

# Proceedings of *Sinn und Bedeutung 19*

Edited by

EVA CSIPAK (Georg-August-University Göttingen)

HEDDE ZEIJLSTRA (Georg-August-University Göttingen)



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# Introduction

The present volume contains a collection of papers presented at the 19<sup>th</sup> annual meeting "Sinn und Bedeutung" of the Gesellschaft für Semantik, which was held at the Georg-August-Universität Göttingen on September 15<sup>th</sup> - 17<sup>th</sup>, 2014 and which was jointly organized by LinG (Linguistics in Göttingen).

163 abstracts were submitted to SuB19; of the 52 talks of the program, 39 were elaborated into the papers in this collection, which appears online at:

[LinG - Linguistics in Göttingen](#) & [semanticsarchive.net](#)

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 our fellow organizers, Regine Eckardt, Paula Menendez-Benito, Edgar Onea, Igor Yanovich, our secretary Margitta Strüber, our student helpers, Nurcam Akcam, Ronja Brodhun, Benjamin Burkhardt, Paul Dijkzeul, Lea Fricke, Carina Kauf, Swantje Tönnis, Jessica Vaupel, Tanja Wiessner, all anonymous reviewers, the invited speakers, Ashwini Deo, Sabine Iatridou, Sophia Malamud and Ede Zimmermann (who could not be present) and all others involved for contributing to the success of this conference.

Göttingen, July, 2015.

Eva Csipak & Hedde Zeijlstra

# Deontic and Epistemic Modals in Suppositional [Inquisitive] Semantics\*

Martin Aher — *University of Tartu*

Jeroen Groenendijk — *ILLC, University of Amsterdam*

**Abstract.** In Groenendijk and Roelofsen (2015) a suppositional semantics for implication is proposed within the general framework of inquisitive semantics. Our aim is to extend this semantic approach to epistemic and deontic modals, but, for the purposes of this short paper, we bracketed off inquisitive aspects of meaning. To illustrate the semantics we discuss a semantic solution to a Jackson inspired puzzle which involves the interaction of implication and both types of modals.

## 1. Introduction

Our starting point is the suppositional treatment of implication in Groenendijk and Roelofsen (2015), within the general framework of inquisitive semantics. Our overall aim is to extend the coverage of the semantics to a propositional language with epistemic and deontic modals. To distinguish between the modals, epistemic possibility and necessity are designated standardly with  $\Diamond\varphi$  and  $\Box\varphi$ . Deontic permission and obligation are designated by  $\Diamond^v\varphi$  and  $\Box^v\varphi$ , marked with a  $v$ , which signifies that deontic rules can be *violated*.

Deontic modals have been studied within the general framework of inquisitive semantics (see Aher 2011, 2013), and the same holds for epistemic modals (see Ciardelli et al. 2009, 2014; Roelofsen 2013), but these analyses were carried out in two quite different extensions of the basic inquisitive system (see, e.g., Ciardelli et al. 2012, 2013). Our aim is to bring implication, epistemic and deontic modals together within a single semantic system, and to study their interaction. To serve the conciseness of this paper, we focus on suppositional and informative aspects of the meaning of these operators and bracket off inquisitive features, which explains the title of the paper.

As for epistemic modals, we follow the simple treatment of epistemic possibility in update semantics proposed in Veltman (1996), see also Groenendijk et al. (1996), and turn it into a suppositional approach with minimal changes, ignoring dynamic aspects. This means that we do not follow the alternative attentive treatment of epistemic possibility proposed in Ciardelli et al. (2014), which is arguably also simple, but adds attentive content to informative and inquisitive content as an additional aspect of meaning. Ciardelli et al. argue specifically in relation to Veltman's analysis, that what is obtained there as *semantic* content of  $\Diamond\varphi$ , can be obtained from its purely attentive

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\*The material in this paper was presented at the Tenth International Tbilisi Symposium on Language, Logic and Computation, Gudauri, September 2013; at Sinn und Bedeutung 19 and at the Questions in Discourse Workshop, both in Göttingen, September 2014; and at LeGO, Amsterdam, November 2014. We thank those present, and the anonymous reviewers of abstracts we submitted, for useful comments and remarks. Special thanks go to Ivano Ciardelli, Stefan Hinterwimmer, Robert van Rooij, Frank Veltman and Matthijs Westera for discussion and help, and in particular to Floris Roelofsen who made crucial contributions to many of the presented ideas. Financial support from the Netherlands Organisation for Scientific Research and the Estonian Research Council is gratefully acknowledged.

meaning and *pragmatic* principles. This point could apply for the analysis we will propose here. Also, more generally, it has been argued that the suppositional phenomena that we target can be accounted for pragmatically. To the extent that this is the case, we aim to flesh out an alternative semantic approach for comparison. As for deontic modals, we follow Anderson (1967), which is particularly suitable in the context of this paper, since in such an approach deontic statements are looked upon as a kind of implication.<sup>1</sup> In doing so we are also in the footsteps of the analysis of deontic modals in Aher (2013) in radical inquisitive semantics, the predecessor of this system.

Epistemic and deontic modals, alongside implication, have been extensively studied in philosophy, logic and linguistics. There are many aspects of their meaning that our simple analysis will not touch upon, or that it may even be at odds with. We believe that the suppositional aspects of meaning that we study here for the basic case are orthogonal to other aspects of meaning that one may care to take into account, and that, in principle, the way we propose to deal with suppositional aspects in the basic case can be carried over to other more sophisticated non-suppositional analyses.

We will first discuss the notion of meaning that we use, and how we bracket off inquisitiveness. Next we define the notion of supposability we need for the interpretation of the operators  $\rightarrow$ ,  $\Diamond$  and  $\Diamond$ . Then we present and discuss the clauses for implication and epistemic possibility. In order to deal with deontic modals, we extend information states with ‘deontic information’. Finally, we discuss examples involving the interplay of epistemic and deontic modals.

## 2. Background

Inquisitive semantics is information-based. Sentences are evaluated relative to information states, where information states are sets of possible worlds. For a standard propositional language, a possible world can be identified with a binary valuation for all atomic sentences in the language. We denote the set of all possible worlds by  $\omega$ , and refer to the empty set as *the absurd state*.

In basic inquisitive semantics the interpretation for the language is given by defining recursively when a state  $\sigma$  *supports* a sentence  $\varphi$ , denoted as  $\sigma \models \varphi$ . The proposition expressed by  $\varphi$  consists of the set of all states that support it:  $[\varphi] := \{\sigma \mid \sigma \models \varphi\}$ . The union of all states that support  $\varphi$  is called the *informative content* of  $\varphi$ :  $\text{info}(\varphi) := \bigcup [\varphi]$ . Crucially, due to the interpretation of disjunction in inquisitive semantics as:  $\sigma \models \varphi \vee \psi$  iff  $\sigma \models \varphi$  or  $\sigma \models \psi$ , it need not be the case that the state that equals  $\text{info}(\varphi)$  is itself a state that supports  $\varphi$ . By definition,  $\varphi$  is *inquisitive* iff  $\text{info}(\varphi) \notin [\varphi]$ . Most typically, the classical tautology  $p \vee \neg p$ , where  $\text{info}(p \vee \neg p) = \omega$ , is inquisitive. Any state that supports  $p \vee \neg p$  either consists only of worlds where  $p$  is true, or only of worlds where  $p$  is false. Hence,  $\text{info}(p \vee \neg p)$ , the union of all such states, is not itself a state that supports  $p \vee \neg p$ . For this reason, in inquisitive semantics,  $p \vee \neg p$ , abbreviated as  $?p$ , is not a tautological statement, but a non-tautological inquisitive *question*. However, in the disjunction-free fragment of a propositional language, no sentence  $\varphi$  is inquisitive, for any sentence in this fragment it holds that  $\text{info}(\varphi) \in [\varphi]$ , i.e., that no disjunction-free sentence is inquisitive.

<sup>1</sup>Recently, there has also been renewed interest in Andersonian deontic modals, see for example Barker (2010).

In Groenendijk and Roelofsen (2015), the interpretation for the language is given by defining by simultaneous recursion the three semantic relations of (i) when a state *supports* a sentence,  $\sigma \models^+ \varphi$ ; (ii) when it *rejects* it,  $\sigma \models^- \varphi$ ; and (iii) when it *dismisses a supposition* of it,  $\sigma \models^\circ \varphi$ . The *proposition* expressed by a sentence, is then determined by the triple:  $[\varphi] := \langle [\varphi]^+, [\varphi]^-, [\varphi]^\circ \rangle$ , where  $[\varphi]^+ := \{\sigma \mid \sigma \models^+ \varphi\}$ , and likewise for the other two components. Just focusing on  $[\varphi]^+$ , the (support) *informative content* of  $\varphi$  is defined as  $\text{info}(\varphi) := \bigcup [\varphi]^+$ . And, as in the basic case, a sentence is (support) inquisitive in case  $\text{info}(\varphi) \not\subseteq [\varphi]^+$ , but now with the proviso  $\text{info}(\varphi) \neq \emptyset$ . This still holds for  $p \vee \neg p$ , but unlike in the basic case, it now also holds for the sentence  $\neg(p \wedge \neg p)$  that is classically equivalent with it. The equivalence does not hold in basic inquisitive semantics, where no sentence  $\neg\varphi$  is inquisitive. In suppositional inquisitive semantics no sentence is inquisitive in the fragment of a propositional language that is both disjunction-free and conjunction-free. For any sentence  $\varphi$  in this fragment, it holds that if  $\text{info}(\varphi) \neq \emptyset$ , then  $\text{info}(\varphi) \in [\varphi]^+$ , i.e.,  $\text{info}(\varphi) \models^+ \varphi$ .

The strategy in this paper is to focus on the informative and suppositional aspects of the meanings assigned to conditional statements, to statements expressing epistemic possibility or necessity, and to statements expressing deontic possibility or necessity, while completely ignoring inquisitive aspects of meaning. Technically, the way to do this is to restrict ourselves to a language that is disjunction-free and conjunction-free. So the only operators we are considering are  $\{\neg, \rightarrow, \Diamond, \Diamond^\circ\}$ , where  $\Box$  and  $\Box^\circ$  are defined as the dual of  $\Diamond$  and  $\Diamond^\circ$  respectively.

The original motivation behind the suppositional enrichment of the basic system was to give a *semantic* account of certain intuitions concerning implication. We will show below how the semantics accounts for the most relevant intuitions that (1a) and (1b) *contradict* each other, and that (1c) *suppositionally dismisses* both (1a) and (1b).

- |     |   |                        |
|-----|---|------------------------|
| (1) | a. If Abe goes to the party, Bea will go.     | $p \rightarrow q$      |
|     | b. If Abe goes to the party, Bea will not go. | $p \rightarrow \neg q$ |
|     | c. Abe won't go.                              | $\neg p$               |

**Postulating properties of propositions.** It is a foundational feature of basic inquisitive semantics that *support is persistent*: if  $\sigma \models \varphi$ , then for all  $\tau \subseteq \sigma$ :  $\tau \models \varphi$ , and hence the absurd state supports any sentence:  $\emptyset \models \varphi$ , for all  $\varphi$ . In the suppositional system we **postulate** that *the absurd state dismisses every sentence*, and that *dismissal is fully persistent*. I.e., if a state dismisses a supposition of a sentence, then so does any more informed state. The intuitive motivation for these postulates is that in the semantics, suppositional dismissal of a sentence in a state is always caused by the impossibility to coherently make a certain *supposition* in that state, and as the information available in a state grows, it may become impossible to coherently make that supposition, and once that is the case, it remains the case by further growth of information, and it is impossible to coherently make any supposition in the absurd state.

