certain priority modals, i.e. circumstantial modals that are relative to a preference inducing ordering source, such as deontic modals, bouletic modals or teleological modals (Portner, 2009). Here, I will only discuss deontic and teleological modals.

Teleological modals are not subject to the ban on low perfects, as illustrated in (35) and (36).

(35) To become a virtuoso violinist, you must have started to practice early in your life.

(36) To become a virtuoso violinist, you should have started to practice early in your life.

On the other hand, the perfect may scope below some deontic modals but not all of them. As observed by Ninan (2008), while *ought to* is felicitous with a past orientation in (37), *must* can only be interpreted epistemically in (38).

(37) Sam ought to have gone to confession.

(38) Sam must have gone to confession.
In the previous subsection, I proposed an account of the ban on low perfects that relies on the assumption that the modal base of a pure circumstantial modal includes all propositions that describe facts and that are relevant to assessing the truth of the prejacent. In this subsection, I will argue that teleological and deontic modals are not subject to the ban on low perfects because their modal base is not subject to this requirement.

2.2.1. Teleological modals

Teleological modals describe what is possible or necessary given certain goals. These modal statements are circumstantial insofar as their truth depends on certain facts about the world of evaluation, and not just on the goals to be achieved. Consider for instance (39), from Sæbø (2001) via von Fintel and Iatridou (2005). Whether it is necessary for the addressee to take the A train or not does not only depend on the goal to go to Harlem that the assertion ascribes to her, it also depends on certain facts about the current location of the addressee, the situation of public transportation systems, etc.

(39) To go to Harlem, you ought to take the A train.

von Stechow (2004) and von Fintel and Iatridou (2005) argue that the purpose clause in such modals describe a designated goal which is added to the circumstantial modal base, in the spirit of Kratzer’s (1981) analysis of conditionals. This extended modal base is ordered by the set of goals of the addressee.

The relation between the prejacent and the modal base in teleological modals is intuitively quite different from what we observed in pure circumstantial modals. The modal base of pure circumstantial modals describe facts that condition the realization of an eventuality described by the prejacent. As a consequence, it is possible to justify a possibility statement with this flavour by pointing out that the prejacent is actually true, as illustrated in (40). By contrast, the prejacent of a teleological modal describes means to reaching certain goals, and the circumstantial modal base describe facts that are relevant to determine which means can be used to reach these goals. Consequently, whether the prejacent is actually true is irrelevant to a teleological statement, as demonstrated by the oddity of the continuation in (41), if it is intended as a justification of the preceding modal statement.

(40) Of course hydrangeas can grow here. Hydrangeas DO grow here!
(41) Of course you can take the A train to go to Harlem. #You ARE on the A train!
I propose that the circumstantial modal base of teleological modals is subject to the following constraint. Consequently, the principle of self-relevance does not force the inclusion of a prejacent with a past orientation in the modal base, which explains why a teleological modal may have a perfect operator in its scope without violating the diversity condition.

\[ (42) \quad \text{Relevant facts for teleological modals} \]

The facts that are described by the modal base of a teleological modal with designated goal \( g \) are only facts \( f \) such that knowing whether \( f \) obtains is relevant to determining which means are available to reach \( g \).

2.2.2. Deontic modals

Deontic modals describe what is possible or necessary given certain rules or moral principles. Their prejacent describes a state of affairs that is presented as (not) permissible or (not) mandatory, given the facts described in the modal base and the rules described in the ordering source.

\[ (43) \quad \text{John must be fined.} \]

As with teleological modals, knowing whether the prejacent is actually true or false is not helpful to assess the truth of the modal statement. This is illustrated in (44), where the continuation is odd, if it is intended as a justification of the modal statement.

\[ (44) \quad \text{Of course John may eat a piece of cake. #He is eating one right now!} \]

I propose that the modal base of deontic modals is subject to the following constraint. Here again, the principle of self-relevance will not force the inclusion of a prejacent with a past orientation in the modal base.

\[ (45) \quad \text{Relevant facts for deontic modals} \]

The facts that are described by the modal base of a deontic modal with ordering source \( g \) are only facts \( f \) such that knowing whether \( f \) obtains is relevant to determining whether the prejacent is inconsistent with or a consequence of the rules described in \( g \).

This assumption explains why the perfect may scope below the deontic modal in (46), but it leaves the absence of deontic interpretation of (47) unexplained.
(46) Sam ought to have gone to confession.
(47) Sam must have gone to confession.

According to Ninan (2008), it is performativity that explains the lack of past orientation of must-type deontic modals. Performative deontic modals are interpreted as directive speech acts on top of their modal assertive meaning, as illustrated in (48). When the temporal perspective of the modal is the time of utterance, the perfect cannot scope below the modal because it doesn’t make sense to ask an agent to realize a past action.

(48) Sam must go to confession.
   Assertion: Among the set of circumstantially accessible worlds, those that are optimally lawful are all worlds in which Sam goes to confession.
   Directive speech act: the speaker places a requirement on the addressee to ensure that Sam goes to confession.

An interesting prediction of this analysis is that the ban on low perfects with performative deontic modals should disappear when the prejacent describes a future eventuality, which may be the case if the temporal perspective of the modal is in the future. In such a case, the past orientation of the prejacent would not be incompatible with the directive speech act, since the prejacent could still describe a state of affairs that lies in the future of the time of utterance. This prediction is borne out, as demonstrated by the availability of a deontic interpretation in (49), from Portner (2009).

(49) Mary must have left by the time I get back.

Unfortunately, this analysis does not account for the persistence of the ban on low perfects with non-performative deontic uses of must. This issue is illustrated in (50) from Ninan (2008).

(50) #If Sam must have gone to confession, he did something wrong.

This casts serious doubts on Ninan’s analysis. One way out of this problem is to assume that must actually has a metaphysical modal base. This would derive the ban on low perfects as a straightforward consequence of the diversity condition. However, in the absence of independent evidence to support this hypothesis, it is hardly explanatory.
3. The diversity condition and the non-past orientation of pure circumstantial modals

Kratzer (2011) and Matthewson (2012) argue that the future orientation of circumstantial modals is due to the use of a (covert) prospective aspect in their complement, rather than built in the lexical entry of these modals. Cross-linguistic support for this analysis comes from Gitksan, a language where the prospective aspect is overt and obligatory with circumstantial modals (Matthewson, 2012).

In order to discuss this analysis, it will be useful to adopt the following lexical entries. Modal operators are defined with respect to a modal base $M$ and an ordering source $O$, where $Best(M)(O)(w)(t)$ is the set of worlds in $\bigcap M(w)(t)$ that are best ranked with respect to the ordering induced by $O(w)(t)$.

\begin{align}
\text{(51)} & \quad [\text{might}]^c = \lambda P.\lambda t.\lambda w. \exists w'[w' \in Best(M)(O)(w)(t) \land P(t)(w')] \\
\text{(52)} & \quad [\text{PFV}]^c = \lambda P.\lambda t.\lambda w. \exists e[P(e)(w) \land \tau(e) \subseteq t] \\
\text{(53)} & \quad [\text{PERF}]^c = \lambda P.\lambda t.\lambda w. \exists t'[t' < t \land P(t')(w)] \\
\text{(54)} & \quad [\text{PROSP}]^c = \lambda P.\lambda t.\lambda w. \exists t'[t' > t \land P(t')(w)] \\
\text{(55)} & \quad [\text{PRES}]^c = t_c \\
\text{(56)} & \quad [\text{PAST}]^c = \lambda P.\lambda w. \exists t[t < t_c \land P(t)(w)]
\end{align}

The following examples illustrate the prospective analysis of the future orientation of modals.

\begin{align}
\text{(57)} & \quad \begin{array}{l}
\text{a. It might rain.} \\
\text{b. PRES > might > PROSP > PFV} \\
\text{c. } \lambda w.\exists w'[w' \in Best(M)(B)(w)(t_c) \land \exists t'[t' > t_c \land \exists e[\text{rain}(w')(e) \land \tau(e) \subseteq t']]]
\end{array}
\end{align}

According to this analysis, the past and future orientations of modals are symmetric, the latter being obtained when the prospective aspect is inserted below a modal operator. Consequently, the correct generalization about the temporal orientation of circumstantial modals is that pure circumstantial modals have an obligatory future interpretation, while epistemic modals and priority circumstantial modals may be interpreted with a past, present or future orientation, the latter being illustrated in (58), (59) and (60) respectively.

\begin{align}
\text{(58)} & \quad \text{Sam ought to have been to confession.} \\
\text{(59)} & \quad \begin{array}{l}
\text{a. Sam ought to be at church.} \\
\text{b. Sam ought to be sleeping.}
\end{array}
\end{align}
Sam ought to go to church.

In this section, I would like to argue that these generalizations follow from the diversity condition and additional assumptions about grammatical aspect. Let us assume that viewpoint aspect (perfective vs imperfective) is obligatory with eventive VPs and illicit with stative VPs. Let us also assume that perfect and prospective aspects are optional. Finally, let us assume that eventive VPs without progressive -ing morphology are perfective. There are three combinations to consider with each viewpoint aspect. I will examine each combination in turn, with a present temporal perspective.

Aspect combinations in the complements of modals

a. MODAL > IMP/PFV
b. MODAL > PERF > IMP/PFV
c. MODAL > PROSP > IMP/PFV

Present perspective, perfective viewpoint A pure circumstantial modal interpretation of the first combination is ruled out by the diversity condition. Furthermore, assuming that \( t_c \) is an instant and that events are not instantaneous, the first combination in (61) results in a contradiction, see Taylor (1977); Dowty (1979) and also Kratzer (2011). This means that an epistemic interpretation of the modal is not available either, nor is the combination attested with a priority modal, as illustrated in (63).

A pure circumstantial interpretation of the second combination is ruled out by the diversity condition. However, an epistemic interpretation is available in (65), and the combination is also attested with priority modals, as illustrated in (65).

a. It might rain.
b. PRES > might > PFV
   *pure circumstantial, *epistemic
c. \( \lambda w. \exists w'[w' \in \text{Best}(M)(O)(w)(t_c) \land \exists e[\text{rain}(w')(e) \land \tau(e) \subseteq t_e]] \)

A pure circumstantial interpretation of the second combination is ruled out by the diversity condition. However, an epistemic interpretation is available in (65), and the combination is also attested with priority modals, as illustrated in (65).

a. It might have rained.
b. PRES > might > PERF > PFV
   *pure circumstantial, \( \check{\text{epistemic}} \)
c. \( \lambda w. \exists w'[w' \in \text{Best}(M)(O)(w)(t_c) \land \exists t'[t' < t_c \land \exists e[\text{rain}(w')(e) \land \tau(e) \subseteq t']]] \)

a. Sam ought to have left.
b. PRES > ought > PERF > PFV
   \[∀\lambda w.∀w'[w' ∈ Best(M)(O)(w)(t_c) → ∃t'[t' < t_c ∧ ∃e[leave(w')(s) ∧ τ(e) ⊆ t']]]\]

Pure circumstantial modals are only compatible with the third combination, which explains the future orientation of non-progressive eventive pure circumstantial modals. Epistemic and priority interpretations are available with this combination too.

(66) a. It might rain (tomorrow).
   b. PRES > might > PROSP > PFV
     \[∀\lambda w.∀w'[w' ∈ Best(M)(O)(w)(t_c) ∧ ∃t'[t' > t_c ∧ ∃e[rain(w')(e) ∧ τ(e) ⊆ t']]]\]

(67) a. Sam ought to leave (tomorrow).
   b. PRES > ought > PROSP > PFV
     \[∀\lambda w.∀w'[w' ∈ Best(M)(O)(w)(t_c) → ∃t'[t' > t_c ∧ ∃e[leave(w')(s) ∧ τ(e) ⊆ t']]]\]

Present perspective, imperfective viewpoint A pure circumstantial interpretation of the first combination violates the diversity condition, however it is not contradictory because of the imperfective aspect. Consequently, while a pure circumstantial interpretation is ruled out, epistemic and priority interpretations are available.

(68) a. It might be raining.
   b. PRES > might > IMP
     \[∀\lambda w.∃w'[w' ∈ Best(M)(O)(w)(t_c) ∧ ∃e[rain(w')(e) ∧ τ(e) ⊇ t_c]]\]

(69) a. Sam ought to be sleeping.
   b. PRES > ought > IMP
     \[∀\lambda w.∀w'[w' ∈ Best(M)(O)(w)(t_c) → ∃e[sleep(w')(e)(s) ∧ τ(e) ⊇ t_c]]\]

A pure circumstantial interpretation of the second combination is again ruled out by the diversity condition. Epistemic and priority interpretations are attested.

(70) a. It might have been raining.
   b. PRES > might > PERF > IMP
     \[∀\lambda w.∃w'[w' ∈ Best(M)(O)(w)(t_c) ∧ ∃t'[t' < t_c ∧ ∃e[rain(w')(e) ∧ τ(e) ⊇ t']]]\]

(71) a. Sam ought to have been sleeping.
   b. PRES > ought > PERF > IMP
     \[∀\lambda w.∀w'[w' ∈ Best(M)(O)(w)(t_c) → ∃t'[t' < t_c ∧ ∃e[sleep(w')(e)(s) ∧ τ(e) ⊇ t']]]\]
Finally, prospective imperfective combinations license all three interpretations:

(72) a. It might be raining (when Anna arrives tomorrow).
    b. PRES > might > PROSP > IMP  \( \checkmark \) pure circumstantial, \( \checkmark \) epistemic
    c. \( \lambda w.\exists w'[w' \in \text{Best}(M)(O)(w)(t_c) \land \exists t'[t' > t_c \land \exists e[\text{rain}(w')(e) \land \tau(e) \supseteq t']]] \)

(73) a. Sam ought to be sleeping (when Anna arrives tomorrow).
    b. PRES > ought > PROSP > IMP  \( \checkmark \) deontic
    c. \( \lambda w.\forall w'[w' \in \text{Best}(M)(O)(w)(t_c) \rightarrow \exists t'[t' > t_c \land \exists e[\text{sleep}(w')(e)(s) \land \tau(e) \supseteq t']]] \)

In sum, if we assume that the past and future orientations of modals are obtained by inserting a perfect and prospective aspect (respectively) in the scope of the modal, the extension of the diversity condition to pure circumstantial modals (as opposed to just metaphysical modals) allows us to derive their future orientation, without blocking the past and present orientation of epistemic and priority modals.

A complication with past ability modals  The diversity condition should apply to modal operators independently of their temporal perspective. In particular, it should prevent the use of pure circumstantial modal bases with modal operators whose prejacent has a past or a present orientation, no matter whether the temporal perspective of the operator is in the present or in the past. In this respect, the availability of a pure circumstantial interpretation (namely, an ability interpretation) of sentences like (74) is surprising:

(74) Michel a pu soulever 100 kg d’un seul bras.
    ‘Michel could lift 100 kg with one arm.’

The modal auxiliaries pu and could in (74) have a past perspective. The fact that their prejacent has a present orientation should block the ability interpretation, since it violates the diversity condition. Indeed, insofar as the prejacent describes an event that is ongoing at the temporal perspective, it describes a fact of the world of evaluation, and therefore it should be included in the circumstantial modal base. Nevertheless, (74) is acceptable.

Note that (74) also triggers an actuality inference (see Bhatt, 1999; Hacquard, 2006; Homer, 2010): (74) entails that Michel did lift 100kg with one arm. Interestingly, Kratzer (2011) proposes that actuality entailments of past ability statements are due to the fact that the event described by the prejacent is part of the circumstances that are described in the modal base. But these are precisely the conditions under which the diversity condition is violated!

Kratzer’s proposal suggests that actuality entailments may be a way to redeem violations of the diversity condition. However, it raises the question why actuality entailments do not arise with
other flavours of pure circumstantial modality, as in (75).

(75) Hier matin, il a pu pleuvoir.    
‘It might have rained yesterday morning.’  

Only epistemic

I leave these questions for further research.

4. Conclusion

I have argued that the ban on low perfects with metaphysical modals applies to all pure circumstantial modals, and I have proposed that the difference between pure circumstantial modals and priority modals in this respect is due to the fact that the modal bases of these modals are subject to different constraints. One component of this proposal is the claim that the composition of the modal base of a circumstantial modal depends on the meaning of its prejacent. This is not a new idea: it is a version of Hacquard’s (2006) claim that circumstantial modal bases are anchored in the event argument of the prejacent VP. What may be more original is the proposal that the way the meaning of the prejacent is exploited in the computation of the modal base varies across classes of circumstantial modals. In Hacquard’s terms, one may say that there exist different functions that map VP events to circumstantial modal bases, and different flavours of circumstantial modality exploit different such functions.

References


Truth and typicality in the interpretation of quantifiers
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Abstract. The standard view in natural language semantics is that quantifiers denote relations between sets. Psychological research, however, has shown that quantified statements often convey finer-grained information that is not encoded in their set-theoretic definitions. We investigate the relationship between these meaning aspects on the basis of two experiments.

Keywords: quantification; probability; typicality; scalar inference.

1. The interpretation of quantifiers

The interpretation of quantifiers has been investigated from a range of perspectives. The standard view in natural language semantics is that quantifiers denote relations between sets (e.g., Barwise and Cooper 1981; Keenan and Stavi 1986; Montague 1973). For example, ‘All A are B’ is true iff the set of A is a subset of the set of B, ‘Some A are B’ is true iff the intersection between the set of A and the set of B is nonempty, and ‘Most A are B’ is true iff the number of A that are B is greater than the number of A that are not B. Formally, using the italic form of a term to refer to its extension:

‘All A are B’ is true iff  \[ A \subseteq B \]
‘Some A are B’ is true iff  \[ A \cap B \neq \emptyset \]
‘Most A are B’ is true iff  \[ |A \cap B| > |A - B| \]

These set-theoretic definitions assign binary truth values: quantified sentences are either true or false in a situation. No finer-grained differences between situations are thus expected.

Psychological research, however, suggests that quantified statements often convey finer-grained information than what is encoded in their set-theoretic definitions. To illustrate, Newstead et al. (1987) asked participants to fill in the blanks in sentences like the following, where the quantifier Q and the total set size n were varied between items:

If Q of a group of n people are male, then ____ people are male.

In addition, Newstead et al. asked participants what they would expect to be the minimum and maximum number of people that satisfied the predicate given the truth of the antecedent. For

*This research was supported by a grant from the Netherlands Organization for Scientific Research (NWO), which is gratefully acknowledged.
statements where the total set size was 60, Newstead et al. found the following mean estimates (in %) for the previously mentioned quantifiers ‘all’, ‘some’, and ‘most’:

<table>
<thead>
<tr>
<th></th>
<th>Min</th>
<th>Mean</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>All</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Some</td>
<td>17</td>
<td>33</td>
<td>45</td>
</tr>
<tr>
<td>Most</td>
<td>66</td>
<td>83</td>
<td>90</td>
</tr>
</tbody>
</table>

The results for ‘all’ are in line with its set-theoretic definition: ‘All people are male’ implies that there are no females. The response ranges for ‘some’ and ‘most’, however, are much smaller than suggested by their set-theoretic definitions. For example, even though, according to its set-theoretic definition, ‘Some people are male’ is true whenever more than one person is male, participants infer from this statement that between 17% and 45% people are male. Further research has shown that the precise estimates are influenced by extralinguistic factors, such as:

- **Total set size.** Newstead et al. (1987) found for some quantifiers that the estimated number of people that satisfies the predicate depends on the total set size. An example is ‘Some people are male’: if there are just twelve people, participants estimate that 37% of them are male, whereas in a situation with ten thousand people their estimation drops to about 27%.

- **World knowledge.** Estimates for statements of the form ‘Q A are B’ depend on the intuitive likelihood that As are B: they will be higher for statements like ‘Q people find Miss Sweden attractive’ than for statements like ‘Q earthquakes occurred in California in 1951’ (e.g., Moxey and Sanford 1993; Pepper and Prytulak 1974).

- **Audience design.** Yildirim et al. (2013) provide evidence that listeners tailor their interpretation of quantified statements to the idiosyncracies of the speaker. If a speaker consistently refers to situations where half of the A are B with ‘Some A are B’ instead of ‘Many A are B’, listeners take this information into account in their estimates.

- **Alternatives.** Chase (1969) found that estimates for quantified statements depend on the alternative expressions that feature in the experiment. He asked participants to rate the likelihood of an event on a five-point scale. In one condition, these events were described by means of high-frequency quantifiers (e.g., ‘very often’, ‘usually’); in the other condition, by means of low-frequency quantifiers (e.g., ‘seldom’, ‘occasionally’). In many cases, Chase found that the mean likelihood ratings in these conditions were statistically indistinguishable.

These findings can be modelled in various ways. Some authors have proposed that quantifiers denote probability distributions over situations. In other words, ‘Q A are B’ denotes a function from
situations to numerical values that sum to one (e.g., Yildirim et al., 2013). However, there are a number of issues with this proposal. First, it is not immediately obvious what the numerical values represent. Suppose that the function assigns a value \( p \) to a particular situation. One interpretation is that this means that the listener believes that the likelihood of this situation is \( p \). Another interpretation is that the likelihood that a listener believes this situation is the one the speaker had in mind is \( p \). Yet another interpretation is that the listener believes that the speaker believes that the likelihood of that situation is \( p \). For our current purposes, the differences between these proposals are immaterial but it is an issue that stands in need of further analysis. A more pressing problem with the probabilistic account is that for most quantifiers it presupposes knowledge about the size of the quantifier domain. Consider the sentence ‘Some A are B’. In order to assign a probability value to a situation with, for example, five As that are B, it will be necessary to know how many As there are in total: the value will be much higher in a situation with ten As than in a situation with ten thousand As. This indeterminacy goes against the intuition that it is perfectly possible to interpret quantified statements without having knowledge about the size of the quantifier domain.

In order to avoid this issue, we will model the finer-grained interpretation of quantified statements by assigning them functions from situations to typicality values (Rosch, 1975). This is a more general approach than the probabilistic account because it does not require that the numerical values sum to one. It is therefore possible to assign a definite value to a situation even if the total set size is unknown. The numerical values represent the “typicality” of a situation with respect to the quantified statement. In the next section, we explain the notion of typicality in some more detail. Typicality values can be converted to probability values by dividing them by the sum of the typicality values, which will only be possible if information about the total set size is available.

What is the relationship between typicality structure and the set-theoretic truth definitions proposed by natural language semanticists? Are these meaning aspects disparate, or are they reflections of one underlying dimension? Are set-theoretic definitions of quantifiers still needed in light of the findings from psychological experiments? In Section 4, we address these questions on the basis of the results of two experiments that will be discussed in Section 3. This investigation follows the lead of McCloskey and Glucksberg (1978), who inquired into the interpretation of nouns. In the next section, we consider their arguments in some detail.

2. McCloskey and Glucksberg (1978)

Nouns like ‘bird’ and ‘furniture’ refer to categories. According to the classical view, already propagated by Socrates in Plato’s Statesman and later popularised by Aristotle, categories are sets of objects that fulfill a list of necessary and sufficient conditions. For example, ‘bird’ refers to the set of individuals that are warm-blooded and egg-laying vertebrates with feathers and wings. According to this account, all individuals are either birds or nonbirds.

Psychological research, however, suggests that listeners often make finer-grained distinctions between objects than the binary distinction imposed by the classical definition of a category. For
example, Rosch (1975) found that participants consider sparrows to be more typical birds than penguins or chickens. Some authors have argued that these typicality judgements indicate that category membership itself is a matter of degree: sparrows are birds to a greater degree than are penguins or chickens (e.g., Lakoff 1973). Other authors, however, have criticised this view (e.g., Kamp and Partee 1995).

What is the relationship between typicality judgements and category membership? Do listeners have access to classical definitions for categories denoted by nouns like ‘bird’ and ‘furniture’? To address these questions, McCloskey and Glucksberg (1978) probed participants for typicality judgements and category membership judgements for a range of categories and objects.

Table 1 provides a sample of the results for the categories denoted by ‘bird’ and ‘furniture’. In both cases, the average typicality values line up along a continuum between the two extremes. In the case of ‘furniture’, the percentages of positive responses in the category membership task also form such a continuum. In the case of ‘bird’, by contrast, almost all percentages of positive responses are close to the extremes of 0 and 100. Hence, there was more agreement about category membership for ‘bird’ than for ‘furniture’.

<table>
<thead>
<tr>
<th>Object</th>
<th>$\tau$</th>
<th>$\varsigma$</th>
<th>Object</th>
<th>$\tau$</th>
<th>$\varsigma$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Robin</td>
<td>10.00</td>
<td>100</td>
<td>Chair</td>
<td>9.95</td>
<td>100</td>
</tr>
<tr>
<td>Eagle</td>
<td>9.58</td>
<td>100</td>
<td>Table</td>
<td>9.83</td>
<td>100</td>
</tr>
<tr>
<td>Partridge</td>
<td>8.42</td>
<td>100</td>
<td>Bed</td>
<td>9.58</td>
<td>98</td>
</tr>
<tr>
<td>Goose</td>
<td>8.29</td>
<td>97</td>
<td>Rug</td>
<td>6.25</td>
<td>48</td>
</tr>
<tr>
<td>Condor</td>
<td>8.23</td>
<td>100</td>
<td>Lampshade</td>
<td>5.70</td>
<td>63</td>
</tr>
<tr>
<td>Buzzard</td>
<td>8.08</td>
<td>98</td>
<td>Sewing machine</td>
<td>5.32</td>
<td>11</td>
</tr>
<tr>
<td>Turkey</td>
<td>7.92</td>
<td>100</td>
<td>Refrigerator</td>
<td>5.07</td>
<td>18</td>
</tr>
<tr>
<td>Chicken</td>
<td>7.75</td>
<td>95</td>
<td>Waste basket</td>
<td>4.70</td>
<td>31</td>
</tr>
<tr>
<td>Loon</td>
<td>7.43</td>
<td>100</td>
<td>Bookends</td>
<td>4.53</td>
<td>43</td>
</tr>
<tr>
<td>Ostrich</td>
<td>7.25</td>
<td>97</td>
<td>Ironing board</td>
<td>4.32</td>
<td>16</td>
</tr>
<tr>
<td>Penguin</td>
<td>6.96</td>
<td>92</td>
<td>Pillow</td>
<td>4.12</td>
<td>31</td>
</tr>
<tr>
<td>Bat</td>
<td>3.63</td>
<td>17</td>
<td>Electric fan</td>
<td>3.78</td>
<td>13</td>
</tr>
<tr>
<td>Flying squirrel</td>
<td>2.63</td>
<td>5</td>
<td>Ashtray</td>
<td>3.45</td>
<td>21</td>
</tr>
<tr>
<td>Vampire</td>
<td>2.29</td>
<td>13</td>
<td>Door</td>
<td>2.87</td>
<td>10</td>
</tr>
<tr>
<td>Bee</td>
<td>2.04</td>
<td>3</td>
<td>Ceiling</td>
<td>2.03</td>
<td>0</td>
</tr>
<tr>
<td>Locust</td>
<td>1.83</td>
<td>9</td>
<td>Fence</td>
<td>1.87</td>
<td>0</td>
</tr>
</tbody>
</table>

Table 1: Sample of the results of the typicality and category membership tasks for the categories denoted by ‘bird’ (left column) and ‘furniture’ (right column) as found by McCloskey and Glucksberg (1978). $\tau$: Average typicality on a 10-point scale; $\varsigma$: Percentage of positive responses in the category membership task.
Do participants have access to a well-defined category for these nouns, or are their category membership judgements fully determined by typicality differences? In order to answer this question, we constructed two models predicting proportions of positive responses in the category membership task: one based on a classical definition and one based on typicality judgements. The classical model for ‘bird’ assigned 1 to all biological birds and 0 to all other objects. In the case of ‘furniture’, there was no straightforward criterion for distinguishing category members from nonmembers. Therefore a cutoff point in the typicality ratings was used: all objects that scored higher than 5.5 were assigned 1 and all other objects 0. The typicality model was formed by the normalised typicality ratings. For both nouns, we compared the absolute differences between the predicted and attested proportions of positive responses in the category membership task by means of Welch $t$-tests. In the case of ‘bird’, the classical model provided a better fit than the typicality model (mean differences of .06 and .17, $t(54) = -3.94, p < .001$), whereas the converse was the case for ‘furniture’ (mean differences of .19 and .09, $t(34) = 2.48, p = .02$).

The results for ‘bird’ are thus in accordance with the classical account of categorisation. For this noun, judgements of category membership were relatively crisp. This suggests that participants have access to a well-defined category of birds. The results for ‘furniture’ are in accordance with the typicality account, since judgements of category membership were better approximated by typicality judgements than by any classical definition. These observations can be formalised as follows. Here, $\varsigma_A(x)$ is the proportion of participants who indicate that $x$ is an instance of the category denoted by ‘$A$’, and $\tau_A(x)$ is the normalised mean typicality rating for $x$ in the category denoted by ‘$A$’. These are values in the interval $[0, 1]$. $x \in A$ means that $x$ is a member of the category denoted by ‘$A$’ according to its classical definition. This equals a value in the set $\{0, 1\}$.

$$
\begin{align*}
\varsigma_{\text{BIRD}}(x) &= x \in \text{BIRD} \\
\varsigma_{\text{FURNITURE}}(x) &= \tau_{\text{FURNITURE}}(x)
\end{align*}
$$

A further question that stands in need of an explanation is what determines the typicality judgements that McCloskey and Glucksberg found. In the case of ‘bird’, category membership plays a prominent role in the typicality judgements as well: the difference in mean typicality rating between the least typical birds (i.e., 6.96 for penguins) and the most typical nonbirds (i.e., 4.96 for pterodactyls) is much greater than the difference between any other pair of neighbours on the $\varsigma$-scale. No such effect is visible in the case of ‘furniture’. In addition, typicality judgements are often explained in terms of distance from the prototype (e.g., Rosch and Mervis 1975). A prototype is an object that is especially representative of a category because it satisfies most or all of the characteristics that are standardly associated with that category. For example, a prototypical bird might be an animal that is capable of flight, relatively small, and not too exotic. These observations can be formalised as follows. Here, $\text{dist}(x, p)$ is a measure of the distance between $x$ and the prototype $p$. This equals a value in the interval $[0, 1]$. The resultant typicality values occur in the interval $[-1, 1]$ and should therefore be normalised to the $[0, 1]$ interval.
In order to address the questions we posed at the end of the Introduction, we conducted two experiments analogous to McCloskey and Glucksberg’s to determine and model the relationship between set-theoretic definitions and typicality structure in the interpretation of quantifiers. To that end, we gathered and analysed truth value judgements and typicality judgements for quantified statements. Since sentences refer to situations instead of individuals, we used pictures of situations instead of words referring to individuals. An example of a trial is shown in Figure 1. The quantifiers that were included in the experiments are listed in Table 2.