It may typically play a role, also for support and rejection of a sentence  $\varphi$  in a state  $\sigma$ , that certain

suppositions can be coherently made in  $\sigma$ . And  $\varphi \rightarrow \psi$ ,  $\Diamond\varphi$ , and  $\Diamond\varphi$  share this semantic feature. In case of  $\varphi \rightarrow \psi$  and  $\Diamond\varphi$ , it will be a prerequisite for both support and rejection in  $\sigma$  that  $\varphi$  is supposable in  $\sigma$ , if not, suppositional dismissal results. As for  $\Diamond\varphi$ , it can be looked upon as just a check of the supposability that  $\varphi$ . Rejection of  $\Diamond\varphi$  then requires non-supposability of  $\varphi$ . Given the non-persistent feature of supposability, it may then typically hold that whereas  $\varphi$  is supposable in  $\sigma$ , this no longer holds in some more informed state  $\tau \subset \sigma$ . This implies that support and rejection are not fully persistent. A state  $\sigma$  can support or reject  $\varphi \rightarrow \psi$ ,  $\Diamond\varphi$ , or  $\Diamond\varphi$ , whereas some stronger state  $\tau \subset \sigma$  no longer does. However, we **postulate** that *support and rejection are persistent modulo suppositional dismissal*: for any  $\varphi$ , if  $\sigma \models^+ \varphi$  and  $\tau \subseteq \sigma$ , then  $\tau \models^+ \varphi$  or  $\tau \models^\circ \varphi$ , and similarly for rejection. It may even hold for certain sentences,  $\Diamond\varphi$  is a case in point, that whereas it is supported by a state  $\sigma$ , it is rejected by some more informed state  $\tau \subset \sigma$ , but then it cannot fail to be the case that  $\tau$  simultaneously suppositionally dismisses the sentence. The same can happen in the opposite direction, here  $\Box\varphi$  is a case in point, some state  $\sigma$  can reject a sentence, where some  $\tau \subset \sigma$  supports it, but then  $\tau$  also suppositionally dismisses it. So, support and dismissal need not exclude each other, and the same holds for rejection and dismissal. However, as is to be expected, we **postulate** that *support and rejection are mutually exclusive*. Finally, we have seen that we take the absurd state to dismiss every sentence, but we ban it from support and rejection: we **postulate** that *the absurd state neither supports nor rejects any sentence*.

We have postulated that the set of states that dismiss a supposition of  $\varphi$  is never empty, it will always be the case that  $\emptyset \in [\varphi]^\circ$ . To distinguish *suppositional* sentences, we define:

**Definition 1.** (Suppositionality).  $\varphi$  is *suppositional* iff for some non-absurd state  $\sigma$ :  $\sigma \models^\circ \varphi$ .

Below, and in the full inquisitive system, only sentences with  $\rightarrow$ , or  $\Diamond$ , or  $\Diamond$  can be suppositional.

### 3. Implication in suppositional [inquisitive] semantics

Before we turn to the treatment of implication for the non-inquisitive fragment of a propositional language, we first state the semantic clauses for atomic sentences and negation, where this restriction of the language plays no role.

**Atomic sentences and negation.** For support/rejection of an atomic sentence  $p$  in a state  $\sigma$ , we require, as is to be expected, that  $p$  is true/false in every world  $w \in \sigma$ . Only, in view of the general constraint on propositions that the absurd state does not support or reject any sentence, we add the condition that  $\sigma$  is not the absurd state. And we declare that  $\sigma$  suppositionally dismisses  $p$  iff it is absurd. So, under the definition of suppositionality, atomic sentences are not suppositional. The clauses for negation are straightforward: support/rejection of  $\neg\varphi$  switches to rejection/support of  $\varphi$ , and suppositional dismissal of  $\varphi$  is preserved by  $\neg\varphi$ , which means that  $\neg\varphi$  is suppositional if and only if  $\varphi$  is. Clearly double negation holds:  $\varphi$  is equivalent with  $\neg\neg\varphi$ .<sup>2</sup>

<sup>2</sup>Negation behaves very differently here from how it does in basic inquisitive semantics, where the maximal supporting states for  $\varphi$  and  $\neg\varphi$  cannot overlap. Here, the maximal states that support and reject a suppositional sentence



**Definition 2.** (Atomic sentences).

$$\begin{aligned} \sigma \models^+ p & \text{ iff } \sigma \neq \emptyset \text{ and } \forall w \in \sigma: w(p) = 1 \\ \sigma \models^- p & \text{ iff } \sigma \neq \emptyset \text{ and } \forall w \in \sigma: w(p) = 0 \\ \sigma \models^\circ p & \text{ iff } \sigma = \emptyset \end{aligned}$$

**Definition 3.** (Negation).

$$\begin{aligned} \sigma \models^+ \neg\varphi & \text{ iff } \sigma \models^- \varphi \\ \sigma \models^- \neg\varphi & \text{ iff } \sigma \models^+ \varphi \\ \sigma \models^\circ \neg\varphi & \text{ iff } \sigma \models^\circ \varphi \end{aligned}$$

Just for simplicity, if the language contains only a single atomic sentence  $p$ , a state can include at most two different worlds, depicted in an obvious way in the figures below, which indicate what the maximal states are that support, reject, and suppositionally dismiss  $p$ .

Figure 1: Supporting  $p$ Figure 2: Rejecting  $p$ Figure 3: Dismissing  $p$ 

**Supposability.** As we said above, under our suppositional analysis, in evaluating support, rejection, and suppositional dismissal in a state  $\sigma$  of  $\varphi \rightarrow \psi$ ,  $\Diamond\varphi$ , and  $\Diamond\varphi$ , it plays a role whether  $\varphi$  is *supposable* in  $\sigma$ . In our non-inquisitive setting, this central notion can be defined as follows.

**Definition 4.** (Supposability for non-inquisitive  $\varphi$ ).  $\varphi$  is *supposable* in  $\sigma$  iff  $\sigma \cap \text{info}(\varphi) \models^+ \varphi$ .

Recall that since  $\varphi$  is not inquisitive,  $\text{info}(\varphi) = \emptyset$  or  $\text{info}(\varphi)$  is bound to support  $\varphi$ . And since support is persistent modulo suppositional dismissal, it can then only be the case that  $\sigma \cap \text{info}(\varphi)$  does not support  $\varphi$ , because it dismisses a supposition of  $\varphi$ , i.e.,  $\sigma \cap \text{info}(\varphi) \models^\circ \varphi$ . This will invariably be the case when  $\sigma \cap \text{info}(\varphi) = \emptyset$ , since the absurd state suppositionally dismisses every sentence. So, supposability of  $\varphi$  in  $\sigma$  implies that  $\varphi$  is consistent with  $\sigma$ . And for sentences  $\varphi$  which are not suppositional, i.e., which are only dismissed by the absurd state, supposability of  $\varphi$  in  $\sigma$  boils down to consistency with  $\sigma$ . This holds for example for an atomic sentence  $p$  and its negation. However, when  $\varphi$  is itself suppositional, it can also hold that  $\sigma \cap \text{info}(\varphi)$  does not support  $\varphi$  and  $\sigma \cap \text{info}(\varphi) \models^\circ \varphi$ , while  $\sigma \cap \text{info}(\varphi) \neq \emptyset$ , because a prerequisite for support of  $\varphi$  is the supposability of some sentence  $\chi$  and  $\chi$  is not supposable in  $\sigma \cap \text{info}(\varphi)$ . As we will see in more detail below, a case in point is  $\Diamond(p \rightarrow q)$ . Taking  $\varphi = p \rightarrow q$ , and  $\chi = p$ , we have an example of a sentence  $\varphi$  which requires the supposability of  $\chi$ . So, according to the definition, for  $\varphi = p \rightarrow q$  to be supposable in a state  $\sigma$  it should also hold that  $p$  is supposable in  $\sigma$ . So, this is then also a prerequisite for support of  $\Diamond(p \rightarrow q)$ .

**Implication.** Apart from inquisitive features which we leave out of the picture here, there are two crucial features in the semantic treatment of implication in suppositional inquisitive semantics. The first is that  $\varphi \rightarrow \psi$  is deemed neither supported nor rejected, but dismissed in a state  $\sigma$ , when the antecedent  $\varphi$  is not supposable in  $\sigma$ , according to the definition given above. The second feature lies in the non-classical way in which support and rejection in a state  $\sigma$  are treated. In both cases

$\varphi$  may overlap, but states in the overlap cannot fail to dismiss a supposition of  $\varphi$ . Also, in basic inquisitive semantics, negation blocks inquisitiveness, hence  $\varphi$  is not equivalent with  $\neg\neg\varphi$  in case  $\varphi$  is inquisitive.

we consider the state  $\tau = \sigma \cap \text{info}(\varphi)$  that results from *supposing* the antecedent  $\varphi$  in  $\sigma$ . Then if the supposed state  $\tau$  supports the consequent  $\psi$ , the implication  $\varphi \rightarrow \psi$  as a whole is taken to be supported by  $\sigma$  as such, and if  $\tau$  rejects the consequent  $\psi$ , the implication  $\varphi \rightarrow \psi$  as a whole is taken to be rejected by  $\sigma$  as such. Finally,  $\varphi \rightarrow \psi$  is not only dismissed in  $\sigma$  when  $\varphi$  is not supposable in  $\sigma$ , but also when if we coherently can and do suppose the antecedent  $\varphi$  in  $\sigma$ , we reach a state where the consequent  $\psi$  is dismissed. This additional element in the dismissal of  $\varphi \rightarrow \psi$  is only relevant when the consequent  $\psi$  is itself suppositional. This leads to the following clauses for implication in suppositional inquisitive semantics, when restricted to the non-inquisitive fragment of the full propositional language.

**Definition 5.** (Implication in suppositional [inquisitive] semantics).

$$\begin{aligned} \sigma \models^+ \varphi \rightarrow \psi & \text{ iff } \sigma \cap \text{info}(\varphi) \models^+ \varphi \text{ and } \sigma \cap \text{info}(\varphi) \models^+ \psi \\ \sigma \models^- \varphi \rightarrow \psi & \text{ iff } \sigma \cap \text{info}(\varphi) \models^+ \varphi \text{ and } \sigma \cap \text{info}(\varphi) \models^- \psi \\ \sigma \models^\circ \varphi \rightarrow \psi & \text{ iff } \sigma \cap \text{info}(\varphi) \not\models^+ \varphi \text{ or } \sigma \cap \text{info}(\varphi) \models^\circ \psi \end{aligned}$$

The three figures below jointly depict the meaning of the simplest example of an implication  $p \rightarrow q$ . The light-gray area in Fig. 4 corresponds to the maximal state that supports  $p \rightarrow q$ . Any substate of it will still support it, except when it is completely included in the darker area, in which case we end up in a state that suppositionally dismisses it. The maximal dismissing state is shown in Fig. 6. All substates of it also dismiss  $p \rightarrow q$ , including the absurd state. Fig. 5 is read similarly to Fig. 4.

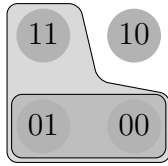


Figure 4: Supporting  $p \rightarrow q$

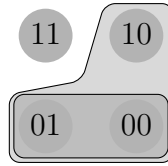


Figure 5: Rejecting  $p \rightarrow q$

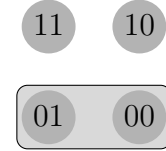


Figure 6: Dismissing  $p \rightarrow q$

It is not difficult to see that the states that reject  $p \rightarrow q$  are the same as the states that support  $p \rightarrow \neg q$ , and the states that reject  $p \rightarrow \neg q$  support  $p \rightarrow q$ . So, this accounts for the intuition that (1a) and (1b) contradict each other. Also the states that dismiss  $p \rightarrow q$  are the same as those that dismiss  $p \rightarrow \neg q$ . The maximal state that does so is also the maximal state that supports  $\neg p$ . We thereby account for the intuition that (1c) suppositionally dismisses both (1a) and (1b).

#### 4. Epistemic possibility in suppositional [inquisitive] semantics

In Veltman (1996) a semantics for an epistemic possibility operator  $\Diamond$ , pronounced as *might*, is presented in the framework of update semantics. The update of an information state  $\sigma$  with a sentence  $\Diamond\varphi$  either succeeds or fails. It only succeeds when  $\varphi$  is consistent with the information in  $\sigma$ , otherwise it fails. In the first case the update of  $\sigma$  with  $\Diamond\varphi$  has no effect, it leaves the state as it is. In the second case the update of  $\sigma$  with  $\Diamond\varphi$  would lead to the absurd state. We say *would* lead to the absurd state, because the addressee of an utterance of  $\Diamond\varphi$  whose information state is

inconsistent with  $\varphi$  will of course not actually perform the update. What she will rather do is signal in response to the speaker that, apparently unlike his state, her state is inconsistent with  $\varphi$ . It is for this reason that  $\Diamond\varphi$  is referred to by Veltman as a ‘consistency test’. The primary conversational function of an utterance of  $\Diamond\varphi$  is for a speaker to check with the hearer(s) whether they agree that  $\varphi$  is consistent with their current information states.

There could be other conversational functions of  $\Diamond\varphi$ , such as drawing attention to a certain possibility or possibilities, but these are not directly modeled in Veltman’s semantics, and the same holds for the suppositional semantics proposed here. In Ciardelli et al. (2009, 2014) it is precisely this attentive effect of  $\Diamond\varphi$  that is taken as the hallmark of its semantics, and its conversational function as a consistency check is explained pragmatically. The attentive analysis gives rise to a semantic explanation for free choice effects for disjunctive sentences which involve epistemic possibility. That is also within the power of our suppositional semantics, for both epistemic and deontic possibility, but this can only be shown in the full inquisitive version of the semantics.

In the spirit of Veltman’s proposal, we treat  $\Diamond\varphi$  as a *supposability check* relative to information states.<sup>3</sup> We let a state  $\sigma$  support  $\Diamond\varphi$  if  $\varphi$  is supposable in  $\sigma$ , according to the definition of supposability given above. In case  $\varphi$  is not supposable in  $\sigma$ , we deem  $\Diamond\varphi$  to be dismissed in  $\sigma$ . If, unlike  $\varphi$ ,  $\neg\varphi$  is supposable in  $\sigma$ , then  $\sigma$  rejects  $\Diamond\varphi$ . When neither  $\varphi$  nor  $\neg\varphi$  is supposable, we let  $\sigma$  dismiss  $\Diamond\varphi$ . In this case, dismissal occurs either because  $\sigma$  is absurd or because a supposition of  $\varphi$  fails in  $\sigma$ . When  $\varphi$  is not suppositional, checking the supposability of  $\varphi$  in  $\sigma$  boils down to checking consistency of  $\varphi$  with  $\sigma$ .

**Definition 6.** (Epistemic possibility in suppositional [inquisitive] semantics).

$$\begin{aligned} \sigma \models^+ \Diamond\varphi & \text{ iff } \sigma \cap \text{info}(\varphi) \models^+ \varphi \\ \sigma \models^- \Diamond\varphi & \text{ iff } \sigma \cap \text{info}(\varphi) \not\models^+ \varphi \text{ and } \sigma \cap \text{info}(\neg\varphi) \models^+ \neg\varphi \\ \sigma \models^\circ \Diamond\varphi & \text{ iff } \sigma \cap \text{info}(\varphi) \not\models^+ \varphi \text{ or } \sigma \cap \text{info}(\varphi) \models^\circ \varphi \end{aligned}$$

The suppositional nature of the semantics proposed for  $\Diamond\varphi$  manifests itself in three ways. First, because it constitutes a supposability check. Secondly, for any informative sentence  $\varphi$ , it holds that  $\Diamond\varphi$  is suppositional, so there is a non-absurd state that dismisses it. Thirdly, rejection of  $\Diamond\varphi$  implies dismissal, in line with the postulate that rejection is persistent modulo suppositional dismissal.

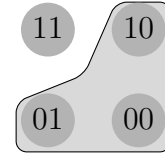
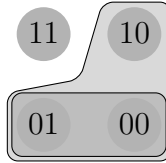
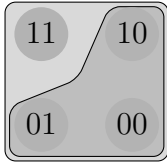
Below we depict the meaning of the simple example  $\Diamond p$ , only reckoning with a single atomic sentence in the language. It can be compared with the pictures above of the meaning of  $p$  as

<sup>3</sup>The semantics as such is neutral as to who beholds the information state relative to which we evaluate a sentence. There is a lively debate going on concerning so-called *contextualist* analyses of epistemic possibility. Such analyses share the idea that the state relative to which  $\Diamond\varphi$  is evaluated need not be the state of the speaker/hearer, but that, as (Yanovich, 2013, p. 29) puts it, it can be “some body of knowledge determined by the evaluation world and the context of utterance”. Our semantics as such does not model this, but there is also nothing that excludes extending it in a way that it does. And when this is done, a contextualist analysis may profit from the fact that it is then not consistency, but supposability relative to such a contextual body of information that the semantics will cover.

such. Note that  $\Diamond p$  is supported in the ignorant state that consists of all worlds. What is not completely clear from the picture as such is that not all states that dismiss  $\Diamond p$  also reject it; the absurd state is the exception. For this example, and the one given next, rejection of  $\Diamond\varphi$  and  $\varphi$  is fully the same. That is not always so in the full language, but what does hold generally is that  $\text{info}(\neg\Diamond\varphi) = \text{info}(\neg\varphi)$ .

Figure 7: Supporting  $\Diamond p$ Figure 8: Rejecting  $\Diamond p$ Figure 9: Dismissing  $\Diamond p$ 

We have seen in the discussion of  $\Diamond\varphi$ , that except when  $\varphi$  is suppositional, it boils down to a consistency check, as in Veltman's update semantics. Since  $p \rightarrow q$  is suppositional, we can observe the additional suppositional features of  $\Diamond\varphi$  by inspecting the meaning of  $\Diamond(p \rightarrow q)$ , depicted below. A state  $\sigma$  supports  $\Diamond(p \rightarrow q)$  when  $p \rightarrow q$  is supposable in  $\sigma$ . This is so as long as  $\sigma$  contains a world  $w$ :  $w(p) = w(q) = 1$ . As soon as that is not the case,  $\Diamond(p \rightarrow q)$  is dismissed in  $\sigma$ . Furthermore  $\Diamond(p \rightarrow q)$  is not only dismissed but also rejected in  $\sigma$  when  $\neg(p \rightarrow q)$ , which is equivalent with  $p \rightarrow \neg q$ , is supposable in  $\sigma$ . This is so as long as  $\sigma$  contains a world  $w$ :  $w(p) = 1$  and  $w(q) = 0$ . In particular when  $\sigma$  only contains worlds  $w$ :  $w(p) = 0$ , i.e., when  $\sigma$  supports  $\neg p$ ,  $\sigma$  neither supports, nor rejects  $\Diamond(p \rightarrow q)$ , but only dismisses it.

Figure 10: Supporting  $\Diamond(p \rightarrow q)$  Figure 11: Rejecting  $\Diamond(p \rightarrow q)$  Figure 12: Dismissing  $\Diamond(p \rightarrow q)$ 

**Epistemic necessity.** Unfortunately, we do not have sufficient space here to include a proper discussion of the semantics that results for  $\Box\varphi$  when defined as the dual of  $\Diamond\varphi$ . In a nutshell, parallel to the conversational function of  $\Diamond\varphi$  as a supposability check for  $\varphi$ , the semantics of  $\Box\varphi$  turns it into a *non-supposability check* for  $\neg\varphi$ . What the semantics suggests is that the primary conversational function of an utterance of  $\Box\varphi$  is for a speaker to check with the hearer(s) whether they agree that  $\neg\varphi$  is *not supposable*. The less information a hearer has, the easier it becomes to reject  $\Box\varphi$ , like it is the case for support of  $\Diamond\varphi$ . This has also interesting effects when we consider the interplay of epistemic necessity and implication, as in the simple case of  $p \rightarrow \Box q$ , which comes out equivalent with  $\Box(p \rightarrow q)$ . This modal implication is much easier to reject than  $p \rightarrow q$ , having no information concerning  $p$  and  $q$  already suffices in case of  $p \rightarrow \Box q$ , because this is enough to support  $p \rightarrow \Diamond\neg q$ , but that is not enough to support  $p \rightarrow \neg q$ , which is needed to reject  $p \rightarrow q$ .<sup>4</sup>

<sup>4</sup>See von Fintel and Gillies (2010) for an overview of recent literature on epistemic *must*.

## 5. Deontic suppositional [inquisitive] semantics

To be able to state an information-based semantics for deontic modalities, we enrich our information states in a way that they can also embody *deontic information*.

**Worlds with a deontic dimension.** We will define worlds (and information states) in such a way that they have both an *ontic dimension* and a *deontic dimension*. The ontic dimension of a world is given by an *ontic possibility*: a possible assignment of truth values to the atomic sentences. So, what used to be called the set of possible worlds  $\omega$  is now called the set of ontic possibilities. The deontic dimension of a world is given by a *deontic possibility*: a function  $d$  which determines for every possible world  $v$  whether a rule is violated in  $v$ .<sup>5</sup>  $\Delta$  denotes the set of all deontic possibilities.

For the purposes of this paper, we make two assumptions concerning possible worlds. The first is the innocent assumption that two worlds cannot *only* differ in their ontic dimension. If this could be the case, then the assignment of a truth value to an atomic sentence in a world could depend on its deontic dimension, whence an atomic sentence could carry deontic information. The second assumption is that whether a world  $v$  is characterized by a deontic possibility  $d$  as being a world where some deontic rule is violated is *independent of the deontic dimension of  $v$* .<sup>6</sup> This means that, technically, the set of deontic possibilities  $\Delta$  can be taken to be the set of functions  $d$  which specify for each *ontic possibility*  $o \in \omega$  whether it violates a deontic rule. Indirectly, the deontic dimension  $d$  of a world  $w$  then also determines which *worlds*  $v$  are such that a deontic rule is violated in  $v$ , viz., all worlds  $v$  that have an ontic possibility  $o$  as their ontic dimension such that  $o$  is a violation according to the deontic dimension  $d$  of  $w$ . Under these two assumptions concerning the nature of worlds, we can identify the set of possible worlds with the Cartesian product of the set of ontic possibilities  $\omega$  and the set of deontic possibilities  $\Delta$ .<sup>7</sup>

**Definition 7.** (Possible worlds as pairs of an ontic and a deontic possibility).

- The set of *ontic possibilities*  $\omega$  is the set of all valuations for the atomic sentences.
- The set of *deontic possibilities*  $\Delta$  is the set of all functions  $d$  that specify for each ontic possibility  $o \in \omega$  whether  $o$  is a violation of some deontic rule or not.
- The set of *possible worlds*  $\Omega = \omega \times \Delta$ .

The two assumptions we made concerning worlds justify the following two notation conventions.