Some of the circles are black

![Sample item used in the experiments.](image)

Figure 1: Sample item used in the experiments.

In the first experiment, participants had to indicate on a seven-point scale how well the situation was described by the statement; in the second experiment, they had to indicate whether the statement was true or false in the depicted situation. One of our goals was to investigate if truth value judgements are better approximated by set-theoretic definitions or by typicality judgements. The set-theoretic definitions we used to this end are also listed in Table 2.

<table>
<thead>
<tr>
<th>Quantifier</th>
<th>Definition</th>
<th>Quantifier</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>All</td>
<td>$A \subseteq B$</td>
<td>Most</td>
<td>$</td>
</tr>
<tr>
<td>Every</td>
<td>$A \subseteq B$</td>
<td>None</td>
<td>$A \cap B = \emptyset$</td>
</tr>
<tr>
<td>Few</td>
<td>$</td>
<td>A \cap B</td>
<td>&lt; \delta$</td>
</tr>
<tr>
<td>Many</td>
<td>$</td>
<td>A \cap B</td>
<td>&gt; \delta$</td>
</tr>
<tr>
<td>More than half</td>
<td>$</td>
<td>A \cap B</td>
<td>&gt;</td>
</tr>
</tbody>
</table>

Table 2: Quantifiers used in the experiments and the corresponding set-theoretic definitions.

These definitions are the standard ones from the literature. ‘Few’ and ‘many’ are vague quantifiers. This implies that their meaning depends on the context. ‘Few A are B’ expresses that the number of A that are B is surprisingly low. This can be formalised by means of a contextually determined threshold value $\delta$ below which the real number of A that are B is supposed to fall. ‘Many A are B’ conversely implies that the number of A that are B is surprisingly high, and should therefore exceed some contextually determined threshold value $\delta$. It turns out that in our experiment, the value that most participants assigned to $\delta$ was 5 for both quantifiers.
There is one likely complication that warrants some further discussion. It is well known that truth value judgements are influenced by pragmatic inferences. To illustrate, the truth conditions of ‘Some A are B’ are compatible with all situations where one or more A is B. Nonetheless, someone who utters this sentence will often exclude some of these situations by pragmatic means. This particular utterance carries at least three possible inferences. First, it might implicate that it is not the case that only one A is B. This inference is triggered by the plural marking on the subject and verb. Some authors have argued that this plurality inference is pragmatic in nature (e.g., Spector 2006). Second, the utterance might implicate that it is not the case that all of the A are B. This is a scalar inference based on the lexical scale ⟨some, all⟩. By using a weaker expression on this scale, the speaker implicates that she believes that using the stronger expression would have caused the utterance to be false. Third, it might implicate that it is not the case that most of the A are B. This scalar inference is based on the lexical scale ⟨some, most⟩. Zevakhina (2012) provides evidence that the ‘not all’ inference is more robust than the ‘not most’ inference.

It has been shown that some participants judge sentences false in situations where their pragmatic inferences are false (e.g., Bott and Noveck 2004). Note that this does not necessarily mean that these participants consider a sentence like ‘Some A are B’ equally bad in a situation where all of the A are B as they do in a situation where none of them are, and where the set-theoretic truth conditions of the sentence are thus violated: Katsos and Bishop (2010) show that most participants consider the sentence worse in the last-mentioned situation when given the option to distinguish between degrees of badness. In our experiments, these differences in degrees of badness might reveal themselves in the typicality judgements.

Most of the quantifiers in our investigation licensed pragmatic inferences. The quantifiers ‘many’, ‘more than half’, and ‘most’ license the inference that not all of the circles are black; the quantifiers ‘few’, ‘not all’, and ‘not many’ license the inference that at least one of the circles is black. Note that ‘some’ is exceptional in that it carries three potential pragmatic inferences, whereas all of the other quantifiers have just one possible inference. It seems plausible to suppose that these pragmatic inferences will have an effect on the results of both experiments. We will discuss this issue in more detail in the Results section.

3. The experiments

3.1. Participants

We posted surveys for 340 participants on Amazon’s Mechanical Turk. Only workers with an IP address in the United States were eligible for participation. In addition, these workers were asked to indicate their native language. Payment was not contingent on their response to this question. 120 participants provided truth value judgements (mean age: 34; range: 18-61; 68 females). All of these participants were native speakers of English. 220 participants provided typicality judgements (mean age: 37; range: 18-70; 135 females). 30 participants provided typicality judgements for the quantifiers ‘some’ and ‘every’; 20 participants provided typicality judgements for all of the other
quantifiers. 5 participants provided typicality judgements for more than one quantifier. 11 of the 220 participants in the typicality task were excluded from the analysis because they were not native speakers of English.

3.2. Materials

Sentences were of the following form:

(1) Q {circle is / of these circles are} black.

Q was instantiated by the quantifiers in Table 2. The corresponding pictures consisted of ten circles which were either black or white. The distribution of black and white circles was manipulated, thus creating eleven situation $s_0, \ldots, s_{10}$. In a situation $s_n$, $n$ of the circles were black and the remaining $10 - n$ circles were white. An example trial is shown in Figure 1.

Surveys in the truth value judgement task consisted of twenty trials. Each of the ten quantifiers was instantiated twice with two different pictures. The pictures for one quantifier always differed in at least three circles. Because there was an uneven number of situations, one of them, $s_5$, occurred twice as often as the other situations: 40 instead of 20 times. The order of the items was randomised for each participant, making sure that the same quantifier never occurred consecutively. The truth value judgement task differed from McCloskey and Glucksberg’s who asked participants to categorise all possible instantiations. We avoided this procedure because it might lead to contrastive readings of quantifiers. Intuitively, if ‘some’ receives a contrastive reading, which usually manifests itself by means of prosodic stress, it excludes ‘all’ by entailment. We wanted to avoid this potential confound as much as possible.

In the typicality experiment, participants were presented with one quantifier in all eleven situations. The order of the items was randomised for each participant.

3.3. Procedure

To collect truth value judgements, participants were presented with the following instructions:

In the following survey, we will show you pairs of pictures and sentences. In each case, we ask you to decide whether or not the sentence gives a correct description of the picture. If you feel that the sentence is true, check “True”. If not, check “False”.

The quantifiers. 5 participants provided typicality judgements for more than one quantifier. 11 of the 220 participants in the typicality task were excluded from the analysis because they were not native speakers of English.

3.2. Materials

Sentences were of the following form:

(1) Q \{circle is / of these circles are\} black.

Q was instantiated by the quantifiers in Table 2. The corresponding pictures consisted of ten circles which were either black or white. The distribution of black and white circles was manipulated, thus creating eleven situation $s_0, \ldots, s_{10}$. In a situation $s_n$, $n$ of the circles were black and the remaining $10 - n$ circles were white. An example trial is shown in Figure 1.

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In the typicality experiment, participants were presented with one quantifier in all eleven situations. The order of the items was randomised for each participant.

3.3. Procedure

To collect truth value judgements, participants were presented with the following instructions:
We are interested in your spontaneous judgments, so please don’t think too long about your answers.

In order to collect typicality judgements, participants were presented with the following instructions (based on the instructions used by Rosch 1975):

This experiment is about how sentences are interpreted. Consider the sentence “This is a vehicle”. Many people agree that this sentence is a better description of a car or a motorbike than of a sled or a tractor, even though they are strictly speaking all vehicles. Below is another example.

This circle is dark.

In my eyes, the picture is a reasonable instance of the sentence. I can imagine worse instances (for example a white circle) but I can also imagine better instances (for example a black circle). For that reason, I gave a rating that is in between the two extremes 1 and 7. However, the exact rating is a matter of taste and you might want to give a higher or lower rating. In this experiment, you will see one sentence with eleven pictures. For each picture, you have to indicate how well it is described by the sentence. It doesn’t matter why you think that a sentence is a good or bad description of a particular picture. Just follow your intuition.

3.4. Results

Figure 2 provides the normalised mean typicality judgements and the proportions of positive responses in the truth value judgement task. The figure suggests that, in general, typicality judgements were less pronounced than the proportions of positive responses in the truth value judgement task. Furthermore, the average typicality values were more evenly distributed across the space of possible answers, whereas the proportions of positive responses in the truth value judgement task clustered around the extremes of 0 and 1. This suggestion is confirmed by a comparison of the variances: the variance in normalised typicality ratings was significantly greater than the variance in the proportions of positive responses in the truth value judgement task ($F(109,109) = 1.9$, $p < .05$).
Both of these observations are captured by the density plot in Figure 3: the modes of the average typicality values are closer to the center than the modes of the proportions of positive responses in the truth value judgement task, and there are more values in the middle region of the space of possible answers in the average typicality values than in the proportions of positive answers in the truth value judgement task.

One anomalous observation is the proportion of positive responses for ‘some’ in \( s_8 \) (\( M = .79 \)). This proportion is unexpectedly higher than in situations with seven (\( M = .56 \)) or nine (\( M = .50 \)) black circles. The difference, however, is not statistically significant in either case. It is presumably caused by the between-participants design of the truth value judgement task: \( s_8 \) was judged by different participants than \( s_7 \) and \( s_9 \). Apparently \( s_8 \) was judged by more charitable participants than the other two situations.

Which situations are prototypical of the quantifiers that were investigated? There are at least two ways of answering this question. The first is to take the situations with the highest mean typicality judgements. The second is to take the situations that received the highest typicality judgements from the largest number of participants. For almost all of the quantifiers, these methods lead to the same prototypes. The sole exception is ‘not all’. For this quantifier, the highest mean typicality judgement was for \( s_6 \), whereas \( s_9 \) was assigned the highest typicality rating by the most participants. This discrepancy reflects a high degree of disagreement between participants in the typicality task for this quantifier. Some participants gave the highest rating to \( s_0 \), some to \( s_9 \), and
As hypothesised, there is a strong effect of pragmatic inferences on both truth value and typicality judgements. We compared the results for situations where a pragmatic inference was violated with the results for the nearest situation where this was not the case. The mean difference between these situations was higher in the truth value judgement task ($M = .46$) than in the typicality task ($M = .28$). This difference was marginally significant ($t(7) = 1.87$, one-sided $p = .05$). Focusing on the results of the truth value judgement task, the difference was higher for negative quantifiers ($M = .69$) than for positive quantifiers ($M = .32$, $t(6) = 2.46$, one-sided $p = .03$). There was no analogous effect of monotonicity on the effect of pragmatic inferences in the average typicality judgements.

What factors underlie truth value judgements in this experiment? Based on the discussion in Section 2, two possible answers suggest themselves: truth value judgements are determined either by typicality judgements or by set-theoretic definitions. In order to decide between these two possible answers, we constructed three models predicting proportions of positive responses in the truth value judgement task. The first model used the set-theoretic truth definitions given in Table 2 as predictor variable. The second and third model were based on the normalised mean typicality ratings. The second model mapped these typicality ratings straight onto proportions of positive responses in the truth value judgement task. The intuition that underlies this model is that the typicality of an object reflects the likelihood that the sentence is considered true in that situation. The third model dichotomised the typicality judgements on the basis of a cutoff point. We calculated that the optimal cutoff point was 4.4. Values below the cutoff point were mapped to 0 and values above it to 1. According to this model, listeners make truth value judgements by dichotomising...
their typicality judgements. Unlike the typicality model, it is not obvious what the rationale behind the dichotomised model is. Why do listeners dichotomise typicality judgements on the basis of an apparently arbitrary cut-off point? One possible answer is that this cut-off point reflects whether the sentence is true according to its set-theoretic definition. But in that case the model draws upon set-theoretic definitions just like the set-theoretic model. If this model is to be a competitor to the set-theoretic model, it thus stands in need of a principled motivation.

The mean distances between these three models and the results from the truth value judgement task are given in Table 3. For the set-theoretic model, the mean distances range from .00 for ‘every’ to .25 for ‘some’. For the typicality model, the mean distances range from .04 for ‘more than half’ to .27 for ‘not all’. For the dichotomised typicality model, the mean distances range from .00 for ‘every’ to .24 for ‘not all’.

<table>
<thead>
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<th>Quantifier</th>
<th>Set</th>
<th>Typ</th>
<th>Dich</th>
<th>Quantifier</th>
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<td>.18</td>
<td>.23</td>
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<tr>
<td>Many</td>
<td>.06</td>
<td>.12</td>
<td>.10</td>
<td>Not all</td>
<td>.08</td>
<td>.27</td>
<td>.24</td>
</tr>
<tr>
<td>More than half</td>
<td>.04</td>
<td>.04</td>
<td>.04</td>
<td>Not many</td>
<td>.11</td>
<td>.18</td>
<td>.11</td>
</tr>
</tbody>
</table>

Table 3: Mean difference between the proportions of positive responses in the truth value judgement task and (i) the set-theoretic definitions in Table 2 (= Set), (ii) the normalised typicality judgements (= Typ), and (iii) the dichotomised typicality judgements (= Dich)

We compared the distances between these models and the proportions of positive responses in the truth value judgement task. The mean distance was significantly greater for the typicality model ($M = .16$) than for the set-theoretic model ($M = .08$, $t(109) = 3.77$, $p < .001$). It was also significantly greater for the typicality model than for the dichotomised typicality model ($M = .11$, $t(109) = 2.42$, $p = .002$). The difference in mean distances between the set-theoretic and dichotomised typicality models was marginally significant ($t(109) = 1.52$, one-sided $p = .07$).

A substantial part of the lack of fit in all of the models is caused by the confounding effect of pragmatic inferences. Therefore we also used the models to predict a restricted set of the data points that were not affected by pragmatic inferences. This improved all of the models. We once again compared the distances between these limited models and the proportions of positive responses in the truth value judgement task. The mean distance was significantly greater for the typicality model ($M = .15$) than for the set-theoretic model ($M = .03$, $t(96) = 8.27$, $p < .001$) and for the dichotomised typicality model ($M = .06$, $t(96) = 5.01$, $p < .001$). The mean distance for the dichotomised typicality model was significantly greater than for the set-theoretic model ($t(96) = 1.94$, one-sided $p = .03$).

Proportions of positive responses in the truth-value judgement task are thus better approximated by set-theoretic definitions or dichotomised typicality values than by simple typicality values. More-
over, there is some evidence that the set-theoretic model is more appropriate than the dichotomised model: it is a marginally better predictor of the proportions of positive responses including data points that are influenced by pragmatic inferences and a significantly better predictor of the proportions of positive responses excluding those data points. In addition, the dichotomised model lacks a principled explanation for the use of a seemingly arbitrary cut-off point in the mean typicality ratings, and the sole plausible motivation seems to invoke set-theoretic truth conditions.