**Definition 8.** (Two notation conventions).

- Let  $w$  be a world with ontic possibility  $o$ , and  $p$  an atomic sentence, then by  $w(p)$  we mean the truth value assigned by  $o$  to  $p$ .

<sup>5</sup>What these rules are and how we learn them is left implicit. We only model the results of having learned them.

<sup>6</sup>This assumption is not innocent. We disregard the realistic possibility that a world  $v$  is a violation because the actual deontic rules that hold in  $v$  violate some more general deontic rule, set by a higher authority. In not reckoning with this possibility we typically restrict ourselves to the most basic situation where only a single authority is in play.

<sup>7</sup>The contents of  $\omega$  and  $\Delta$  are fully determined by the set of atomic sentences in the language.



- Let  $w$  be a world with deontic possibility  $d$ , then  $bad(w)$  denotes the set of all worlds  $v \in \Omega$  with ontic possibility  $o$  such that  $o$  is a violation according to  $d$ .

By the first convention, the formulation of the clauses for atomic sentences (and the other clauses) can remain as it is.<sup>8</sup> The second convention introduces the auxiliary notion of a deontic predicate *bad*, which facilitates the statement of the semantic clauses for deontic modalities. Jointly these two conventions guarantee that in the semantic clauses for deontic modalities we do not have to explicitly refer to one of the two components of which our worlds consist.<sup>9</sup>

**States with a deontic dimension.** As usual, we take states to be sets of worlds, i.e.,  $\sigma \subseteq \Omega = \omega \times \Delta$ , where the ontic dimension of a state  $\sigma$  is determined by the ontic dimension of the worlds in  $\sigma$ , i.e., the ontic dimension of a state is characterized by a subset of the set of ontic possibilities  $\omega$ . Likewise, the deontic dimension of a state  $\sigma$  is determined by the deontic dimension of the worlds in  $\sigma$ , i.e., the state's deontic dimension is characterized by a subset of the set of deontic possibilities  $\Delta$ .

We also make an assumption concerning information states, viz., that the ontic and deontic dimension of an information state  $\sigma$  are *epistemically independent*. This is enforced by requiring that for every ontic possibility  $o$  that occurs in some world  $w \in \sigma$ , and for every deontic possibility  $d$  that occurs in some world  $v \in \sigma$ , there is a world  $u \in \sigma$  such that  $u = \langle o, d \rangle$ . The conceptual motivation for the epistemic independence of ontic and deontic information is that by obtaining information about the actual state of affairs, we do not obtain information about which possible states of affairs are violations, and vice versa.

**Definition 9.** (Information states with an ontic and deontic dimension).

An *information state*  $\sigma$  is a subset of the set of worlds  $\Omega = \omega \times \Delta$  such that for any two worlds  $w, v \in \sigma$  where  $w = \langle o, d \rangle$  and  $v = \langle o', d' \rangle$ , there exists some world  $u \in \sigma$  such that  $u = \langle o, d' \rangle$ .

We can view a state as a pair of a set of ontic possibilities and a set of deontic possibilities.

**Fact 1.** (Two views of states).

For any information state  $\sigma$  there is some  $\alpha \subseteq \omega$  and some  $\delta \subseteq \Delta$  such that  $\sigma = \alpha \times \delta$ .

We use this fact in depicting a state  $\sigma$  as a two-dimensional matrix where the rows are determined

<sup>8</sup>This implies that no sentence in the language without a deontic modality can provide deontic information.

<sup>9</sup>In principle, this makes the formulation of the semantics neutral with respect to the (non-innocent) assumption that gives rise to constructing worlds as pairs consisting of an ontic and a deontic possibility. Alternatively, we could consider worlds to be primitive entities in our model; let the model contain a valuation function for the atoms relative to worlds that takes care of their ontic dimension; and let the deontic predicate *bad*, which clearly has the flavour of an accessibility relation, be the component in the model that takes care of the deontic dimension of worlds by specifying for each world  $w$  which worlds  $v$  are such that a deontic rule that holds in  $w$  is violated in  $v$ . So, our models then become more like models in standard deontic logic. In principle this may lead to an enrichment of the semantics presented here, but it would also rob us of the simple pictures of states that we can use here to illustrate the semantics.

by the ontic possibilities in  $\sigma$ , and the columns by its deontic possibilities. A cell in the matrix determined by a row headed with an ontic possibility  $o$  and a column headed by a deontic possibility  $d$  then reflect the value of  $d(o)$ , violation/not, which we indicate by coloring the cell red/green.

**Semantics for permission.** A central notion in the semantics, which makes use of the deontic predicate *bad*, characterizes when a *world*  $w$  in a state  $\sigma$  is such that according to the deontic information  $\sigma$  embodies,  $w$  is a world where some deontic rule is violated.

**Definition 10.** (Violation worlds in a state). Let  $\sigma$  be a deontic information state,  $w \in \sigma$ .  $w$  is a *violation world* in  $\sigma$  iff  $\forall v \in \sigma: w \in \text{bad}(v)$ .

Relative to the matrices we will use to depict states, a world  $w \in \sigma$  is a violation world in  $\sigma$  if the whole row in the matrix that is headed by the ontic possibility  $o$  in  $w$  is colored red (and if the whole row for  $o$  is colored green, we may call  $w$  a non-violation world).

Our suppositional semantics for the deontic modality  $\Diamond \varphi$  can be stated informally as follows:

- Our information supports  $\Diamond \varphi$  if, when supposing that  $\varphi$ , no world is a violation world.
- Our information rejects  $\Diamond \varphi$  if, when supposing that  $\varphi$ , every world is a violation world.
- Our information neither supports nor rejects but dismisses  $\Diamond \varphi$  if  $\varphi$  is not supposable.

The Andersonian nature of the semantics can be observed from the fact that the support, rejection, and dismissal conditions specified informally above for  $\Diamond \varphi$ , are the same as the corresponding conditions for the implication  $\varphi \rightarrow \text{safe}$ , where *safe* is a special sentence that is supported in a state  $\sigma$  if no world in  $\sigma$  is a violation world in  $\sigma$ , rejected if every world in  $\sigma$  is a violation world in  $\sigma$ , and neither supported nor rejected, but dismissed, when  $\sigma$  is absurd. Of course, we take it that implication is interpreted here in the suppositional way defined above. The modality  $\Diamond \varphi$  will thus inherit the suppositional features of implication. Likewise it will inherit the non-standard features that support and rejection of implication have in our semantics.

Without introducing such a special sentence *safe*, the semantics for  $\Diamond \varphi$  can be directly stated in a way that immediately reflects the informal characterization given above.

**Definition 11.** (Permission in suppositional [inquisitive] semantics).

$$\begin{aligned} \sigma \models^+ \Diamond \varphi &\text{ iff } \sigma \cap \text{info}(\varphi) \models^+ \varphi \text{ and } \forall w \in \sigma \cap \text{info}(\varphi): \forall v \in \sigma: w \notin \text{bad}(v) \\ \sigma \models^- \Diamond \varphi &\text{ iff } \sigma \cap \text{info}(\varphi) \models^+ \varphi \text{ and } \forall w \in \sigma \cap \text{info}(\varphi): \forall v \in \sigma: w \in \text{bad}(v) \\ \sigma \models^o \Diamond \varphi &\text{ iff } \sigma \cap \text{info}(\varphi) \not\models^+ \varphi \end{aligned}$$

The meaning of  $\Diamond p$  is depicted by Figs. 13-15. For brevity we assume that  $p$  is the only atomic sentence in the language. Then there are only two ontic possibilities which determine the two rows in the matrices, and there are four deontic possibilities which determine the four columns and color the ontic possibilities in the rows either red (violation) or green (no violation). So, when you ignore the demarcated areas in the matrices, what is depicted is the deontically ignorant state.

$\sigma_1$	$d_1$	$d_2$	$d_3$	$d_4$
$o_1$	1	1	1	1
$o_2$	0	0	0	0

Figure 13: Supporting  $\Diamond p$ 

$\sigma_2$	$d_1$	$d_2$	$d_3$	$d_4$
$o_1$	1	1	1	1
$o_2$	0	0	0	0

Figure 14: Rejecting  $\Diamond p$ 

$\sigma_3$	$d_1$	$d_2$	$d_3$	$d_4$
$o_1$	1	1	1	1
$o_2$	0	0	0	0

Figure 15: Dismissing  $\Diamond p$ 

The worlds as such are not depicted in the matrices. There are eight of them corresponding to all pairs  $\langle o_i, d_j \rangle$  that can be reconstructed from the picture. Note that by the definition of a state, a subset of those eight pairs only counts as a state when in its picture either a whole row or a whole column from the picture of the ignorant state is missing. All demarcated areas in the three matrices satisfy this condition.

If we consider  $\text{info}(p)$ , then we obtain the four worlds that remain when we ignore the second row. Now first consider when  $p$  is not supposable in  $\sigma$ . This is only the case if none of those four worlds in  $\text{info}(p)$  is in  $\sigma$ , i.e., when only the second row remains. This is depicted in Fig. 15, where the demarcated area in the matrix corresponds to the maximal state that suppositionally dismisses  $\Diamond p$ . Next consider support of  $\Diamond p$ . The maximal substate of the ignorant state that supports  $\Diamond p$  corresponds to the largest demarcated area in Fig. 13.<sup>10</sup> I.e., only the four worlds remain with deontic possibility  $d_1$  or  $d_2$ , which have in common that they color the ontic possibility  $o_1$  where  $p$  is true green, as opposed to  $d_3$  and  $d_4$  which color it red. If in the state with these four worlds with deontic possibility  $d_1$  or  $d_2$  we suppose that  $p$ , this leaves us only with the two worlds  $\langle o_1, d_1 \rangle$  and  $\langle o_1, d_2 \rangle$ . In the state consisting of those two worlds no world is a violation world. This means that by the joint force of the support clause for  $\Diamond p$  and the definition of the deontic predicate *bad*, the state that corresponds to the largest demarcated area in Fig. 13 supports  $\Diamond p$ , and it is the maximal state that does. Any substate of it (delete a column or a row within the demarcated square) still supports  $\Diamond p$ , except when we delete the first row, which would leave us with the demarcated sub-area, where we end up in a state that suppositionally dismisses  $\Diamond p$ . The rejection of  $\Diamond p$ , i.e., the support of  $\neg \Diamond p$ , shown by Fig. 14, is explained analogously. Note that in the maximal states that support  $\Diamond p$  and reject  $\Diamond p$ , that correspond to  $\text{info}(\Diamond p)$  and  $\text{info}(\neg \Diamond p)$ , not all deontic possibilities occur, but all ontic possibilities do occur. This means that  $\Diamond p$  and  $\neg \Diamond p$  only provide deontic information, and do not provide ontic information.

**Semantics for obligation.** When we define  $\Box \varphi$  as the dual of  $\Diamond \varphi$ , we obtain the following fact.

**Fact 2.** (Obligation in suppositional [inquisitive] semantics).

$\sigma \models^+ \Box \varphi$  iff  $\sigma \cap \text{info}(\neg \varphi) \models^+ \neg \varphi$  and  $\forall w \in \sigma \cap \text{info}(\neg \varphi): \forall v \in \sigma: w \in \text{bad}(v)$

$\sigma \models^- \Box \varphi$  iff  $\sigma \cap \text{info}(\neg \varphi) \models^+ \neg \varphi$  and  $\forall w \in \sigma \cap \text{info}(\neg \varphi): \forall v \in \sigma: w \notin \text{bad}(v)$

$\sigma \models^\circ \Box \varphi$  iff  $\sigma \cap \text{info}(\neg \varphi) \not\models^+ \neg \varphi$

<sup>10</sup>For reasons made explicit in von Wright (1968), we don't want a deontically ignorant state to support  $\Diamond p$ , and thus define permission as is standard in the Andersonian tradition, i.e., as strong permission.

$\sigma_4$	$d_1$	$d_3$	$d_2$	$d_4$
$o_1$	1	1	1	1
$o_2$	0	0	0	0

Figure 16: Supporting  $\boxed{v}p$ 

$\sigma_5$	$d_1$	$d_3$	$d_2$	$d_4$
$o_1$	1	1	1	1
$o_2$	0	0	0	0

Figure 17: Rejecting  $\boxed{v}p$ 

$\sigma_6$	$d_1$	$d_3$	$d_2$	$d_4$
$o_1$	1	1	1	1
$o_2$	0	0	0	0

Figure 18: Dismissing  $\boxed{v}p$ 

Informally, this amounts to the following characterization of obligation:

- Our information supports  $\boxed{v}\varphi$  if, when supposing that  $\neg\varphi$ , every world is a violation world.
- Our information rejects  $\boxed{v}\varphi$  if, when supposing that  $\neg\varphi$ , no world is a violation world.
- Our information neither supports nor rejects, but dismisses  $\boxed{v}\varphi$  if  $\neg\varphi$  is not supposable.

The picture of the meaning of  $\boxed{v}p$  is given by Figs. 16-18. Note that in order to obtain nice pictures we changed the order of the deontic possibilities in the columns as compared to Figs. 13-15. This means that, unlike what is suggested at a first glance, support of  $\Diamond p$  and  $\boxed{v}p$  do not exclude each other: Fig. 13 and Fig. 16 share the column headed by  $d_2$ .

Before we turn to the illustrations below, consider a simple case of epistemic and deontic modal interaction called *Kant's law* in McNamara (2014). He argues that  $\boxed{v}p$  ought not to imply  $\Diamond p$ . We obtain this straightforwardly. Recall that for a state to support  $\Diamond p$ ,  $p$  must be supposable. But  $\boxed{v}p$  requires that  $\neg p$  is supposable. The disjoint supposability conditions allow us to construct a counter-example to Kant's law: consider a state  $\sigma$  where  $\neg p$  holds and every world in  $\sigma$  is a violation world, this state supports  $\boxed{v}p$  but not  $\Diamond p$  (nor  $\Diamond p$ , covering the deontic version as well).

## 6. Illustrations

We illustrate the semantics by considering a situation inspired by a puzzle for deontic modals in Jackson (1985). Imagine that you receive a request to write a review and so face the issue whether you ought to accept the request to write a review or not, i.e., whether  $\boxed{v}p$  holds. We entertain the intuition that there is a strong tendency to answer affirmatively, unless there is a good reason against it, such as when you know already that you will not write the review. We can thus motivate the deontic rule in (2a) that specifically holds in academia.<sup>11</sup> We take it that the situation is also governed by the instantiation in (2b) of the general rule that accepting to do something obligates you to do it. The relevant issue then becomes whether (2c) or (2d) holds. Note that (2a) is particularly suitable for studying the interaction between implication and both types of modals.

- (2)    a.    If it is possible that you write the review, you ought to accept the request.     $\Diamond q \rightarrow \boxed{v}p$   
       b.    If you accept the request to write a review, you ought to write it.             $p \rightarrow \boxed{v}q$

<sup>11</sup>Ciardielli et al. (2014) argue that in English *might*-sentences in the antecedent of an implication are difficult to interpret, and a paraphrase of (2a) with *might* can indeed sound odd. But an analogous sentence like: “If Maria might apply for the job, I ought not to do so,” seems perfectly fine. The issue is also discussed in Yanovich (2013), and he provides an example with the same flavour: “If Bill might be in Boston, we should send a team there.”

- c. It is possible that you write the review.  $\Diamond q$   
 d. It is *not* possible that you write the review.  $\neg\Diamond q$

The case is semantically unproblematic when (2c) holds where, intuitively, you *ought to accept the request and write the review*. The more puzzling case, at least for certain analyses of implication and deontic modals, arises when (2d) holds, which also means that  $\neg q$  holds according to your information. A case in point is Jackson's Dr. Procrastinate who never finishes assignments. In her case it intuitively holds that she *ought not to accept*. This becomes particularly transparent when we observe that, intuitively, rule (2b), where  $p$  makes  $q$  obligatory, implies that if you do not bring about  $q$ , then you ought not to bring about  $p$  either, as that would necessarily lead to a violation of the obligation.<sup>12</sup> In other words,  $p \rightarrow \Box q$  intuitively implies that  $\neg q \rightarrow \Box \neg p$ . By similar reasoning, the converse holds also, suggesting that  $p \rightarrow \Box q$  and  $\neg q \rightarrow \Box \neg p$  are equivalent. We will refer to entailments of this form as instances of *modal contraposition*. When a semantics gives rise to modal contraposition for (2a), then if (2d) holds, it follows that, as desired,  $\Box \neg p$  holds. Contraposition of (2a) is not a common feature of standard deontic modal logics. For example, it does not hold for the standard deontic logics in von Wright (1951). However, it does hold for certain plausible deontic modal logics which are in this tradition.<sup>13</sup>

In the widely accepted Kratzer semantics for modals and implication,<sup>14</sup> there is a puzzle because the antecedent of an implication is taken to restrict the modal base (a set of worlds) for the overt modal in its consequent.<sup>15</sup> Then, when  $\neg\Diamond q$  holds, restricting to the antecedent  $\Diamond q$  of (2a) results in the modal base for the consequent  $\Box p$  being the empty set. But then, from (2d) and (2a), it follows that  $\Box p$  vacuously holds. So, due to the nature of the semantics, when  $\Diamond q \rightarrow \Box p$  holds, it has the same effect as  $\Box p$  itself. This counter-intuitively predicts that regardless of whether  $\Diamond q$  or  $\neg\Diamond q$  holds,  $\Box p$  holds and, thus,  $\Box \neg p$  cannot. To escape from this semantic predicament one can appeal to pragmatic reasoning regarding vacuous truth, but we aim to explore a *semantic solution*.

**The deontic situations according to our system.** With respect to the two atomic sentences  $p$  and  $q$ , there are four ontic possibilities we have to reckon with, viz., 11, 10, 01 and 00. To reduce the number of deontic possibilities in consideration from 16 to 8, we ignore the intuitively strange ontic possibility 01, where you do not accept the request, but write a review anyway. This restriction plays no other role in the story than brevity. Concerning ontic information, there are two distinct

<sup>12</sup>Although it fits the concrete example we are discussing, it is not essential that  $p$  and  $q$  are situations you can 'bring about'. From: "If your mother is seriously ill, you ought not to go on a holiday", it also follows that: "If you go on a holiday, it ought not to be the case that your mother is seriously ill". Regarding this example, the only thing you can 'bring about' is collecting more information on the state of health of your mother.

<sup>13</sup>More precisely, as Frank Veltman has pointed out to us, modal contraposition of (2b) holds if implication is strict and the accessibility relation is transitive and weakly symmetric, i.e., if  $xRy$  and  $yRz$ , then  $zRy$ . Weak symmetry corresponds to the intuitive idea that all 'ideal worlds' are equally ideal.

<sup>14</sup>See Kratzer (1977, 1979, 2012) among others.

<sup>15</sup>There's an alternative approach put forward in Frank and Kamp (1997) and Kaufmann and Schwager (2011) which always assumes a covert necessity operator over the consequent. See Kratzer (2012) for arguments why such a solution is problematic for similar examples.



$\sigma_7$	$d_1$	$d_2$	$d_3$	$d_4$	$d_5$	$d_6$	$d_7$	$d_8$
$o_1$	11	11	11	11	11	11	11	11
$o_2$	10	10	10	10	10	10	10	10
$o_3$	00	00	00	00	00	00	00	00

$\sigma_7$ : Ignorant state for 11, 10, 00

$\sigma_8$	$d_{1,3}$	$d_{2,4}$	$d_{5,7}$	$d_{6,8}$
$o_2$	10	10	10	10
$o_3$	00	00	00	00

$\sigma_8$ : Ignorant state for 10, 00

relevant cases of information states  $\sigma$  to be distinguished: the case where the ontic possibilities in  $\sigma$  are  $\{11, 10, 00\}$  and the case where the ontic possibilities in  $\sigma$  are  $\{10, 00\}$ . In both of these two cases one can choose to neither accept nor write. The first can be considered the standard case, as one can accept the request and write, but also accept the request and neglect to write. The second case applies to people like Dr. Procrastinate who never finish writing tasks, so when she accepts, she will not write. The deontically ignorant states that pertain to the two relevant situations are depicted by the matrices for  $\sigma_7$  and  $\sigma_8$ .

We will show that in our semantics, if we assume the two deontic rules (2a) and (2b) to apply, we get a straightforward semantic account for our intuitions concerning the two ontic situations we distinguished above. We will see that in our suppositional semantics, the two rules (2a) and (2b) suffice to account for the intuition that when the ontic possibilities in a state  $\sigma$  are  $\{11, 10, 00\}$ , then under the rules it holds that  $\Box p$  and  $\Box q$ , whereas when the ontic possibilities in  $\sigma$  are  $\{10, 00\}$ , then according to the rules, it holds that  $\Box \neg p$ . In order to check this, we first need to see which rules govern the situation, i.e., whether either of the rules is dismissed.

**The standard case.** First, consider the situation where the ontic possibilities in  $\sigma$  are  $\{11, 10, 00\}$ . In this case, neither of the two deontic rules (2a) and (2b) is dismissed. To start with the latter, according to the dismissal clause for implication,  $p \rightarrow \Box q$  is not dismissed in  $\sigma$  iff (i)  $p$  is supposable in  $\sigma$  and (ii) when we suppose  $p$  in  $\sigma$ , then  $\Box q$  is not dismissed. According to the dismissal clause for deontic necessity, the latter is the case iff  $\neg q$  is supposable. So,  $p \rightarrow \Box q$  is not dismissed in  $\sigma$  iff we can suppose that both  $p$  and  $\neg q$  in  $\sigma$ . This holds in the standard case, due to the presence of the ontic possibility 10, and still holds in the Dr. Procrastinate case with ontic possibilities  $\{10, 00\}$ . For  $\sigma$  to support  $p \rightarrow \Box q$ , it should hold that if we do suppose that both  $p$  and  $\neg q$ , which leaves us only with the single ontic possibility 10 in  $\sigma$ , this ontic possibility should be colored red by all deontic possibilities in  $\sigma$ . So, in order to arrive at the maximal state with the ontic possibilities  $\{11, 10, 00\}$  where  $p \rightarrow \Box q$  is supported, we have to eliminate the four deontic possibilities such that they do not color 10 red from the picture of the deontically ignorant state  $\sigma_7$ , and then we arrive at the picture of the deontic state  $\sigma_9$ . Note that  $\sigma_9$  neither supports  $\Box p$  nor  $\Box q$ .

It follows from similar considerations that  $\neg q \rightarrow \Box \neg p$  is supported in  $\sigma$  iff both  $\neg q$  and  $\neg \neg p$ , i.e.,  $p$ , are supposable in  $\sigma$  and that if we do suppose both  $\neg q$  and  $p$  in  $\sigma$ , leaving us with only the single ontic possibility 10 in  $\sigma$ , it should be colored red in all deontic possibilities in  $\sigma$ . In other words,  $p \rightarrow \Box q$  and  $\neg q \rightarrow \Box \neg p$  have the same dismissal and support conditions, and in fact the same holds for their rejection conditions. So, we obtain the following fact.