What factors underlie typicality judgements in this experiment? Based on the discussion in Section 2, two possible answers suggest themselves: typicality judgements are determined either by set-theoretic definitions and distance from the prototype or by distance from the prototype alone. In order to decide between these possible answers, we constructed two models predicting mean typicality judgements. The first model included the set-theoretic definitions from Table 2 and distance from the prototype as predictor variables, whereas the second model included distance from the prototype alone. Before these models can be operationalised, however, a number of parameters have to be set. First, what are the prototypes associated with quantified sentences? Second, how to operationalise distance from the prototype? Third, what is the relative importance of set-theoretic definitions and distance from the prototype in the first model? We discuss these issues in turn.

What are the prototypes associated with quantified sentences? As noted before, quantifiers differ in how unambiguous and salient the prototype is: for quantifiers like ‘every’ and ‘none’, all participants converged on the same prototype, for quantifiers like ‘some’ and ‘most’, there was an overall consensus but judgments were not fully unanimous, and for ‘not all’ there was a large amount of disagreement among participants. The choice of prototype seems to be determined by at least two factors: set-theoretic truth conditions and competing quantifiers. To start with the first factor, prototypes are always situations where the sentence is true according to its set-theoretic truth definition. For some quantifiers, however, this still leaves a number of situations to choose from. In that case, the choice might be influenced by competing quantifiers: a prototypical situation is one that is maximally distinct from the prototypical situations of competing quantifiers. This criterion can explain the different choices of prototypes for ‘not all’. Participants who assume that ‘not all’ competes with ‘all’ will consider \( s_0 \) as the prototype because that situation is maximally distinct from the prototype for ‘all’. Participants who also took into consideration ‘none’ as a competitor would opt for a situation with around five black circles. Lastly, participants who also considered ‘not many’ might have converged on a prototype that lies somewhere on the upper end of the scale.

This discussion leaves open some further questions. What determines the choice of competing quantifiers? Which quantifiers are in principle available as competitors? How do the alternatives that determine the choice of prototype relate to the alternatives that are involved in the computation of pragmatic inferences? While we believe these questions are interesting and might warrant further analysis, we will simply stipulate that the prototypes are the situations that received the highest mean typicality ratings.
A second question is how to operationalise distance from the prototype. This question has a straightforward answer: the distance between a prototypical situation $s_n$ containing $n$ black circles and another situation $s_i$ equals the absolute difference between $n$ and $i$.

The final question involves the relative importance of set-theoretic truth conditions and distance from the prototype in the model that included both of these factors. Because we do not have specific expectations about these parameters, we simulated them by means of a Monte Carlo procedure. To this end, we assigned 5,000 random values to both parameters. For each pair of values, we calculated the predicted typicality values and the correlation between these predicted values and the attested typicality values. In the optimal situation, the effect of set-theoretic truth conditions was more than seven times as large as the effect of increasing the distance from the prototype by one. We therefore weighed the two factors accordingly in the first model.

Figure 4 provides a visual overview of the goodness of fit of both models. The correlation between the typicality values predicted by the first model containing both set-theoretic definitions and distance from the prototype, and the attested typicality values was $r = .94$. The correlation between the typicality values predicted by the second model consisting of distance from the prototype alone and the attested typicality values was $r = .83$. We compared the two models on the basis of the absolute differences between predicted and attested typicality values. The mean difference was significantly higher for the second model ($M = .21$) than for the first model ($M = .12$, $t(109) = 6.53$, $p < .001$). As before, the fit of both models is relatively poor for situations that are excluded for pragmatic reasons. Excluding those data points from consideration leads to correlations of $r = .96$ for the first model and $r = .87$ for the second one.

What do these results tell us about the questions we posed at the end of the Introduction? What is the relationship between set-theoretic truth conditions and typicality judgements? Do listeners have access to set-theoretic definitions of quantified sentences? In the following section, we discuss these questions on the basis of the foregoing results.

4. General discussion

In the Introduction, we observed that the interpretation of quantified statements is often finer-grained than what is encoded in their set-theoretic definitions. For example, according to its set-theoretic truth conditions, the statement ‘Some A are not B’ is true in all situations where not all of the A are B. But when participants are asked how many A are B given that this statement is true, Newstead et al. (1987) found that their estimates are much more precise and range between 55% and 89% of the total number of A.

These findings can be modelled in different ways. Some authors have proposed that quantifiers denote probability distributions over situations. This proposal, however, presupposes knowledge about the total set size, whereas it seems possible to interpret quantifiers even in the absence of this knowledge. The current findings provide a further argument against a probabilistic view on
quantification. Consider the typicality judgements for the quantifiers ‘all’, ‘every’, and ‘none’. These steadily decrease with the distance from the prototypical situation, which means that all situations except for the most distant one received a positive rating. It seems implausible, however, to conclude from these findings that, for example, that given that ‘All the circles are black’, the probability of a situation with three black circles is anything other than zero.

In order to avoid these issues, we have modelled the finer-grained interpretation of quantifiers by assuming that they denote typicality functions. In that case, is it still plausible to suppose that listeners have access to set-theoretic definitions of quantifiers? The results of our experiments provide a number of arguments to substantiate the role of set-theoretic definitions in the interpretation of quantifiers. First, we constructed three models to predict proportions of positive responses in the truth value judgement task. One model consisted of set-theoretic definitions; the second model consisted of typicality judgements; and the third model dichotomised these typicality judgements based on a cutoff point. We found that the absolute deviations from the first model were significantly smaller than those from the second model, and marginally smaller than those from the third model.

These findings demonstrate that the typicality of a situation should not be equated to the likelihood that the corresponding quantified statement is judged true. The evidence against the view that truth value judgements are dichotomised typicality judgements, however, was less convincing. Still, even if we assumed that truth value judgements are dichotomised typicality judgements, it wouldn’t be clear why this should be so, and set-theoretic definitions would still have to feature in the explanation of the typicality judgements themselves.

We constructed two models to predict typicality judgements. The first model consisted of set-theoretic definitions and distance from the prototype, where the former factor was given seven times as much weight as the latter. The second model consisted of distance from the prototype.
alone. We found that absolute deviations from the first model were significantly smaller than those from the second model. This finding again indicates that listeners have access to set-theoretic definitions of quantifiers.

A related argument in favour of the view that set-theoretic definitions feature in the interpretation of quantified statements is the rarity of disagreement between participants about whether a quantified statement was true or false. More precisely, aside from situations where pragmatic inferences play a role, there were four proportions of positive responses in the range between 0.1 and 0.9. Three of these involved the \( s_5 \) situation for the proportional quantifiers ‘most’, ‘many’, and ‘few’, and one involved the \( s_4 \) situation for ‘many’. These three quantifiers all involve some kind of threshold value. So a possible explanation for these anomalous observations is that participants might have disagreed about the exact value of this threshold. By contrast, there was a substantial amount of disagreement in the typicality judgements for all quantifiers. If truth value judgements were calculated on the basis of typicality judgements, we would have expected a similar amount of disagreement in both of these measures.

Furthermore, it might be argued that set-theoretic definitions are necessary to account for the interpretation of embedded quantifiers. For example, it seems inevitable to suppose that the interpretation of ‘not all’ is a function of the interpretation of ‘all’. This relationship is apparent in the truth value judgements but not in the typicality judgements: the correlation between the proportions of positive responses in the truth value judgements task for ‘all’ and ‘not all’ is -.88 and, if the effect of the pragmatic inference for ‘not all’ is taken into account, -.98. This strength of association is absent in the typicality judgements: the correlation between typicality judgements for ‘all’ and ‘not all’ is -.47. (Note, however, that the typicality structure of ‘many’ does provide a reliable fit to the typicality structure of ‘not many’.)

We have thus provided a number of arguments in favour of the view that listeners have access to set-theoretic interpretations of quantifiers. One apparent exception to this rule is ‘some’. The set-theoretic definition for this quantifier was a poor fit to the actual truth value judgements. Truth value judgements were equivocal for all situations other than those with zero black circles, where it was judged false by all participants, and those with two, three, or four black circles, where it was judged true by all or almost all participants. As noted, however, ‘some’ is exceptional in that it licenses three pragmatic inferences. Surprisingly, participants also make distinctions between situations that do not correspond to a pragmatic inference: for example, the statements was judged true by more participants in \( s_9 \) than in \( s_9 \), even though both situations violate the pragmatic inference that not most of the circles are black. Apparently, then, distance from the prototype also influences judgements about what to do with statements that violate a pragmatic inference: the likelihood that a sentence is judged false in such a situation depends on how salient its violation is.

Aside from demonstrating the role of set-theoretic definitions in the interpretation of quantifiers, we have provided a model for truth value and typicality judgements for quantified statements based on
set-theoretic definitions, distance from the prototype, and pragmatic inferences. The interpretation of quantifiers is thus a multidimensional phenomenon that warrants further investigation.

References


An experimental investigation of partial control
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Abstract. In Partial Control, the understood subject of an obligatorily controlled complement is construed as properly containing the controlling argument (e.g., John wanted [PRO to gather at noon], where PRO = John and contextually salient others). Since this phenomenon was first systematically described by Landau (2000), many accounts of it have been offered. But some of the diversity in these accounts reflects disagreement over what the facts are. To address this, we use experimental syntax to collect and analyze sentence acceptability judgments that bear on the availability of Partial Control across a wide range of control predicates. Results indicate a substantial amount of gradability in the availability of Partial Control as a function of the choice of control predicate, in a way that depends in part on the predicate’s temporal, aspectual, and modal properties. Although these findings are not fully consistent with any existing approach to Partial Control, we suggest that Pearson’s (2013) approach lays a promising foundation for further research.

Keywords: control, partial control, propositional attitude predicates, experimental syntax

1. Introduction

Landau (2000) — systematizing observations by Wilkinson (1971); Lawler (1972); Williams (1980); Martin (1996); Petter (1998); Wurmbrand (1998) — identifies a split between E(xhaustive) C(ontrol) predicates and P(artial) C(ontrol) predicates: whereas EC predicates require that the controlling argument exhaustively identify the understood subject of the controlled complement, PC predicates allow the controller to partially identify the subject of the controlled complement. The contrast can be brought out via collective predicates, which crucially are unacceptable with a syntactically singular, non-group-denoting subject, as illustrated in (1). As shown in (2)–(4), a singular, non-group-denoting controller is unacceptable with a collective controlled complement when the control predicate is try, but acceptable when the control predicate is regret or want. Consequently, try is classified as an EC predicate whereas regret and want are classified as PC predicates, the latter group giving rise to control structures in which the controlled position includes the controller but may also include other referents made salient in the context.

(1) a. Kim [solved the problem].
   NONCOLLECTIVE PREDICATE
b. *Kim [solved the problem together].
   COLLECTIVE PREDICATE
Landau (2000) singles out the control predicate’s temporal properties as a crucial factor in determining whether it is EC or PC. In particular, Landau suggests that the EC status of *try* correlates with its inability to support matrix/embedded temporal mismatches and the PC status of *regret* and *want* correlates with their ability to do so, as brought out by the data in (5)–(7). Taking this correlation as central, Landau (2000) argues that the availability of matrix/embedded temporal mismatches are signals of T-to-C movement in the complement clause, which interacts with the determination of PRO’s features in such a way that PC may obtain only if T-to-C movement obtains.

(5) *Today, Kim tried* [PRO to solve the problem *yesterday/tomorrow*].

(6) *Today, Kim regretted* [PRO solving the problem *yesterday*].

(7) *Today, Kim wanted* [PRO to solve the problem *tomorrow*].

In the years since Landau’s seminal work, a number of researchers have proposed alternative accounts of the EC/PC split. In one vein, Wurmbrand (2002); Barrie (2004); Barrie and Pittman (2004); Cinque (2006); Costantini (2010); Grano (2012) all entertain versions of the view that the split tracks a distinction in whether the control predicate is a restructuring predicate or not. In another vein, some researchers working with the Movement Theory of Control (Hornstein, 1999) have argued that PC arises when a silent associate morpheme is stranded in the controlled complement (Rodrigues, 2008), or when the controlled complement contains a silent commitative expression (Boeckx et al., 2010), or when defective thematic intervention obtains (Sheehan, 2012). (See also Dubinsky and Hamano 2010 for the view that movement is blocked with PC predicates be-
cause the complement of a PC predicate has its own event feature.) A number of scholars have also pursued non-syntactic approaches. Jackendoff and Culicover (2003) argue that PC is not syntactically distinct from EC but rather “occurs in contexts where the controller holds a joint intention with respect to the activity described by the complement” (p. 549). Bowers (2008) argues that PC is “not actually a grammatical phenomenon at all” (p. 140) but rather instantiates a kind of metonymy that is found even in raising and monoclausal contexts. More recently, Pearson (2013) argues that the EC/PC split arises as a semantic consequence of the mechanism by which attitude-ascribing control predicates quantify over world-time-individual triplets. On Pearson’s view, in order for a control predicate to be a PC predicate, it must support matrix/embedded temporal mismatches and must also be attitude-ascribing. In a similar vein to Pearson 2013 and also drawing on Bianchi 2003, Landau (2013b) updates his own previous view, suggesting that the fundamental distinction between EC and PC predicates is that only the latter are attitude predicates. For crosslinguistically oriented work on partial control, see also Madigan 2008 (Korean); Witkos and Snarska 2008 (Polish); Modesto 2010 (Brazilian Portuguese).

The motivation for the present study is that one source of the diversity found in the aforementioned approaches is disagreement over what the data and descriptive generalizations are. To take one example, Landau (2000) and Pearson (2013), although they both take a control predicate’s temporal properties as relevant in tracking the EC/PC split, come down differently on whether English claim as well as Romance control predicates of belief such as Italian credere ‘believe’ is EC or PC. To take another example, Rodrigues (2008) departs from both Landau and Pearson by claiming that modal auxiliaries like can are PC. In a more extreme case, Bowers (2008) suggests that (some of) Landau’s EC predicates, as well as (some) raising predicates support PC, and that even direct (monoclausal) predication between a collective predicate and a singular non-group denoting subject is possible in some contexts. (For a response to some of these positions, see Landau 2013a:155–172.)

Consequently, the goal of the work described here is to use experimental techniques to address the following three questions:

(8) a. Do control predicates reliably differ in their tolerance for PC?  
   b. If so, are Landau (2000) and Pearson (2013) correct that the temporal properties of the predicate reliably predict its tolerance for PC?  
   c. Do other (nontemporal) properties of the predicate correlate with the acceptability of PC?

In a nutshell, our results indicate affirmative answers to all three questions: control predicates differ in their tolerance for PC, and the relative tolerance of a given predicate correlates not only with its temporal properties but also with aspectual and modal properties to be discussed in more detail below. Our results also indicate a substantial amount of gradability in the tolerance for PC as a function of the choice of embedding predicate, and the statistical analysis reported below suggests
that this gradability is not reducible to inter-speaker variation. As far as we know, no existing theoretical account predicts this full range of influencing factors, though we suggest below that Pearson (2013) lays a promising foundation for further research.

The organization of the rest of the paper is as follows. Section 2 describes the methodology for the experiment. Section 3 describes the results and detailed statistical analysis. Section 4 articulates some overall conclusions and speculations toward a theoretical account of the findings.