$\sigma_9$	$d_1$	$d_2$	$d_3$	$d_4$
$o_1$	11	11	11	11
$o_2$	10	10	10	10
$o_3$	00	00	00	00

$$\sigma_9 \models^+ p \rightarrow \boxed{v}q$$

$\sigma_{10}$	$d_2$	$d_4$	$d_6$	$d_8$
$o_1$	11	11	11	11
$o_2$	10	10	10	10
$o_3$	00	00	00	00

$$\sigma_{10} \models^+ \Diamond q \rightarrow \boxed{v}p$$

$\sigma_{11}$	$d_2$	$d_4$
$o_1$	11	11
$o_2$	10	10
$o_3$	00	00

$$\sigma_{11} \models^+ p \rightarrow \boxed{v}q, \Diamond q \rightarrow \boxed{v}p$$

**Fact 3.** (Modal contraposition).  $p \rightarrow \boxed{v}q$  and  $\neg q \rightarrow \boxed{v}\neg p$  are equivalent.

This fact becomes particularly enlightening when we consider the Dr. Procrastinate case where the ontic possibilities are  $\{10, 00\}$ , whence the antecedent of  $\neg q \rightarrow \boxed{v}\neg p$  is supported. But for now we continue with the standard case where the ontic possibilities are such that this is not the case.

Next we consider the academia-specific rule (2a). According to the dismissal clause for implication,  $\Diamond q \rightarrow \boxed{v}p$  is not dismissed in  $\sigma$  when it allows for the ontic possibilities  $\{11, 10, 00\}$ :  $\Diamond q$  is supposable, since  $q$  is, and supposing  $\Diamond q$  in  $\sigma$ , which leaves us in  $\sigma$  as such, does not dismiss  $\boxed{v}p$ , since  $\neg p$  is supposable in  $\sigma$ . Then, for  $\sigma$  to support  $\Diamond q \rightarrow \boxed{v}p$  it has to hold that  $\sigma$  as such supports  $\boxed{v}p$ . I.e., when we suppose that  $\neg p$  in  $\sigma$ , which leaves us only with the ontic possibility 00 in  $\sigma$ , it should be colored red by every deontic possibility in  $\sigma$ . So, in order to arrive at the maximal state with the ontic possibilities  $\{11, 10, 00\}$  where  $\Diamond q \rightarrow \boxed{v}p$  is supported, we have to eliminate the four deontic possibilities that do not color 00 red from the picture of the deontically ignorant state  $\sigma_7$ , and we then arrive at the picture of the deontic state  $\sigma_{10}$ . This state supports  $\boxed{v}p$ , but not  $\boxed{v}q$ .

However, we do arrive at the desired result that  $\sigma$  supports both  $\boxed{v}p$ , and  $\boxed{v}q$ , if we do not consider the two rules separately, but jointly. If we do so, we arrive at the picture of the state  $\sigma_{11}$ , where only two deontic possibilities remain, which is the maximal state that supports both deontic rules (2a) and (2b) at the same time. If we now inspect the picture of state  $\sigma_{11}$ , it can easily be seen that not only  $\boxed{v}p$ , but also  $\boxed{v}q$  is supported in it. If we suppose that  $\neg p$ , which leaves us only with the ontic possibility 00 in  $\sigma$ , we see that it is colored red by both deontic possibilities in  $\sigma$ ; and if we suppose that  $\neg q$ , which leaves us only with the ontic possibility 10, we see that it is also colored red by both deontic possibilities in  $\sigma$ . As desired, if we assume both deontic rules (2a) and (2b), and the ontic possibilities in state  $\sigma$  are  $\{11, 10, 00\}$ , then you ought to accept the request and write.

The state  $\sigma_{11}$  has the interesting feature that it still reckons with the deontic possibility that accepting and writing is a violation, next to the possibility that it isn't. This is as it should be. It reflects that there could be additional deontically relevant features in the situation that we have not reckoned with that would also turn worlds  $w$  such that  $w(p) = w(q) = 1$  into violation worlds, leading to a situation of *deontic conflict*. E.g., writing the review may interfere with other academic duties.

**The Dr. Procrastinate case.** Consider the case where the ontic possibilities in  $\sigma$  are  $\{10, 00\}$ . Here it is the case that the deontic rule in (2a),  $\Diamond q \rightarrow \boxed{v}p$ , is suppositionally dismissed, because the

antecedent is not supposable in  $\sigma$ :  $\text{info}(\Diamond q) = \omega$ , whence  $\sigma \cap \text{info}(\Diamond q) = \sigma$ , and  $\sigma$  does not support  $\Diamond q$ , but rejects and suppositionally dismisses it. But, as was already observed above, the deontic rule (2b) is not suppositionally dismissed in  $\sigma$  when the ontic possibilities in  $\sigma$  are  $\{10, 00\}$ , since it contains the ontic possibility 10. Then, as we saw above, for  $\sigma$  to support  $p \rightarrow \Box q$  it has to hold that all deontic possibilities in  $\sigma$  color the ontic possibility 10 red. So, to arrive at the maximal state with ontic possibilities  $\{10, 00\}$  that supports  $p \rightarrow \Box q$ , we have to eliminate the deontic possibilities where 10 is not red from the ignorant state  $\sigma_8$ . Thus arriving at the picture of state  $\sigma_{12}$ .

$\sigma_{12}$	$d_{1,3}$	$d_{2,4}$
$o_2$	10	10
$o_3$	00	00

$$\sigma_{12} \models^+ p \rightarrow \Box q \text{ and } \sigma_{12} \models^\circ \Diamond q \rightarrow \Box p$$

Since, as we also saw above,  $p \rightarrow \Box q$  and  $\neg q \rightarrow \Box \neg p$  are equivalent,  $\sigma_{12}$  is also the maximal state with ontic possibilities  $\{10, 00\}$  that supports  $\neg q \rightarrow \Box \neg p$ . As is then to be expected, since  $\sigma$  supports  $\neg q$ , the state depicted here supports the desideratum  $\Box \neg p$ . When in this state it is supposed that  $p$ , leaving us only with the ontic possibility 10, then this ontic possibility is colored red by every deontic possibility in the state. Thus, you ought not to accept the request if your information excludes the ontic possibility 11, where you also write if you accept. What plays a decisive role here, is that in the Dr. Procrastinate case only the general deontic rule (2b) plays a role, because the specific rule (2a) is suppositionally dismissed, and modal contraposition holds.

This may seem a happy end, but the problem with Dr. Procrastinate is, of course, that she doesn't realize herself that of the two cases discussed above, the Dr. Procrastinate case applies to her.

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# The semantics of additive *either*<sup>1</sup>

Dorothy Ahn — *Harvard University*

**Abstract.** Focus particles *too* and additive *either* have been analyzed as fully presuppositional elements that presuppose an existence or reference of some salient antecedent. In this paper, I propose an alternative account of *too* and *either*, where they are two-place predicates taking as arguments the overt proposition they adjoin to and a silent propositional anaphor. While *too* asserts a conjunction of the two arguments, *either* asserts a disjunction of the two arguments. The main advantages of this proposal are that *too* and *either*'s non-presuppositional behavior is accounted for, and that the conjunction-disjunction switch has implications on additive *either*'s NPI behavior.

**Keywords:** focus, presuppositions, Negative Polarity Items

## 1. Introduction

The focus particles *too* and additive *either* appear clause-finally and add to the host proposition a meaning similar to the adverb *also*. For example, (1) can be paraphrased as *John also came to the party* while (2) can be paraphrased as *John also didn't come to the party*.

- (1) John<sub>F</sub> came to the party too.
- (2) John<sub>F</sub> didn't come to the party either.

Additive *either* is similar to *too* in requiring some antecedent information to be salient in the context, meaning that (1) requires a salient information entailing that someone other than John came to the party, while (2) requires one that entails that someone else did not come. On the other hand, *either* differs from *too* in that its distribution is restricted. It is not licensed, for example, in a positive environment like (3):

- (3) \*We're going to Philly either.

In order to explain this relation between *too* and *either*, this paper proposes that *too* and *either* assert a conjunction and a disjunction, respectively. This deviates from the general assumption that additive particles such as *too* and *also* only add a presuppositional component to the meaning of the host proposition (see Heim 1992, Rullmann 2004, Cohen 2009, a.o.). I argue that this paper's proposal is a harmless modification to the existing presuppositional analyses, and that analyzing *either* as its disjunctive counterpart provides a natural way to account for its NPI behavior.

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## 2. Previous accounts of *too* and *either*

Rullmann (2003) treats additive *either*<sup>2</sup> as an NPI counterpart of *too*. He begins by pointing out a problem with purely morphological accounts of *too* and *either* (Klima 1984, a.o.), in which *either* is simply an allomorph of *too* that appears in negative clauses. Under the assumption of the morphological account that *too* and *either* are identical in meaning, the unacceptability of using *either* in (5) is not explained.

- (5) John washed the dishes. He shouldn't do the laundry too/\**either*.

Rullmann argues that *too* and *either* are not identical in meaning – more specifically that *either* has a different presupposition from that of *too*. Unlike *too* which presupposes that some antecedent is true in addition to the host proposition it adjoins to, *either* presupposes that the antecedent is false. This negative presupposition is not satisfied by the antecedent clause in (5), thus ruling out *either*. Rullmann's definition of *too* is given below:

- (6) Semantics of *too*:
- a. ordinary semantic value:  $\llbracket p \text{ too} \rrbracket^o = \llbracket p \rrbracket^o$
  - b. focus value:  $\llbracket p \text{ too} \rrbracket^f = \{ \llbracket p \rrbracket^o \}$
  - c. presupposition:  $\llbracket p \text{ too} \rrbracket$  presupposes that there is at least one contextually salient proposition  $q \in \llbracket p \rrbracket^f - \{ \llbracket p \rrbracket^o \}$  such that  $q$  is true.

With this definition, *too* adjoining to a proposition  $p$  (*John left*) would assert that  $p$  is true, and presuppose that there is at least one contextually salient proposition  $q$  such that  $q$  is true. This  $q$  must be a focus alternative of  $p$ .

As shown in (7), Rullmann analyzes *either* to be identical to *too* except for its negative presupposition: it presupposes that the contextually salient proposition  $q$  is false. This negative presupposition explains why *either* cannot appear in (5): the antecedent clause is not compatible with the negative presupposition.

<sup>2</sup>There are at least three different uses of *either* in modern English (Rullmann 2003, 2004), as shown below (using Rullmann's labels):

- (4)
- a. **Disjunctive:** We're **either** going to Cambridge or to Philadelphia.
  - b. **Determiner:** We're not going to **either** city.
  - c. **Additive:** We're not going to Cambridge. We're not going to Philadelphia, **either**.

This paper focuses on proposing an analysis for the additive *either*, and I will interchangeably use the terms 'either' and 'additive *either*' to refer to this type.

(7) Semantics of *either*:

- a. ordinary semantic value:  $\llbracket p \text{ either} \rrbracket^o = \llbracket p \rrbracket^o$
- b. focus value:  $\llbracket p \text{ either} \rrbracket^f = \{\llbracket p \rrbracket^o\}$
- c. presupposition:  $[p \text{ either}]$  presupposes that there is at least one contextually salient proposition  $q \in \llbracket p \rrbracket^f - \{\llbracket p \rrbracket^o\}$  such that  $q$  is false.