2. Methodology

2.1. Materials

We constructed items using the template in (9a), where X and Y are proper names, P is one of the 30 embedding predicates in (10), and Q is one of the five embedded predicates in (11), in either infinitival or gerundive form depending on the selectional properties of P. P mostly consists of uncontroversial control predicates, chosen to represent a wide range of semantic properties, but also includes for comparison one raising predicate (be likely to) as well as two predicates (begin to and need to) that have raising uses and whose control status is controversial (see, among many others, Perlmutter 1970; Rochette 1999; Fukuda 2012 on aspectual predicates and Bhatt 1998; Wurmbrand 1999; Barbiers 2002 on root modals).

For each of the P/Q pairings, we constructed two variants, one which included together in the embedded predicate (the COLLECTIVE embedded predicate types) and one which excluded together (the NONCOLLECTIVE types). Because all of the instantiations for Y constitute a syntactically singular non-group-denoting entity, the assumption is that the COLLECTIVE embedded predicate types should be acceptable only in syntactic contexts that support PC. The “preamble” X said that... was prepended to all items to facilitate PC by making salient a plurality, i.e., X and Y (Landau, 2000).

(9) a. X said that Y P-ed {to Q / Q-ing} (together).
   b. X said that Y Q-ed (together).

(10) P ∈ \{be afraid to, be eager to, be likely to, be ready to, begin to, claim to, decide to, deserve to, expect to, hate ing, hate to, hope to, intend to, like ing, like to, love ing, love to, manage to, need to, offer to, plan to, prefer to, pretend to, promise to, refuse to, regret ing, remember ing, remember to, try to, want to\}

1In (10) and throughout the rest of the paper, we use subscripts to and ing with every embedding predicate to indicate an infinitival complement frame or a gerundive complement frame respectively. As evident in (10), some predicates (hate, like, love, remember) were tested with both infinitival complements and gerundive complements.
Each of the 30 embedding predicates was paired with four out of the five embedded predicates. The resulting 240 items (30 embedding predicates X 4 embedded predicates X COLLECTIVE and NONCOLLECTIVE variants) were distributed over 3 experiments, each of which also included 8 ‘baseline’ items using the template in (9b), as well as 80 filler items each.\(^2\) In each experiment, both the embedding predicate (be afraid\(_{io}\), be eager\(_{io}\), etc., + BASELINE) and the embedded predicate type (COLLECTIVE vs. NONCOLLECTIVE) were within-subject factors.

2.2. Participants

72 native speakers of American English (24 per experiment) were recruited through Amazon’s Mechanical Turk and asked to rate each sentence’s acceptability on a 1-to-7 scale. Four of these participants (two from Experiment 1, one from Experiment 2, one from Experiment 3) were excluded from the results for having average log reaction times that were more than two standard deviations below the mean (mean=8.29, sd=0.59).

3. Results and statistical analysis

3.1. Mean ratings by embedding predicate

Figure 1 shows mean raw ratings. Embedding predicates are ordered along the \(x\)-axis by difference in mean rating between the COLLECTIVE and NONCOLLECTIVE conditions. We see that the BASELINE as well as every embedding predicate is generally rated near ceiling in the NONCOLLECTIVE condition (albeit with some variability that will be analyzed and controlled for below). As for the COLLECTIVE condition, we see a clear cline in the judgments: predicates like need\(_{io}\) (mean=2.20), be likely\(_{io}\) (mean=2.34), try\(_{io}\) (mean=2.39), manage\(_{io}\) (mean=2.11), intend\(_{io}\) (mean=2.45), and begin\(_{io}\) (mean=2.05) are scored on average between 2 and 2.5. At the other end of the spectrum, hate\(_{ing}\) (mean=5.47), regret\(_{ing}\) (mean=5.59), love\(_{ing}\) (mean=5.76), like\(_{ing}\) (mean=5.76), and remember\(_{ing}\) (mean=6.10) fare much better. In some of these cases, the difference in mean rating between the COLLECTIVE and NONCOLLECTIVE conditions is small, reaching a value of 0.62 for remember\(_{ing}\).

The great difference in acceptability under the COLLECTIVE condition found between predicates like try\(_{io}\) at the low end vs. regret\(_{ing}\) at the high end, as well as the placement of the BASELINE

\(^2\)Fillers were constructed by manipulating the test items to contain plural controllers, ECM complements, or for-\(to\) complements. A quarter of the fillers had together in the embedded predicate and a quarter replaced together with alone.

(11) \(Q \in \{\text{be happy, hang out at the mall, rent an apartment in Baltimore, support the child, take yoga classes}\}\)
toward the low end of the spectrum, both support the view that PC is a real phenomenon, not reducible to the putative general availability of collective predication with singular non-group-denoting subjects under certain conditions, contra Bowers 2008. However, the high degree of gradability found in the COLLECTIVE ratings warrants further investigation, which we turn to presently.

3.2. Understanding gradability in ratings

3.2.1. Participant effects and embedded predicate effects

There are at least four possible sources of the high gradability in the COLLECTIVE condition ratings. First, it could be that the acceptability of PC as a function of the choice of embedding predicate is inherently gradable: certain predicates support PC completely, others fail to support it, and still others fall somewhere in between. Second, it could be that the gradability reflects inter-speaker variation; that is, the predicates that fall in the middle of the spectrum are those that are rated high by some speakers and low by other speakers. Third, because each embedding predicate was tested with only four out of the five embedded predicates, it could be that properties of the
To determine which possibility is likely, we will build a statistical model that attempts to take five things into account simultaneously: 1) idiosyncrasies in participants’ use of the Likert scale; 2) differences in how participants rate a specific embedding predicate or embedded predicate; 3) variability in judgments for embedded predicates across syntactic contexts as a whole and in combination with specific embedding predicates; 4) overall higher ratings in a given experiment due to the choice of predicates in that experiment; and 5) the difference between the BASELINE and each predicate in the COLLECTIVE condition once all the other sources of variability are controlled for.

Figure 2 shows the magnitude of the noise added to each embedding predicate’s ratings by participants and by embedded predicates. 4 Embedding predicates are ordered along the x-axis according

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3We use a cumulative link mixed model. This family of models is designed for predicting ordered categorical judgments like those we get from a Likert (1-7) scale. It assumes that sentences fall somewhere on a continuous acceptability scale and attempts to convert the discrete Likert scale judgments into the continuous acceptability scale judgments while at the same time filtering out extraneous effects.

4More precisely, Figure 2 shows the variance estimate for random slopes for each embedding predicate by participant and embedded predicate. Random intercepts for both participants (mean=2.05; 95% CI=1.37–2.79) and embedded predicates (mean=0.11; 95% CI=0.00–0.35) were also fit, but they are not shown in Figure 2.
to the (filtered) difference from BASELINE for that predicate in the COLLECTIVE condition (cf. Figure 3).

As for participant effects, what we see is that only four of the 30 embedding predicates (begin\textsubscript{to}, remember\textsubscript{to}, want\textsubscript{to}, and regret\textsubscript{ing}), plus the BASELINE, show significant amounts of variability in their ratings due to participants. Furthermore, the distribution of this variability does not show a clear pattern with respect to the magnitude of the difference from BASELINE: predicates both on the low and high ends of the spectrum show variability due to participants. The high variability of the BASELINE suggests that some speakers do accept collective predication of a singular non-group-denoting subject, à la Bowers (2008). However, the model also predicts such speakers to be very rare.

As for embedded predicate effects, because, for each experiment, there are fewer embedded predicates per embedding predicate (4) than participants (21 or 22), this estimate is inherently less certain. However, we do see some interpretable results. First, claim\textsubscript{to} shows somewhat high variability (mode=0.53; 95% CI=0.00–4.57) with respect to the embedded predicate, possibly due to the special aspectual restrictions on infinitival complements to claim (cf. Wurmbrand, 2012). The similar status of like\textsubscript{to} (mode=0.67; 95% CI=0.04–8.57) may have an explanation along the same lines. Finally, we see that offer\textsubscript{to} has the highest variability of all (mode=0.86; 95% CI=0.00–4.90). This is somewhat surprising, and we do not have an explanation for it.

3.2.2. Filtered ratings

Figure 3 shows the estimated difference from BASELINE in the COLLECTIVE condition for each embedding predicate after filtering out participant and embedded predicate variability.\footnote{More precisely, these effects were included as fixed effects in the model. A variable representing the experiment each embedding predicate was tested in as well as one representing that variable’s interaction with predicate type (COLLECTIVE v. NONCOLLECTIVE) were also included.} The cline we initially saw in the raw scores represented in Figure 1 appears to remain here. Further, the order stays roughly the same: need\textsubscript{to} (mode=0.45; 95% CI=-0.47–1.29), be likely\textsubscript{to} (mode=0.70; 95% CI=-0.26–1.43), try\textsubscript{to} (mode=0.62; 95% CI=-0.37–1.48), manage\textsubscript{to} (mode=0.43; 95% CI=-0.63–1.14), intend\textsubscript{to} (mode=0.85; 95% CI=-0.26–1.87), and begin\textsubscript{to} (mode=0.02; 95% CI=-1.03–0.91) are all on the low end of PC compatibility. The fact that these predicates’ credible intervals include zero means that there is less than a 95% probability that these predicates’ true ratings are different from BASELINE. And thus, under an $\alpha$-value of .05, we fail to reject the null hypothesis that their ratings are different from BASELINE. Furthermore, there are predicates for which we do reject the null hypothesis: hate\textsubscript{ing} (mode=2.42; 95% CI=1.31–3.21), regret\textsubscript{ing} (mode=2.39; 95% CI=1.22–3.39), love\textsubscript{ing} (mode=2.62; 95% CI=1.57–3.53), like\textsubscript{ing} (mode=2.46; 95% CI=1.78–3.57), and remember\textsubscript{ing} (mode=3.00; 95% CI=2.12–3.90) are all reliably better than BASELINE.
However, three qualifications are in order. First, we can make valid inferences about the “PCness” of a predicate but not about its “ECness”: failing to reject the null hypothesis is not the same as accepting it. Second, there are differences in the estimates for these predicates that we gloss over by binarizing into EC and PC: a predicate like remembering is still much better than a predicate like expect to (mode=1.42; 95% CI=0.47–2.20); in fact, even though expect to would be classed as PC under a hypothesis testing EC-PC binarization, it would also be characterized as significantly different from remembering. Finally, despite the foregoing, we have not definitively shown that gradability in PC exists: predicates with both low and high ratings have large credible intervals. This is partly due to statistical power, but it could also obscure a true binary split between EC and PC predicates if some predicates’ true ratings are at the high end of their credible interval and some are at the low end. To investigate this further, we build a model in Section 3.3 that predicts these filtered ratings from semantic features of the embedding predicates.

3.3. Semantic features of the embedding predicates

In order to investigate the gradability that remains after filtering out participant and embedded predicates effects, we code our embedding predicates for four semantic feature types and build a model that allows us to assess their correlation with the acceptability of PC. These four features were
Feature | Importance | Conditional Importance
--- | --- | ---
attitudinality | 35.63 | 28.70
opacity | 36.65 | 24.88
simultaneity | 34.68 | 25.71
telicity | 25.88 | 19.78

Table 1: Importance of each of the four features. Importance is measured in terms of percent increase in mean squared error due to the feature in a permutation test over the random forest ensemble.

chosen because they play a role in previous accounts of PC: **SIMULTANEITY** (*non-simultaneous* or *simultaneous*) (Landau, 2000; Pearson, 2013), **TELICITY** (*telic* or *atelic*) (Rooryck, 2007; Pearson, 2013),** OPACITY** (*transparent* or *opaque*) (Pearson, 2013; Landau, 2013a), and **ATTITUDINALITY** (*attitudinal* or *nonattitudinal*) (Pearson, 2013; Landau, 2013a). Predictives exemplifying each opposition, along with the diagnostic used for classification, are illustrated in (12)–(15).

(12) **SIMULTANEITY**
   a. *simultaneous*: Today, John **managed** to take a yoga class {#yesterday, #tomorrow}.
   b. *non-simultaneous:*
      (i) Today, John **regretted** taking a yoga class yesterday.
      (ii) Today, John **planned** to take a yoga class tomorrow.

(13) **TELICITY**
   a. *telic*: # For five days, John **decided** to rent an apartment in Baltimore.
   b. *atelic*: For five days, John **liked** renting an apartment in Baltimore.

(14) **OPACITY**
   a. *opaque*: John **wanted** to cut a tomato, but there was no tomato.
   b. *transparent*: John **tried** to cut a tomato, #but there was no tomato.

(15) **ATTITUDINALITY**

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6Pearson does not discuss telicity per se, though aspectual properties (and in particular, the presence vs. absence of temporal containment relations) of both the embedding and embedded predicates do play a role in her theory of PC. Rooryck similarly does not discuss telicity per se but identifies an aspectual component to controller selection. Although his focus is on split control rather than PC, many of his examples actually instantiate PC according to Landau’s (2000) diagnostics.

7Landau (2013a) in fact uses opacity as the diagnostic for attitudinality. In contrast, we follow Pearson (2013) in treating predicates like try\_t and manage\_t as attitudinal even though they are transparent.

8These examples are due to Sharvit 2003. See also Grano 2011; Giannakidou 2013 for discussion.
Figure 4: Tree showing predictions for some feature combinations from random forest.

a. **attitudinal**: John *wanted* to win. [ascribes an attitude to John]
b. **nonattitudinal**: John *deserved* to win. [does not ascribe an attitude to John]

The model we use is a random regression forest (iter=1000; Breiman, 2001). This type of model allows us to assess the importance of a feature type in predicting compatibility with PC. Table 1 gives the importance of each feature type in terms of percent increase in mean squared error, calculated by a permutation test over each tree. Each feature type shows a reliable increase in the variance explained, suggesting that all of these feature types are correlated with PC acceptability. Strobl et al.’s (2008) conditional importance tests were also run, and the overall pattern of importance shifts slightly, favoring **ATTITUDINALITY** and **SIMULTANEITY**. The fact that all of the features remain positive even under the conditional importance test suggests that the importance of each feature type is not due to its correlation with the other feature types, which Strobl et al. (2008) show can result in unimportant features appearing important.

However, the fact that these features are important with respect to PC does not tell us whether the apparent gradability in Figure 3 is due to additivity of these features. It could be that these features interact in such a way that certain combinations are good at about the same level and certain combinations are bad at about the same level. Figure 4 shows the model’s prediction for difference from BASELINE for each feature combination within the **attitudinals**. We find that on average, **attitudi-**

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9 Bootstraps for each iteration were stratified by embedding predicate. The number of features tried per split was tuned to avoid overfitting.
nals (mean=1.48; 95% CI=0.49–2.30) are predicted to be better than nonattitudinals (mean=0.22; 95% CI=0.03–0.51), suggesting that attitudinality does in fact correlate with PC. We now focus in on distinction among the attitudinals.

On average, opaque (mean=1.44; 95% CI=0.86–1.62) predicates do not show much distinction from transparent predicates (mean=1.54; 95% CI=0.48–2.31), which superficially is somewhat unexpected given recent proposals by Landau (2013b); Pearson (2013). However, what appears to be driving the relatively high prediction for transparent predicates is the fact that (departing from Landau 2013b) we classified factive predicates (regret<sub>ing</sub>, like<sub>ing/to</sub>, love<sub>ing/to</sub>, hate<sub>ing/to</sub>, and remember<sub>ing</sub>) as transparent; and as can be seen from Figures 1 and 3, these embedding predicates are some of the best with PC, regardless of variability due to participants and embedded predicates.