Additive *either* is analyzed as a ‘well-behaved NPI’ that scopes under negation, and Rullmann accounts for its NPI distribution by adding a licensing condition to its definition:

(8) Licensing Condition for *either*:

$[p \text{ either}]$  must be contained in a constituent which implies (i.e. entails or implicates) that  $\llbracket p \rrbracket^0$  is false.

This licensing condition can explain the contrast between (9) and (10) because a positive environment in (10) does not entail that  $p$  is false, violating the licensing condition.

## (9) John didn’t leave either.

- a.  $p = \text{John left}$
- b. ALTs: {Mary left, Bill left, Sue left}
- c. Licensing condition: entails that  $p$  is false

## (10) \*John left either.

- a.  $p = \text{John left}$
- b. ALTs: {Mary left, Bill left, Sue left}
- c. Licensing condition: does not imply that  $p$  is false

## 2.1. Advantages and problems

Two main advantages of Rullmann’s account of *either* are that a) it captures the similarity between *too* and *either* by providing a parallel account of both elements, and that b) it analyzes *either* as an NPI that takes scope below the negation.

There are two main differences between *too* and *either*. The first difference is that *too* requires a positive antecedent while *either* requires a negative antecedent. This is accounted for by *either*’s negative presupposition. The second difference is that *either* is an NPI while *too* is not. To account for this difference, Rullmann stipulates a licensing condition that restricts *either*’s distribution. While this condition roughly captures *either*’s restricted distribution, it also runs into conceptual and empirical problems.

Rullmann notes that the licensing condition as defined makes incorrect predictions about *either*'s distribution. For instance, elements like *almost* is predicted to license *either*.

- (11) The paper is almost finished.  
 a. \*The paper is almost finished either.

The sentence in (11) implies that the paper is not finished. Assuming that *either* adjoins to *p* which is *The paper is finished*, the adverb *almost* is wrongly predicted to license *either* because the overall implication of (11) is that *p* is false. While other problems exist and are discussed in his paper, Rullmann leaves the details of the licensing condition to be modified in future work.

However, a problem more critical than the wrong predictions is the use of a stipulated licensing condition to account for *either*'s distribution. Even a modified version of the licensing condition would miss an important generalization that *too* is not an NPI while *either* is. Nothing in this account prevents this licensing condition from being added to *too*, so the licensing condition does no more than simply describing *either*'s behavior.

In Rullmann's proposal, two components are crucial in licensing additive *either*: the presupposition satisfaction and the licensing condition. While the presence of an additive presupposition explains why *too* and *either* both require antecedent information, *either*'s negative presupposition ensures that the antecedent is negative, unlike *too*. *Either*'s NPI distribution, however, cannot be derived from this difference, and a stipulated licensing condition is added to the definition. Thus, what we are in need of is a theory that maintains Rullmann's intuitions about the parallelism between *too* and *either* but derives *either*'s NPI distribution in a way that minimizes stipulations. In the next section, I propose a new account of *too* from which I derive the account of *either*.

### 3. Semantics of *too*

There is a vast literature on the focus particle *too*. In this section, I review three main properties of *too* that an adequate analysis of *too* must account for, and propose an analysis that can derive those properties. Then I compare the proposed account with some previous accounts, showing that it has an advantage over existing presuppositional accounts of *too* (Rullmann 2003, Heim 1992) in that it can account for cases where *too*'s meaning contribution does not seem presupposed.

#### 3.1. *Too*'s requirement of an antecedent

An important property of *too* is its requirement of an antecedent information. It has long been observed that a simple existential presupposition is not adequate to license *too*. For example, in Kripke's (2009) example in (12), an existential presupposition would be that there exists an

antecedent that is also true.

- (12) John<sub>F</sub> is having dinner in New York tonight too.

Kripke shows that, even if it is part of the common knowledge that many people dine in New York every night, this would not make the use of *too* felicitous. Making this observation, many accounts have incorporated anaphoricity in analyzing *too*, deriving the obligatory reference to a salient antecedent (Heim 1992, Kamp & Rossdeutscher 1994). I call this the antecedent requirement property of *too*:

- (13) **Antecedent Requirement** The host proposition of *too* requires a parallel antecedent information that is salient (discourse or contextual).

This salient antecedent information is further constrained by two additional properties of *too*: focus sensitivity and distinctness.

The meaning of *too* is sensitive to focus, which determines the form of the potential antecedent. For example, when (12) is uttered out of the blue, what we seem to be missing is an antecedent entailing that someone else is dining in New York. However, when the stress is on *New York* as in (14), the antecedent we seem to be missing is something that entails that John is having dinner in some other location (Cohen 2009).

- (14) John is having dinner in New York<sub>F</sub> tonight too.

Another restriction is that the antecedent be distinct from the host. This property has been called the non-identity presupposition (Kripke 2009) or the distinctness requirement (Cohen 2009). Kripke (2009) uses an example like (15) to show that *too* presupposes *John* and the *the boss* to refer to distinct individuals.

- (15) If John<sub>i</sub> is coming to the party, the boss<sub>\*i</sub> will come too.

In summary, the three main properties of *too*'s antecedent are that it must be necessary and salient, that it must be a focus alternative of the host, and that it must be distinct from the host. I summarize these properties below:

(16) Main properties of the antecedent of *too*:

1. **Antecedent Requirement** Antecedent must be salient
2. **Focus Sensitivity** Antecedent must entail a proposition in the focus value of the host
3. **Distinctness** Antecedent must be distinct from the host

In the next section, I review Rullmann (2003) and Heim's (1992) accounts of *too* with respect to their implementations of these properties.

### 3.2. Previous accounts of *too*

Under Rullmann's account, *too* presupposes that there exists a contextually salient distinct focus alternative that is true. This presupposition meets the Focus Sensitivity requirement as well as the Distinctness requirement. As for the Antecedent Requirement property, however, what Rullmann posits is a simple existential presupposition. It was already shown that a simple existential presupposition is not adequate in licensing *too*. While Rullmann acknowledges this, he simply uses the notion of a 'contextually salient' antecedent to refer to this property and refers the reader to accounts that do discuss this property further, one of which is Heim (1992).

Heim (1992) argues that *too* is implicitly deictic or anaphoric, with its meaning similar to 'in addition to x'. For example, in (17), *too* has a meaning similar to 'in addition to Mary', and is coindexed with *Mary* in the antecedent sentence.

(17) John believes that  $Mary_1$  is here, and he believes that  $Sue_F$  is here  $too_1$ .

The meaning contribution of *too* under Heim's account can be represented as in (18)

(18)  $\phi[\alpha_F]$   $too_i$  presupposes  $x_i \neq \alpha$  &  $\phi[x_i]$

This is one way to implement the first property of *too*. Note that because Heim assumes *too* itself to be an anaphor, the antecedent that is required is some e type individual. Thus, under her analysis, the implementation of the latter two properties must be modified accordingly: the antecedent would have to be a distinct alternative of the focused element in the host proposition.

While Heim incorporates anaphoricity to the definition of *too*, it still remains a presuppositional account because all *too* does is presuppose that the proposition holds for the salient antecedent as well. In the next section, I propose an alternative account, in which the meaning contribution of

*too* is not restricted to the presupposed component.

### 3.3. Proposal

I propose that *too* is a two-place predicate that takes two arguments. One of the arguments is the host proposition  $p$  that it adjoins to. The other argument is a silent propositional anaphor  $q$ . It presupposes that the propositional anaphor must be a distinct focus alternative of the host proposition, making use of the Rooth (1992) type focus theory. The resulting assertion is a conjunction of the two arguments. The definition is given in (19).

$$(19) \quad \llbracket \text{too} \rrbracket(q)(\llbracket p \rrbracket \sim_C) = \lambda w: q \in C - \{\llbracket p \rrbracket^o\}. q_w \wedge \llbracket p \rrbracket^w$$

For example, in (20), *too* adjoins to the host proposition  $p$  which is *John left*. It takes a silent propositional anaphor  $q$ , which is presupposed to be of the form  $X$  left, and asserts a conjunction between them. The resulting assertion can be paraphrased as ‘In addition to  $q$  being true, John left.’

- (20) John<sub>F</sub> left too.
- a.  $\llbracket p \rrbracket = \text{John}_F \text{ left}$
  - b.  $\llbracket \text{too} \rrbracket(q)(\llbracket p \rrbracket)$ 
    - (i) Presupposes that  $q$  is a distinct focus alternative of  $\llbracket p \rrbracket$ :  $X$  left.
    - (ii) Asserts  $q \wedge \llbracket p \rrbracket$

An assertion of  $q$ , an anaphor that takes a propositional antecedent, can receive a similar analysis as overt propositional pronominals such as *that* in (21). It is also possible to have an antecedent that is embedded under negation. Krifka (2013) shows that while the pronoun *it* in (22a) refers to the whole proposition (22), the same pronoun in (22b) refers to the proposition embedded under negation.

- (21) [John stole the cookie]<sub>1</sub>. Bill knows [that]<sub>1</sub>.

- (22) [NegP John didn't [TP t<sub>John</sub> t<sub>did</sub> lie]<sub>1</sub> ]<sub>2</sub>
- a. ...and he actually can prove [it]<sub>2</sub>.
  - b. ...even though people believed [it]<sub>1</sub>.

The account of *too* proposed in this paper makes desirable predictions of its interaction with negation. When the host proposition contains a negation, the negation can either take wide scope or

narrow scope with respect to *too*. When the negation scopes under *too*, the reference of the propositional anaphor is also predicted to contain a negation. For example, (23) is felicitous because  $q$ , being a focus alternative of  $p$ , must also contain a negation.

- (23) John didn't visit Boston. Bill<sub>F</sub> didn't visit Boston too.
- a.  $p$  = Bill didn't visit Boston.
  - b. Presupposes that  $q$  is of the form  $X$  *didn't visit Boston*.
  - c. Discourse antecedent satisfies the presupposition and resolves the reference of  $q$ .

*Too* can also take scope over negation, as discussed in Kripke (2009) and Soames (2009).

- (24) Sue bought some books. (But) Mary didn't buy them too.

Because the host proposition  $p$  does not contain a negation, the computation is as follows:

- (25) Mary didn't buy them too.
- a.  $= \neg[\![\text{too}]\!](\text{Mary bought the books})$
  - b. Presupposes that  $q$  is of the form  $X$  bought the books.
  - c. Asserts  $\neg[q \wedge p] = \neg q \vee \neg p$

The resulting assertion is a disjunction between  $\neg q$  and  $\neg p$ . The truth value of  $q$ 's reference is already provided via discourse: Sue bought some books, thus  $q$  is true. If we thus rule out the first disjunct, we are left with  $\neg p$ , which is the desired meaning.

The main novelty of the account proposed here is that the additive implication of *too* comes about via an assertion of a conjunction with a silent anaphor, rather than being presupposed. This conjunction account has some advantage over previous accounts in which *too* is fully presuppositional. Abrusán (2014) argues that the additive implication contributed by *too* is also part of the entailment, discussing examples like (26).

- (26) a. #Mary went to the shop, but it is not the case that somebody went there.  
b. Mary went to the shop, but it is not the case that somebody went there as well.

If the additive implication in (26b) was simply presupposed, the entailed meaning of (26b) should be contradictory just like (26a). Because it is not, she argues that the additive meaning of *too* must also be part of the entailed meaning. The conjunctive account in which *too* asserts  $q$  in addition to

$p$  can explain why (26a) leads to a contradiction, but (26b) does not: it is the conjunction that is negated in (26b) while it is the existentially quantified proposition that is negated in (26a).

Abrusán argues that while the additive implication of *too* is part of the entailed meaning, it must always become presupposed, following her presupposition triggering mechanism given in (27).