A likely possibility is that opacity interacts with other semantic properties of the control predicate to license PC. Some evidence for this view comes from apparent differences in the strength of our tense and aspect predictors with respect to opacity. On the one hand, transparent predicates appear to sit on a cline, with simultaneous telics worst, simultaneous atelics better, and nonsimultaneous atelics best, suggesting that both simultaneity and telicity play a role in licensing PC with transparent predicates. On the other hand, only simultaneity appears to matter for opaque predicates; atelics (mean=1.52; 95% CI=0.84–1.62) are only slightly better than telics (mean=1.30; 95% CI=0.89–1.39).

But although opaque simultaneous attitudinals like claim<sub>to</sub> and pretend<sub>to</sub> are not as acceptable with PC as their nonsimultaneous counterparts like want<sub>to</sub> and hope<sub>to</sub>, they are not predicted to be nearly as bad as nonattitudinals or their transparent counterparts like remember<sub>to</sub> and manage<sub>to</sub>. We discuss possible reasons for this in Section 4.2.

4. Conclusions and speculations

4.1. Central conclusions

Our results support four central conclusions:

(16) a. Embedding predicates differ in their tolerance for PC, and these differences form a cline (gradability).

b. Temporal properties of the embedding predicate are a reliable predictor of the availability of PC.

Furthermore, opacity alone does not predict PC; transparent predicates (mean=1.41; 95% CI=0.03–2.31), regardless of attitudinalicity, are not predicted to be very different from opaque predicates (mean=1.24; 95% CI=0.86–1.62) on average.

There may exist some interaction between simultaneity and telicity within the opaque predicates, but it is quite small, if it exists.
c. Aspectual properties of the embedding predicate are a reliable predictor of the availability of PC.
d. Modal properties of the embedding predicate are a reliable predictor of the availability of PC.

In what follows, we elaborate on each of these conclusions.

4.1.1. Gradability

Raw mean ratings show a cline in PC acceptability as a function of the choice of embedding predicate, ranging from 2.05 out of 7 for \textit{beginning} to 6.10 out of 7 for \textit{remembering}. This cline remains even after filtering out variability due to participants and embedded predicates and even after building a model of embedding predicate semantic features. The finding that embedding predicates differ in their tolerance for PC supports most previous theoretical work on the topic (with the possible exception of Bowers 2008), but no existing approaches predict the fine gradation that our experiments show (though see section 4.2 below).

4.1.2. Temporal properties

Embedding predicates that support matrix/embedded temporal mismatches (\textit{nonsimultaneous} predicates) are more acceptable with PC than are predicates that do not support matrix/embedded temporal mismatches (\textit{simultaneous} predicates). This finding is consistent with Landau 2000 and (with some qualifications) Pearson 2013. Given that nonsimultaneous predicates include not only future-oriented predicates like \textit{want} but also past-oriented predicates like \textit{regretting}, this finding also challenges the view in Jackendoff and Culicover 2003 that PC is parasitic on intentionality and consequently found only with future-oriented predicates.

4.1.3. Aspectual properties

Among transparent attitudinal predicates, being atelic as opposed to telic correlates with a boost in PC acceptability. Although telicity has not played a central role in any existing theoretical approaches to PC, it is indirectly manifest in Pearson’s (2013) proposal that progressive aspect improves the acceptability of PC. Also, Rooryck (2007) has identified telicity as a factor in the acceptability of split control.
4.1.4. Modal properties

Opacity appears to modulate the effects of temporal and aspectual properties. Within transparent attitudinal predicates, being atelic as opposed to telic and being nonsimultaneous as opposed to simultaneous both appear to improve PC compatibility, as evidenced by the cline we see with those predicates. Within opaque attitudinal predicates, being nonsimultaneous appears to improve PC compatibility, but being atelic does not.

4.2. Toward a theoretical account: A variant of Pearson’s theory

In this final section, we conclude with some speculative remarks on how Pearson’s (2013) theory of PC might be adapted to account for some of the gradability that we see in our findings. For Pearson (2013), the semantic dimensions of control predicates that matter for determining the availability of PC are as schematized in (17).

As seen in (17), the highest level distinction is between control predicates that ascribe attitudes and those that do not. For example, deserve, although it passes standard tests for control, does not ascribe an attitude to its subject, and so it is classified as non-attitudinal. Among attitudinal predicates, Pearson proposes a split between what she calls ‘canonical’ and ‘non-canonical’ attitude predicates. Drawing on earlier work by Sharvit (2003); Grano (2011), Pearson suggests that non-canonical attitude predicates such as try are those that ascribe an attitude but behave unlike canonical attitude predicates such as want with respect to opacity, as evidenced by contrasts in existential entailments (see (14) above, and see also Giannakidou 2013 for an approach based on veridicality). Finally, among canonical attitude predicates, Pearson identifies a split similar to Landau’s (2000) between those whose tense must be construed as simultaneous with the understood tense of the complement clause and those whose tense can be construed as non-simultaneous with
the understood tense of the complement clause. Of all these categories, Pearson argues that only non-simultaneous canonical attitude predicates support PC.

To explain this generalization, Pearson proposes that canonical attitude predicates (to the exclusion of the other kinds of control predicates) all have a semantics of the kind schematized in (18), where the first argument is a proposition with open slots for an individual argument and a time interval argument. Consequently, as illustrated in (19), a complement to such a predicate undergoes lambda-abstraction with respect to both its tense and its PRO subject.

\[(18) \quad \text{[attitude predicate]} = \lambda P_{t \in \langle i,s,t \rangle} \lambda x t \lambda w. [\ldots] \]

\[(19) \quad \text{Jay claimed/wanted } [\lambda x_1 \lambda t_2 \lambda w_3 [\text{PRO}_1 \text{ to be happy}_{t_2,w_3}]]. \]

Simplifying somewhat, Pearson argues that PC arises as a consequence of the fact that when a canonical attitude predicate imposes a relation of non-simultaneity for its complement’s temporal argument, it correspondingly imposes a subset relation for its complement’s individual argument, as in (20) and (21). When an attitude predicate imposes a simultaneity relation on its complement’s temporal argument, on the other hand, it correspondingly imposes an equality relation on its complement’s individual argument, as in (22).

\[(20) \quad \text{Jay wanted } [\lambda x_1 \lambda t_2 \lambda w_3 [\text{PRO}_1 \text{ to be happy}_{t_2,w_3}]]. \]
\[a. \quad \text{attitude time} < \text{embedded clause time} \]
\[b. \quad \text{attitude holder} \subseteq \text{embedded subject} \]

\[(21) \quad \text{Jay regretted } [\lambda x_1 \lambda t_2 \lambda w_3 [\text{PRO}_1 \text{ being happy}_{t_2,w_3}]]. \]
\[a. \quad \text{attitude time} > \text{embedded clause time} \]
\[b. \quad \text{attitude holder} \subseteq \text{embedded subject} \]

\[(22) \quad \text{Jay claimed } [\lambda x_1 \lambda t_2 \lambda w_3 [\text{PRO}_1 \text{ to be happy}_{t_2,w_3}]]. \]
\[a. \quad \text{attitude time} = \text{embedded clause time} \]
\[b. \quad \text{attitude holder} = \text{embedded subject} \]

Among our experimental findings are that simultaneous canonical attitude predicates (in particular, \textit{claim}) are more acceptable than non-canonical attitude predicates like \textit{try} and \textit{manage} or some non-attitudinal predicates like \textit{need}, though all of these types are less acceptable with PC than are most nonsimultaneous canonical attitude predicates like \textit{promise} and \textit{be eager}. To explain this pattern, it is tempting to adopt a framework like Pearson’s, but with the modification that a simultaneous canonical attitude predicate can be ‘coerced’ into accepting PC by tolerating a subset relation for
its complement’s individual argument despite imposing an equality relation for its complement’s temporal argument, albeit with a moderate degradation in acceptability, as schematized in (23). By contrast, non-canonical attitude predicates and non-attitude predicates are not eligible for this coercion, because, by hypothesis, they do not quantify over time-individual pairs.

(23) “Coerced” partial control:

Jay **claimed** \(\lambda x_1 \lambda t_2 \lambda w_3 \) [PRO \(_1\) to be happy \(_{t_2,w_3}\)]

a. attitude time = embedded clause time
b. attitude holder \(\subseteq\) embedded subject

This modified approach gives us a three-way split between predicates that are inherently PC-compatible (*want, regret*), those that can be coerced at a cost into PC-compatibility (*claim*), and those that are not coercible (*try, manage, deserve, need*). Of course, this three-way split does not account for the full range of variation that we found in the experiment. Furthermore, not all predicates behave as expected on this approach; for example, according to the filtered ratings in Figure 3, *pretend* appears at the low end of the scale, even though, as a simultaneous canonical attitude predicate, it should pattern with *claim* in having intermediate acceptability. Despite these shortcomings, though, this approach strikes us as a promising avenue for further exploration.

References


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**Proceedings of Sinn und Bedeutung 18**

Edited by Urtzi Etxeberria, Anamaria Fălăuș, Aritz Irurtzun & Bryan Leferman

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Abstract. This paper offers a ‘feature-based’ account of neg-raising (NR) phenomenon. This account integrates Alternative Semantics for focus into the grammatical view of scalar implicatures (SIs). I argue that the derivation of an NR or non-NR reading is determined by the distributions of two features, namely, the SI feature [+σ] of NR predicates and the [+F] feature of focused items.

Keywords: Neg-raising, Negation, Focus, Implicatures, Alternatives

1. Introduction

‘Neg-raising’ (henceforth NR) is a phenomenon that the clause-mate negation of a sentence-embedding verb is intuitively interpreted as taking scope in the complement clause. For instance, sentences like (1a) and (2a) are intuitively interpreted as (1b) and (2b), respectively. The narrow scope readings in (1b) and (2b) are called ‘NR readings’, and the wide scope readings in (1c) and (2c) are called ‘non-NR readings’. Predicates that allow NR readings are called ‘neg-raising predicates’ (henceforth NRPs).

(1)  a. John doesn’t believe that it is raining.
    b. ¬ John believes that it isn’t raining.
    c. ⊤ It isn’t the case that John believes that it is raining.

(2)  a. John doesn’t want to leave here.
    b. ¬ John wants not to leave here.
    c. ⊤ It isn’t the case that John wants to leave here.

NR was firstly conceived as a syntactic phenomenon (Fillmore 1963, Lakoff 1969, a.o.). This early syntactic approach postulates that negation in a sentence like (1a) is generated and interpreted in the embedded clause, but it raises into the main clause and is pronounced there. While being popular in its early period, the syntactic view is challenged by various pragmatic and semantic approaches. Representative studies following a semantic/pragmatic vein include: the conventional implicature-based approach (Horn 1978), the presupposition-based approach (Bartsch 1973; Gajewksi 2005, 2007), the scalar implicature (SI)-based approach (Romoli 2012, 2013) and the PPI-based approach (Homer 2012). My proposal is developed from the presuppositional-based account and the SI-based account.

1For helpful comments and criticism, I want to thank Gennaro Chierchia, Kai von Fintel, Danny Fox, Michael Franke, Jim Huang, Manfred Krifka, Jacopo Romoli, Uli Sauerland, Benjamin Spector and the audiences at SuB 18.
In the presupposition-based approach, Gajewksi (2005, 2007) adopts Bartsch’s (1973) view that an NRP gives rise to an excluded middle homogeneity inference, which says that the subject is opinionated about the truth or falsity of the complement clause. For instance, the excluded middle for ‘\(\text{John believes } \phi\)’ is ‘\(\text{either John believes } \phi \text{ or John believes } \neg\phi\)’. To explain the defeasibility of excluded middles, Gajewski (2007) assumes that excluded middles are ‘soft presuppositions’ in the sense of Abusch (2002, 2010), derived from the lexical entries of NRPs.

Romoli (2012, 2013) adopts the viewpoint that NRPs trigger excluded middles. However, he argues that excluded middles are not presuppositions but instead SIs, more precisely, optional indirect SIs activated by relevance. My proposal follows his idea that excluded middles are SIs. However, my approach differs greatly in the way of assuming how excluded middles get activated: instead of attributing the activation to the notion of relevance, I argue that a predicate taking an SI-feature \([+\sigma]\) activates an excluded middle obligatorily. In addition, I consider non-NR readings as results of intervention effects from focus. To highlight the core difference between this two SI-based accounts, I will call Romoli’s (2012, 2013) approach as ‘relevance-based’ while mine as ‘feature-based’.

The primary goal of this paper is to explain the distributions of NR and non-NR readings based on the distributions of features. Gajewski (2005) observes that it is marked to negate an NRP without assuming an excluded middle. To say that the subject is not opinionated at the value of the embedded clause, there must be a stress on the negative auxiliary or on the NRP. For instance, sentences in (3a-b) do not imply the NR inference in (3c) (capitals indicate stress). These facts suggest that the derivation of an NR or non-NR inference is related to F(ocus)-marking.

(3) a. John DOESn’t believe that it is raining.
   b. John doesn’t BELIEVE that it is raining.
   c. \(\neg\text{ John believes it isn’t raining.}\)

The rest of the paper is organized as follows. In section 2, I summarize the SI-based account from Romoli (2012, 2013) and the grammatical theory of SIs he adopts. In section 3, I offer a feature-based account to explain the derivations of NR and non-NR interpretations, and in particular, the cancellation effects from focus. This feature-based account can be summarized in two sentences. First, the requirements of feature-checking and avoiding G-triviality provide a group of eligible EXH-structure candidates. Second, a set of OT constraints select out the winning EXH-structures and the preferred interpretations.
2. The relevance-based approach

2.1. Excluded middles

Bartsch (1973) indicates that the NR phenomenon is influenced by a pragmatic presupposition, called ‘excluded middle’. This inference says that the subject is opinionated about the truth or falsity of its complement clause $\phi$. In a positive case like (4), the excluded middle is asymmetri-
cally entailed by the assertion and hence doesn’t affect the overall meaning. In a negative context like (5), the excluded middle projects over negation, and an NR reading is derived as a logical consequence of the negative assertion and the excluded middle.

(4) a. John believes that it is raining.  
   b. John has an opinion as to whether it is raining.  

(5) a. John doesn’t believe that it’s raining.  
   b. John has an opinion as to if it’s raining.  
   c. John believes that it isn’t raining.

Gajewski (2005, 2007) adopts the idea of excluded middles. However, instead of grouping ex-
cluded middles as pragmatic presuppositions, he argues that they are soft presuppositions lexically
specified for NRPs. The label ‘soft’ is coined by Abusch (2002, 2010) to describe the group of
presuppositions that are defeasible.

In the very recent work by Romoli (2012, 2013), he argues that excluded middles are not presup-
positions but instead SIs. This claim is supported by the non-presuppositional projection status of
excluded middles: although excluded middles survive under negation, they do not project in other
embedding contexts. As illustrated in (7), when the NRP believe is embedded in the antecedent of
a conditional, under an epistemic modal, or in an interrogative, the excluded middle is not implied.
For sake of comparison, as shown in (8), the existential presupposition of an it-cleft is implied in
all those embeddings.

(6) a. Bill believes that Sue is here.  
   b. Bill doesn’t believe that Sue is here.  
   c. $\sim$ Bill is opinionated with respect to if Sue is here.

(7) a. If Bill believes that Sue is here, he will come.  
   b. Perhaps Bill believes that Sue is here.  
   c. Does Bill believe that Sue is here?  
   d. $\therefore$ Bill is opinionated with respect to if Sue is here.

(8) a. It was Mary who killed Bill.
b. It wasn’t Mary who killed Bill.
c. If it was Mary who killed Bill, she should confess.
d. Perhaps it was Mary who killed Bill.
e. Was it Mary who killed Bill?
f. Someone killed Bill.

Furthermore, Romoli (2012, 2013) notices that SIs behave in the same way as excluded middles do. The implicature in (9c) survives as an indirect SI in the negative sentence (9b), but it does not project out when the scalar item is embedded inside the antecedent of a conditional like (10a).

(9) a. Every student came.
   b. Not every student came.
   c. Some student came.
(10) a. If every student came, the party was a success.
     b. Some student came.

2.2. The grammatical view of scalar implicatures

SIs were primarily considered as a wholly pragmatic phenomenon in the Gricean framework (Grice 1975). However, in the recent works by Chierchia et. al. (2013) a.o., SIs are conceived as grammatical matters. This grammatical view assumes that a scalar item triggers a set of alternatives. The alternative set are computed in the same way as questions (Hamblin 1973) or focus (Rooth 1985, 1992). A schematized recursive definition is given below, adopted from Chierchia (2013).

(11) Basic Clause: For any lexical entry \( \alpha \), \( \mathcal{A}lt(\alpha) = \)
    a. \( \{ [[\alpha]] \} \) if \( \alpha \) is lexical and does not belong to a scale;
    b. \( \{ [[\alpha_1]], ..., [[\alpha_n]] \} \) if \( \alpha \) is lexical and part of a scale \( \langle [[\alpha_1]], ..., [[\alpha_n]] \rangle \).
    Where \( \mathcal{A}lt \) is a function from expressions to a set of interpretations.
(12) Recursive Clause: \( \mathcal{A}lt(\beta(\alpha)) = \{ b(a) : b \in \mathcal{A}lt(\beta) \text{ and } a \in \mathcal{A}lt(\alpha) \} \)

Alternatives keep growing until factored into meaning via a covert exhaustivity operator EXH. This operator, with a meaning akin to only, affirms the prejacent and negates an excludable subset of the alternative set (notation: \( \mathcal{E}xcl(p) \)). The excludable alternatives are all the ones that can be

\( \text{2} \)Here and throughout the paper, the symbols EXH and \( p \) are sloppily used for both syntactic phrases and truth conditions. A stricter semantic representation for EXH should be as follows, where \( S \) is the c-commanded phrase of EXH.
consistently negated with the assertion on its own.³

(13) a. EXH(p) = λw.p(w) ∧ ∀q ∈ E\text{cl}(p)[¬q(w)]
b. E\text{cl}(p) = \{q ∈ \mathcal{A}lt(p) : λw[¬q(w)] ∩ p ≠ ∅\}

As a simple illustration, the indirect SI in (14a) is derived as an entailment of global exhaustification, as schematized in (14c). Note that the local exhaustification structure in (14d) is out, because it yields a meaning equivalent to the plain assertion, violating the MaxStrength condition (see section 3.4.1 for extensive discussions).

(14) a. Not every student came. ∼ Some student came.
b. \mathcal{A}lt(¬\phi\text{\_SOME}) = \{¬\phi\text{\_SOME}, ¬\phi\text{\_EVERY}\}
c. EXH(¬\phi\text{\_EVERY}) = ¬\phi\text{\_EVERY} ∧ ¬¬\phi\text{\_SOME} = ¬\phi\text{\_EVERY} ∧ \phi\text{\_SOME} (✓)
d. ¬EXH(\phi\text{\_EVERY}) = ¬\phi\text{\_EVERY} (✗)

Adopting the grammatical theory of SIs, Romoli (2012, 2013) proposes that an NRP is associated with two alternatives, the assertion itself and an excluded middle. Those alternatives must be used up by a c-commanding EXH-operator. In a positive case, the excluded middle is asymmetrically entailed by the assertion and hence the EXH is semantically vacuous, as schematized in (15). In a negative case, exhaustifying over negation denies the negated excluded middle, giving rise to an NR reading, as schematized in (16).

(15) a. \mathcal{A}lt(\text{bel}\phi) = \{\text{bel}\phi, \text{bel}\phi ∨ \text{bel}¬\phi\}
b. EXH(\text{bel}\phi) = \text{bel}\phi
(16) a. \mathcal{A}lt(¬\text{bel}\phi) = \{¬\text{bel}\phi, ¬[\text{bel}\phi ∨ \text{bel}¬\phi]\}
b. EXH(¬\text{bel}\phi) = ¬\text{bel}\phi ∧ ¬¬[\text{bel}\phi ∨ \text{bel}¬\phi] = \text{bel}¬\phi

2.3. Activation of alternatives and non-NR readings

Romoli (2012, 2013) subdivides alternatives into two classes, obligatory ones and optional ones. The activation of the former class is determined by the value of its corresponding grammatical features, while that of the latter is subject to relevance. In Chierchia’s (2006) convention, for instance, scalar alternatives are activated when the SI-feature [σ] takes the ‘+’ value, and are

(1) \[\text{EXH}_w[S] = [S][w] ∧ ∀S′ ∈ E\text{cl}(S)[¬[S'][w]]\]

³Fox (2007) gives a different lexical entry for the EXH-operator, and argues that EXH only negates the Innocently Excludable (IE) alternatives. See Chierchia (2013) and section 3.3 for details.
inactive when \([\sigma]\) gets the ‘-’ value. An alternative is said to be obligatory iff the corresponding feature always takes the ‘+’ value.

Romoli claims that factive alternatives are obligatorily activated by an agreement feature \([\pi]\). This feature always takes the ‘+’ value and always activates a factive alternative. In a negative sentence like (17b), the negated factive alternative is stronger than the negative assertion and is excludable. Hence, as schematized in (19), exhaustification proceeding via a global EXH negates the negated factive alternative, giving rise to a meaning that entails the factive inference.

(17) a. John knows that it is raining.
   b. John doesn’t know that it is raining.
   c. \(\therefore\) It is raining.

(18) a. \(\mathcal{Alt}(\text{know}[+\pi]\phi) = \{\text{know}\phi, \phi\}\)
   b. \(\text{EXH}(\text{know}[+\pi]\phi) = \text{know}\phi\)

(19) a. \(\mathcal{Alt}(\neg\text{know}[+\pi]\phi) = \{-\text{know}\phi, \neg\phi\}\)
   b. \(\text{EXH}(\neg\text{know}[+\pi]\phi) = \neg\text{know}\phi \land \neg\neg\phi = \neg\text{know}\phi \land \phi\)

As for optional alternatives, Romoli assumes that an alternative falling in this class is inactive unless it is relevant to the current question. According to the standard assumption that a question is associated with a partition of the common ground, ‘relevance’ can be defined as in (20), where \(Q\) is the partition set associated with the question. This definition says an assertion is relevant iff it does not discriminate between cell-mates. Namely, for each partition associated with the question, a relevant assertion must eliminate either all the worlds in that cell or none of them.

(20) **Relevance**: A proposition \(p\) is relevant to a question \(Q\) iff \(p\) is (contextually equivalent to) the union of some subset of \(Q\). Heim (2011)

Romoli further classifies excluded middles as optional alternatives. He claims that the assertions in (21a) and (22a) can be thought of as answers to the questions in (21b) and (22b), respectively. The associated partition sets of these two questions are given in (21c) and (22c), of which only the former contains an alternative derived from excluded middles (viz. \(\neg(\mathcal{Bel}\phi \lor \mathcal{Bel}\neg\phi)\)). On a relevance-based account, we can say that the negated excluded middle indiscriminates in \(Q_1\) and discriminates in \(Q_2\). Based on this idea, Romoli concludes that the reason for the non-NR interpretation in (22a) is that here the (negated) excluded middle alternative is inactive.

(21) a. Bill doesn’t believe that it is raining.
   b. What does Bill believe about whether it is raining?
   c. \(Q_1 = \{\mathcal{Bel}\phi, \mathcal{Bel}\neg\phi, \neg(\mathcal{Bel}\phi \lor \mathcal{Bel}\neg\phi)\}\)
(22)  
(a) John DOESn’t believe that it is raining.
(b) Does John believe that it is raining?
(c) $Q_2 = \{\text{Bel } \phi, \neg \text{Bel } \phi\}$

As for the non-NR case in (23) which has narrow focus on the NRP, the (negated) excluded middle is relevant and activated. Romoli (2012, 2013) claims that here the EXH-operator has to be applied locally, so as to be consistent with the denial of excluded middle in the continuation.

(23)  
(a) John doesn’t BELIEVE that it is raining. He isn’t sure.
(b) What does John do with respect to whether it is raining?
(c) $Q_3 = \{\text{Bel } \phi, \text{Bel } \neg \phi, \neg \text{Bel } \phi \land \neg \text{Bel } \neg \phi, \text{hope } \phi, \ldots\}$

2.4. Problems with the relevance-based account

To sum things up, Romoli (2012, 2013) manipulates the NR reading in (24a) as a logical consequence of global exhaustification. In response to the non-NR readings in (24b), he postulates that the excluded middle is inactive in (24a) because of its irrelevance to the current question. As for the non-NR reading in (24c), he assumes that here the EXH-operator has stay locally, so as to stay consistent with the negated excluded middle in the continuation. I agree with his analysis regarding to NR readings but disagree with those to non-NR readings.

(24)  
(a) John doesn’t believe that it is raining.
(b) John DOESn’t believe that it is raining.
(c) John doesn’t BELIEVE that it is raining.

First of all, it is unclear how ‘relevance’ determines whether an alternative is activated, since empirically there is no discernible difference between obligatory alternatives and optional alternatives in terms of the way of being activated. Compare (24a-b) with the examples in (25). The factive inference, which Romoli claims to be obligatorily activated, is cancelled in exactly the same way as the excluded middle is: the factive inference is denied-able when the negative auxiliary is F-marked, and is not denied-able in the absence of this F-marking.

(25)  
(a) John doesn’t know it is raining. # It is not raining.
(b) John DOESn’t know it is raining, since it is not raining.

Second, to get the non-NR reading in (24c), the excluded middle doesn’t have to be negated in the continuation, as illustrated in (26). What’s more, the continuation in (26) sounds even more
natural than the negated exclude middle in (23a). Therefore, being consistent with a continuation shouldn’t be the cause for an EXH to be applied locally.

(26) John doesn’t BELIEVE that it is raining, he KNOWS that it is raining.

Third, it is problematic to say that the scope of an EXH can be decided by the continuation, which incorrectly predicts that excluded middles can be suspended even in the basic negation case in (27).

(27) John doesn’t believe that it is raining, # he is not sure.

3. My proposal: a feature-based account

I offer a feature-based account to explain the distributions of NR and non-NR readings. I follow Romoli’s (2012, 2013) view that excluded middles are SIs, but argue that their activations are not bound to the confines of relevance. More importantly, the account that I assume highlights the role of focus on the cancellation of excluded middles, and provides principles to restrict the landing position of EXHs.

3.1. An overview

I propose that the status of an NR inference is determined by the distributions of two features, a lexically endowed SI feature \([\sigma]\) and a contextually dependent focus feature \([F]\). The \([\sigma]\) feature is adopted from Chierchia’s (2006) analysis on scalar items. I assume that when a predicate \((P)\) has an \([+\sigma]\) feature in its lexicon, it activates an excluded middle alternative, as schematized in (28). In this sense, NRPs are predicates containing an \([+\sigma]\) feature.\(^4\)

\(^4\)A similar assumption has been drawn in Romoli (2012, 2013). However, he assumes that the value of the \([\sigma]\) feature in NRPs is restricted by relevance. In my view, although the \([\sigma]\) feature of NRPs can take the ‘-’ value, it isn’t decided by relevance. As far as I can see, the value of \([\sigma]\) varies in the following ways. First, it varies cross-linguistically. For instance, English hope takes \([+\sigma]\), while German hoffen takes \([-\sigma]\) in the third person use. Second, the value of \([\sigma]\) of a predicate can be affected by the meaning of the complement. For instance, want is uncontroversially NR, however, it can also be paraphrased as the non-NR predicate desire, especially when its complement refers to some high expectation. Consider the examples quoted from Homer (2012), (1a) doesn’t imply (1b). The variation with want can be reduced to Marantz’s (1984) observation that the interpretation of a predicate is sensitive to its object. Third, even in a basic negation case like (2), some native speakers suggest that it is marginally acceptable to interpret a canonical NRP as a non-NR one.

(1) a. My great-grandparents didn’t want to spend all their spare time on the internet.
   b. My great-grandparents wanted not to spend all their spare time on internet.

(2) John doesn’t believe it is raining, ?he isn’t opinionated.
The idea of focus feature [+F] is inspired by Rooth’s (1985, 1992, 1996) Alternative Semantics for focus. I assume that an F-marked item is assigned with an [+F] feature. This feature activates a set of focus-related alternatives \( \mathcal{A}lt F(p) \), namely, a subset of \( [p]^f \) (the focus value of \( p \)) containing the prejacent \( p \) and particular contextually selected elements.

All of the activated alternatives need to be used up by an EXH-operator, which affirms the prejacent \( p \) and negate all the alternatives that are not entailed by the prejacent (Magri 2010, Chierchia et al. 2013). In a basic negation case like (29a), I adopt Romoli’s proposal that here the EXH-operator takes scope over negation, yielding an NR reading. However, as for the non-NR readings in (30a) and (31a), different from Romoli’s view, I argue that the LF structures of these two sentences must take double exhaustification and local exhaustification, respectively.

The heart of my proposal is that, where to insert an EXH is determined by two unviolatable conditions and two OT constraints, listed out in (32) and (33), respectively. In the next section, I will show how to select out the winning LF structures based on those conditions and constraints.

5The [+F] feature and the \( \mathcal{A}lt F(p) \) set resemble the focus interpretation operator ‘\( \sim \)’ and the \( C \) variable in Rooth (1996: 279): “\( \phi \) is a syntactic phrase and \( C \) is a syntactically covert semantic variable, \( \phi \sim C \) introduces the presupposition that \( C \) is a subset of \( [\phi]^f \) containing \( [\phi]^0 \) and at least one other element.”
3.2. Feature-checking

An eligible EXH-structure should be first syntactically well-formed, especially needs to satisfy two requirements on feature-checking. First, a well-formed structure shouldn’t contain any unchecked feature. According to Chierchia (2006, 2013), every feature that takes the ‘+’ value is forced to enter into an agreement relation with a c-commanding EXH; in absence of such an EXH, a feature can only take the ‘-’ value. This requirement rules out the EXH-structures in (34), each of which contains an unchecked feature [+σ]. Second, a well-formed structure shouldn’t contain any syntactically vacuous EXH-operator. Namely, every occurrence of EXH should probe for some feature that takes the ‘+’ value. This requirement rules out the EXH-structures in (35).

(34)  a. *[ ... some [+σ] ]
     b. *[ ... some [+σ] ... [EXH [ ... some [+σ] ... ]]]

(35)  a. *EXH [ ... some [−σ] ... ]
     b. *EXH [EXH [ ... some [+σ] ... ]]

Syntactically well-formed EXH-structures for sentences containing negation and NRPs are listed below. In section 3.3, I will show that the sentence in (37a) must choose the double exhaustification structure in (37c), since its competitive, the global exhaustification one, yields a G-trivial reading. In section 3.4, I will show that global exhaustification is optimal for (36a), and that local exhaustification is strongly preferred for (38a).

(36)  a. John doesn’t believe that it is raining.
     b. EXH ∼ [John believes [+σ] it’s raining]
     c. ∼ EXH [John believes [+σ] it’s raining]

(37)  a. John DOESn’t believe that it is raining
     b. EXH ∼ [+F] [John believes [+σ] it’s raining]
     c. EXH ∼ [+F] EXH [John believes [+σ] it’s raining]

(38)  a. John doesn’t BELIEVE that it is raining
     b. EXH ∼ [John believes [+σ, +F] it’s raining]
     c. ∼ EXH [John believes [+σ, +F] it’s raining]

---

6 This description is still sloppy. A stricter way to state this requirement is as follows: insert an occurrence of EXH to an assertion α iff α contains an expression β such that β takes an alternative-sensitive feature and that β doesn’t fall within the scope of an occurrence of EXH appearing in α.
3.3. Avoid G-triviality

After feature-checking, syntactically well-formed structures will then be sent to the process of semantic compositions. The most important filter in this process is avoiding G-triviality. Chierchia (2013) defines G-triviality as a special case of L-triviality: L-trivial sentences refer to those that are tautologous or contradictory in the traditional sense, while G-triviality says that a sentence receives the same value (1 or 0) regardless how the lexical terminals are replaced in the structure. As a simple illustration, the sentence in (40a) is both G-trivial and L-trivial, while the one in (40b) is merely L-trivial. Unlike the infelicitous sentence in (40b) which can be utterable especially under certain embeddings, the sentence in (40a) is always perceived as “ungrammatical”.

(39) \textbf{G-triviality}: A sentence $\phi$ is G-trivial iff for any situation $s$ and model $M$, $[\phi^s]^M = \text{same}$ (where same is either 1 or 0) and $\phi'$ is obtained from $\phi$ by an arbitrary substitution of its lexical terminal nodes.

(40) a. * some student but John smokes.
    b. # John smokes and doesn’t smokes.

In the grammatical view of SIs, a sentence is considered as G-trivial once applying exhaustification yields a semantic contradiction (or a tautology). Based on this idea, Chierchia (2006, 2013) claims that the reason why NPI any must stay in DE context is that, exhaustifying the D-alternatives of any in a non-DE context yields a contradiction. I won’t get into more details about this idea, but the crucial point is that the meaning of an EXH-structure cannot be G-trivial.

There are different approaches to avoid G-triviality. Besides the way of changing the monotonicity pattern of the embedding context, we can also manipulate the scope or the quantity of EXH-operators. In the case of focused negation, we have seen two LFs that satisfy the feature-checking requirements: one is to insert an occurrence of EXH above negation, as in (41b), and the other is to insert an EXH both above and below negation, as in (41c). I call the former structure “global exhaustification”, and the latter “double exhaustification”.

(41) a. John DOESn’t believe that it is raining
    b. EXH $\neg|^{+F}$ [John believes$|^{+\sigma}$ it’s raining] $\times$
    c. EXH $\neg|^{+F}$ EXH [John believes$|^{+\sigma}$ it’s raining] $\sqrt{\ }$

Global exhaustification yields G-triviality, as shown by the schematized derivation in (42). In this EXH-structure, the alternative set used by the global EXH includes both the affirmed and the negated excluded middles (as underlined), both of which are excludable on their own. However, negating these two alternatives gives rise to a semantic contradiction.
The contradiction can be avoided by applying double exhaustification. According to the principle in (43) from Chierchia (2013), the excluded middle has been (vacuously) used up by the local EXH, and hence is not available for the global EXH. This structure yields a non-NR reading, as expected.

(43) $\mathcal{A}lt(\text{EXH}(\phi)) = \{\text{EXH}(\phi)\}$

(once an EXH applies to some expression $\phi$, $\phi$'s alternatives are no longer available)

(44) a. $\mathcal{A}lt(\neg [+F] \text{EXH} \text{bel} [+\sigma] \phi) = \{\neg \text{EXH bel} \phi, \text{EXH bel} \phi\}$

b. $\text{EXH} \neg [+F] \text{EXH} \text{bel} [+\sigma] \phi = \neg \text{EXH bel} \phi \land \neg \text{EXH bel} \phi = \neg \text{EXH bel} \phi = \neg \text{bel} \phi$

To sum up, as for the case with focused negation, using one single global EXH-operator to check off the [+F] feature on negation and the [+\sigma] feature on NRP yields a semantic contradiction. Hence, the LF has to take double exhaustification, giving rise to a non-NR reading.

3.4. An optimality theory for NR

3.4.1. The conditions

In this part, I offer an OT system to explain why an unmarked negative sentence prefers an NR reading, and why a sentence with an F-marked NRP has to be interpreted as non-NR. Two constraints are considered in this system, ranked in order of priority.

(45) a. $\text{ExclF}$: there must be some excludable F-alternative.

b. $\text{MaxStrength}$: do not exhaustify $S$ in $[S' \ldots S \ldots]$ if it leads to a reading that is weaker than or equivalent to $S'$.

The ExclF condition is motivated by excludability inference of overt only, which requires the focused constituent to trigger at least one excludable alternative. As a simple illustration, the answer in (46c) is infelicitous because all the F-alternatives are entailed by the prejacent. As for the case of the covert EXH-operator, such a requirement is less rigid, as one can stress the strongest alternative as in (46d) without yielding any infelicity. However, we can still observe the effect

7Note that the ExclF condition is different from the AvoidF principle in Schwarzschild’s (1999): “F-mark as little as possible (without violating GIVENness).” The former concerns the most as to whether an F-marked item contrasts to any alternative, while the latter cares the most as to whether a non-given expression should be F-marked. In other words, the former is about the semantic consequence of F-marking, while the latter determines whether to and where to assign an F-mark.
of ExclF in negative sentences. For an utterance like (47a), the global EXH structure in (47b) is bad because under such a structure the focused scalar item doesn’t trigger any excludable F-alternatives. Thus the EXH-operator has to be applied locally, giving rise to a cancellation effect on the SI \( \neg \phi_{ALL} \).

\[(46)\]
\begin{enumerate}
  \item a. A: Which of John and Mary are you going to invite?
  \item b. B: Only JOHN, (not Mary/both).
  \item c. B: # Only BOTH.
  \item d. B: BOTH.
\end{enumerate}

\[(47)\]
\begin{enumerate}
  \item a. I didn’t see SOME of the students. (I saw ALL of the students.)
  \item b. \( \# EXH [\neg \phi_{SOME[+\sigma,+F]}] \)
  \item c. \( \neg EXH [\phi_{SOME[+\sigma,+F]}] = \neg [\phi_{SOME} \land \neg \phi_{ALL}] = \neg \phi_{SOME} \lor \phi_{ALL} \)
  (Either I didn’t see some of the students, or I saw all of the students.)
\end{enumerate}

The MaxStrength condition (also named as “Strongest Meaning Hypothesis” in the literature) has been extensively discussed in a bunch of works, including Chierchia, Fox and Spector (2013), Fox and Spector (2009), Magri (2011), Romoli (2012), among the others. However, each implementation has its own nuances and makes different predictions. For instance, Chierchia, Fox and Spector (2013) provides two candidates and leaves their final decision open. One candidate is to say that the preferred reading is always the strongest possible one (if there is one) among all the possible readings, and the other candidate is to say that the meaning of \( [S'EXH[S]] \) shouldn’t be weaker than \( S' \). Most of the works mentioned above are inclined to the second one, so is MaxStrength. The definition of MaxStrength used in this paper follows Fox and Spector (2009), according to which MaxStrength disallows not only weakening exhaustifications but also semantically vacuous exhaustifications. Without this move, the obligatoriness of NR readings in unmarked sentences cannot be captured.

When the scalar item some in (47a) is not F-marked, the ExclF condition becomes irrelevant. Instead, the MaxStrength condition plays a role and requires to exercise global exhaustification. The meaning of a global exhaustion structure is schematized in (49b). It successfully predicts that the SI \( \neg \phi_{ALL} \) cannot be canceled in an unmarked sentence like (48).

\[(48)\] I didn’t see some of the students. (# I saw all of the students.)
\( \rightarrow \) I saw some of the students. (viz. It isn’t the case that I didn’t see any student.’)

\[(49)\]
\begin{enumerate}
  \item a. \( \neg EXH [\phi_{SOME[+\sigma]} = \neg \phi_{SOME} \lor \phi_{ALL} \)
  (Either ‘I didn’t see some of the students’, or ‘I saw all the students,’)
  \item b. \( EXH [SOME_{i,[+\sigma]} [\neg \phi_{t_i}]] = [SOME_{i} [\neg \phi_{t_i}]] \land \neg [ALL_{i} [\neg \phi_{t_i}]] \)
  (‘I didn’t see some of the students, but not that I didn’t see any student.’)
\end{enumerate}
3.4.2. Distributing NR and non-NR readings

In section 3.3, I have shown that the requirement of avoiding G-triviality requires the case of focused negation to take double exhaustification. In this part, I will show how the OT constraints select out the winning structures for the other two cases.

The basic negation case  In absence of F-marked items, the LF structure contains one and only one occurrence of \( \text{EXH} \)-operator that checks off the \([+\sigma]\) feature on \textit{believe}. Both the global \text{EXH}-structure and the local one are syntactically well-defined, and are both independent from the ExclF constraint. However, the local one leads to a reading that is equivalent to the plain assertion, as schematized in (51), and hence violates the MaxStrength constraint. In contrast, as schematized in (52), global exhaustification gives rise to a stronger reading, namely, the NR reading.

(50) John doesn’t believe that it is raining.

\[
\begin{array}{|c|c|c|}
\hline
\text{Input: } & \text{ExclF} & \text{MaxStrength} \\
\hline
\text{bel}[^{+\sigma}]\phi & \text{EXH}[\neg\text{bel}[^{+\sigma}]\phi] & \ast! \\
\hline
\end{array}
\]

(51) a. \( \mathcal{A}lt \) (\( \text{bel}[^{+\sigma}]\phi \)) = \{\text{bel}\phi, \text{bel}\phi \lor \text{bel}\neg\phi\}

b. \( \ast\neg\text{EXH} \) [\text{bel}[^{+\sigma}]\phi] = \neg\text{bel}\phi

(52) a. \( \mathcal{A}lt \) (\( \neg\text{bel}[^{+\sigma}]\phi \)) = \{\neg\text{bel}\phi, \neg[\text{bel}\phi \lor \text{bel}\neg\phi]\}

b. \text{EXH} [\neg\text{bel}[^{+\sigma}]\phi] = \neg\text{bel}\phi \land \neg[\text{bel}\phi \lor \text{bel}\neg\phi] = \text{bel}\neg\phi

The case of stressed NRP  A stressed NRP carries two features, the SI feature \([+\sigma]\) that activates an excluded middle, and the [+F] feature that triggers a set of focus-alternatives. For a sentence like (53), the focus-alternative \textit{know}\phi asymmetrically entails the asserted component \textit{bel}\phi in the terminal level, while its negation \( \neg\text{know}\phi \) is asymmetrically entailed by \( \neg\text{bel}\phi \) in the global level. The landing position of \text{EXH} determines at which level the focus-alternative is factored into meaning. The predominant constraint ExclF requires the focused item to activate an excludable alternative. Hence, according to the results drawn in (54d) and (55d), we conjecture that here the \text{EXH}-operator has to be applied under negation, giving rise to a non-NR reading that is weaker than the plain assertion.

(53) Bill doesn’t BELIEVE it is raining, he KNOWS it is raining.
(54) a. *\text{EXH} (\neg \text{bel}_{+[\sigma, +F]} \phi)
   b. \text{Alt} (-\text{bel}_{+[\sigma, +F]} \phi) = \{-\text{bel}\phi \lor \text{bel}\neg\phi, \neg\text{bel}\phi, \neg\text{know}\phi\}
   c. \text{Excl}_{\sigma} (-\text{bel}_{+[\sigma, +F]} \phi) = \{-\text{bel}\phi \lor \text{bel}\neg\phi\}
   d. \text{Excl}_{F} (-\text{bel}_{+[\sigma, +F]} \phi) = \emptyset

(55) a. \neg\text{EXH} (\text{bel}_{+[\sigma, +F]} \phi)
   b. \text{Alt} (\text{bel}_{+[\sigma, +F]} \phi) = \{\text{bel}\phi \lor \text{bel}\neg\phi, \text{bel}\phi, \text{know}\phi\}
   c. \text{Excl}_{\sigma} (\text{bel}_{+[\sigma, +F]} \phi) = \emptyset
   d. \text{Excl}_{F} (\text{bel}_{+[\sigma, +F]} \phi) = \{\text{know}\phi\}
   e. \neg\text{EXH} (\text{bel}_{+[\sigma, +F]} \phi) = \neg[\text{bel}\phi \land \neg\text{know}\phi] = \neg\text{bel}\phi \lor \text{know}\phi

4. Conclusions

In this paper, I proposed a feature-based account to explain the distributions of NR and non-NR readings. This account inherits the merits of the SI-based account from Romoli (2012, 2013), and improves this SI-based view by highlighting the role of focus in cancellations and providing restrictions on the selection of EXH-structures. I argued that NR readings come from global exhaustification, and that non-NR readings result from either double exhaustification and local exhaustification, depending on the location of focus.

(56) a. John doesn’t believe that it is raining. \hspace{1cm} NR
   b. \text{EXH} \neg [\text{John believes}_{+[\sigma]} \text{it’s raining}] \hspace{1cm} \text{Global EXH}

(57) a. John DOESn’t believe that it is raining., he isn’t sure. \hspace{1cm} \text{Non-NR}
   b. \text{EXH} \neg_{+[F]} \text{EXH} [\text{John believes}_{+[\sigma]} \text{it’s raining}] \hspace{1cm} \text{Double EXH}

(58) a. John doesn’t BELIEVE that it is raining, he knows it. \hspace{1cm} \text{Non-NR}
   b. \neg \text{EXH} [\text{John believes}_{+[\sigma, +F]} \text{it’s raining}] \hspace{1cm} \text{Local EXH}

I proposed that where to insert EXH is restricted by two inviolable principles (feature checking and avoiding G-triviality) and two OT constraints (ExclF and MaxStrength). Alternative structures are untenable for the following reasons. First, as for the basic negation sentence in (56), local exhaustification results in a reading that is equivalent to the assertion, violating the MaxStrength constraint. Second, as for the sentence in (57) which has narrow focus on negation, an LF with a single local exhaustification has an unchecked feature [+F], failing to satisfy the feature-checking requirement, and an LF with a single global exhaustification has to negate both positive and negative excluded...
middles, yielding G-triviality. Third, as for the sentence in (58) where the NRP is stressed, the focus-alternative set has no excludable member under global exhaustification.

References


Proceedings

Sinn und Bedeutung 18
in the Basque Country

Edited by U. Etxeberria, A. Fălăuş, A. Irurtzun & B. Leferman
University of the Basque Country (UPV/EHU) – September 11-13 2013