(27) *Presupposition triggering*

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 questions are presupposed.

For example, in (28), the additive meaning that John ate something other than beans is neither necessarily about the speech event time nor about the event time of the sentence expressing the most direct answer to the background question, which is the event time of the predicate *ate* in B's response. Therefore, *too*'s additive implication is predicted to be presupposed in Abrusán's mechanism.

(28) A: John ate broccolis. What else did he eat?

B: He also ate [beans]<sub>f</sub>.

*implies*: John ate  $x_c$  &  $x_c \neq$  beans.

Under Abrusán's assumption that *too*'s additive meaning is implied and not asserted, the presupposition triggering mechanism predicts the additive meaning to be always presupposed. However, speakers seem to find cases like (29) felicitous when the question at hand is about whether *both* Mary and John were in the elevator. This is not predicted by the presupposition triggering mechanism because with Abrusán's definition of *too*, that Mary is in the elevator has to be presupposed.

(29) I don't know if Mary is in the elevator. But if John is in the elevator too, we will go over the weight limit. (Adapted and modified from Cohen (2009) and Rooth (1999))

Under the conjunction account, I can argue that the question at hand in (29) is the conjunctive meaning (that both are in the elevator), and so the whole assertion of *too* is entailed and the first conjunct does not need to be presupposed.

In this section, I have shown that the conjunction account of *too* has advantages over fully presuppositional accounts and makes more precise predictions about *too*'s distribution using Abrusán's mechanism.



#### 4. Semantics of *either*

I propose that additive *either* is a disjunctive counterpart of *too*, with its meaning identical to *too* except that it asserts a disjunction rather than a conjunction.

$$(30) \quad \llbracket \text{too} \rrbracket(q)(\llbracket p \rrbracket_{\sim C}) = \lambda w: q \in C - \{\llbracket p \rrbracket^o\}. q_w \wedge \llbracket p \rrbracket^w$$

$$(31) \quad \llbracket \text{either} \rrbracket(q)(\llbracket p \rrbracket_{\sim C}) = \lambda w: q \in C - \{\llbracket p \rrbracket^o\}. q_w \vee \llbracket p \rrbracket^w$$

The assertion of an anaphor *q* captures the same antecedent requirements that *either* and *too* share: there must be a salient distinct antecedent that is a focus alternative of the host. Following Rullmann, I assume that *either* scopes under negation. For example, in (32), negation scopes over *either* adjoining to *p* which is *John left*, and *q* is presupposed to be in *C* constrained by the focus on *John*. Thus, the reference of *q* in (32) is identical to the reference of *q* in the positive sentence with *too* as in (33).

- (32) John<sub>F</sub> didn't leave either.
- a.  $\neg \llbracket \text{either} \rrbracket(q)(\llbracket p \rrbracket)$
  - b.  $p = \text{John left}$
  - c. Presupposes that *q* is of the form *X left*
  - d. Asserts  $\neg[q \vee p] = \neg q \wedge \neg p$
- (33) John<sub>F</sub> left too.

However, because the resulting assertion is a negation of a disjunction, both *p* and *q* end up being negated as shown in (32d). As a result, the meaning in (32) is 'In addition to *q* being false, John didn't leave.' Because *q* is negated in the assertion, the necessary contextual information must entail  $\neg q$ , either with a discourse or contextual information as below:

- (34) a. Discourse antecedent entailing *Bill didn't leave*.  
 b. Context in which Bill didn't leave.

So far I have argued that *too* and additive *either* adjoining to *p* take a silent propositional anaphor *q* and the proposition *p* as arguments. While *too* asserts a conjunction of *q* and *p*, *either* asserts a disjunction. Because *q* is an anaphor that requires an antecedent, a discourse or contextual antecedent must be available, and the truth value of the antecedent must be compatible with the resulting assertion of the sentence containing *too* and *either*.

## 5. Distribution of *either*

The two aspects of additive *either* that we wanted to capture were its relation to *too* and its NPI behavior. By arguing that *too* and *either* both take a silent propositional anaphor as an argument, we have captured the three properties – Antecedent Requirement, Focus Sensitivity, and Distinctness – that *too* and *either* share. It was shown that the difference *too* and *either* show in their requirements of the antecedent arise from *either* asserting a disjunction rather than a conjunction: because negation scopes over disjunction, both  $p$  and  $q$  are asserted to be false, unlike *too*. However, we do not yet have an account for why *either* cannot appear in positive contexts. This section attempts to account for additive *either*'s restricted distribution. It is proposed here that the NPI nature of *either* also derives from its assertion of a disjunction.

### 5.1. Disjunction and NPI

Under the account proposed here, *either* is a disjunction that contains an anaphor. The difference between a conjunction and a disjunction, and between a universal and an existential more generally, carries some implications on an element's polarity sensitivity. There have been cases of polarity sensitive disjunctions attested in other languages (Aranovich 2006, Amritivalli 2003, a.o.), and it is generally observed that existentials rather than universals are sensitive to polarity. For example, existentials like *any* and *ever* are NPIs in English, but universals such as *all* and *every* are not. Thus, the difference between *too* and *either* under my analysis can link *either*'s behavior to a more general discussion of polarity sensitivity. This has an advantage over accounts like Rullmann's, in which the difference in the presuppositions of *too* and *either* does not carry implications for *either*'s NPI nature, needing a separate licensing condition to be stipulated.

There have been recent attempts to formalize the generalization that only existentials tend to be NPIs, one of them being the exhaustification-based analysis of NPIs. In the next section, I discuss the exhaustification framework and show how *either*'s restricted distribution can be derived from its disjunctive meaning under this framework.

### 5.2. Exhaustification-based analysis of NPIs

The Exhaustification-based analysis of NPIs is a program of reducing the NPI behavior to a grammatical process of exhaustification (Krifka 1995, Lahiri 1998, Chierchia 2006, 2013). Regular indefinites like *some* trigger scalar implicature when relevant. Under the grammatical analysis, this implicature arises via exhaustification through an O operator which agrees with the alternative-bearing element in its c-commanding domain, affirms the prejacent, and negates all non-entailed alternatives. For example, the sentence in (35), in a relevant context, triggers exhaustification of all non-entailed alternatives. The prejacent containing *some*, notated as  $\phi_{\text{some}}$ , has as its scalar al-

ternative  $\phi_{all}$ . The resulting exhaustified meaning is that  $\phi_{some}$  is true and  $\phi_{all}$  is false, as shown in (35c).

- (35) Some students passed the test.
- a. O[some students passed the test]
  - b. ALT =  $\{\phi_{some}, \phi_{all}\}$
  - c. O[(35)] = Some but not all students passed the test

Chierchia (2013) argues that, unlike the scalar alternative of *some* which is only activated when relevant, the alternatives of NPIs are not subject to relevance, and therefore always active. Under the assumption that the NPI *any* has an identical meaning to *some*, the contrast in (36) can be explained in terms of this difference in obligatoriness of alternatives. Chierchia argues that this difference arises from the fact that, unlike *some/a*, *any* obligatorily activates its domain alternatives and is exhaustified by  $O_D$  (which selects for domain alternatives).

- (36) a. John ate some cookie.  
 b. \*John ate any cookie  
 (i)  $O_D$ [John ate any<sub>D</sub> cookie]

Domain alternatives are formed by taking subsets of the domain of the prejacent. We can look at a simplified model in (37) for an illustration. In a model where there are three cookies, subdomain alternatives are as listed in (37a).

- (37) Model: three cookies ( $D = \{c_1, c_2, c_3\}$ )
- a. D-ALT =  $\{\{c_1, c_2, c_3\}, \{c_1, c_2\}, \{c_1, c_3\}, \{c_2, c_3\}, \{c_1\}, \{c_2\}, \{c_3\}\}$
  - b. Assertion:  $\exists x \in D [\text{cookie}(x) \wedge \text{eat}(x)(j)]$
  - c. Assertion (simplified):  $C_1 \vee C_2 \vee C_3$
  - d. Exhaustification: negating all non-entailed ALTs  $\rightarrow$  Contradiction ( $\perp$ )  
 $(C_1 \vee C_2 \vee C_3 \wedge \neg C_1 \wedge \neg C_2 \wedge \neg C_3 \dots)$

If we simplify the assertion in (37b) so that  $C_n$  means  $\llbracket \text{John ate } c_n \rrbracket$ , then the simplified assertion can be represented as a disjunction in (37c). Because the prejacent does not entail any of its alternatives, exhaustification negates all the alternatives. This leads to a contradiction because the resulting assertion is that John ate  $c_1, c_2$ , or  $c_3$  but that he didn't eat  $c_1, c_2$ , or  $c_3$ , and so on.

The logical contradiction that results from exhaustification rules out (36b). On the other hand, in (38), where *any* occurs in a negative environment, exhaustification does not lead to a contradiction. This is because a negation of a disjunction is equivalent to a conjunction of negated disjuncts, and

the prejacent entails all its alternatives. This leads to a vacuous exhaustification that simply results in the prejacent we started with.

- (38) John didn't eat any cookie.
- a. Assertion: *No cookie exists such that John ate it.*  $\neg C_1 \wedge \neg C_2 \wedge \neg C_3$
  - b. All alternatives entailed:  $\neg C_1, \neg C_2, \neg C_3$ , and so on
  - c.  $\rightarrow$  Vacuous Exhaustification

The generalization that NPIs are elements that appear in lower-ends of scales such as existentials and indefinites (Lauer 2013, Chierchia 2013) is predicted by the exhaustification-based account: alternatives of such elements are stronger than (not entailed by) the elements, thus must be negated. The alternatives of NPIs cause exhaustification to lead to a contradiction. On the other hand, when such lower-end items appear in downward-entailing contexts (DE), they are the strongest elements of their scales, so all alternatives are entailed and exhaustification is vacuous. Exhaustification via the O operator thus derives and explains why NPIs like *any* and *ever* are only grammatical in DE contexts: in non-DE contexts, the stronger alternatives must be negated, leading to a contradiction.

I propose that additive *either* in positive contexts is ruled out due to the same reason. I assume that, because it asserts a disjunction, additive *either* activates the same domain and scalar alternatives of a regular disjunction. The alternatives of a disjunction, which include the standard scalar alternative and the domain alternatives following Sauerland (2004), are shown in (39).

- (39)  $ALT(q \vee p) = \{q \vee p, q, p, q \wedge p\}$
- a.  $\{q \vee p, q \wedge p\}$ : standard scalar alternatives ( $\sigma A$ )
  - b.  $\{q \vee p, q, p\}$ : each individual disjunct as Domain alternatives (DA) (Sauerland, 2004)

Considering that *either* adjoining to  $p$  and taking a propositional anaphor  $q$  asserts a disjunction between  $q$  and  $p$ , I argue that the alternatives are identical to that of a disjunction:

- (40)  $ALT(\llbracket \text{either} \rrbracket(q)(p)) = \{q_w \vee p_w, q_w, p_w, q_w \wedge p_w\}$

With this assumption, we first check if the exhaustification-based account can be applied to additive *either* and correctly lead to a contradiction in positive contexts. Because *either* activates both domain and scalar alternatives, we exhaustify using  $O_{ALT}$  (ALT: total set of alternatives - scalar and domain, cf. Chierchia 2013). Following the definition of *either* proposed above, the meaning of (41) is (42a). Similar to the case of *any* in a positive context, the resulting disjunction does not entail its alternatives, thus all of them must be negated. This leads to a contradiction, and (41) is ruled out.

(41) \*John left either.

(42)  $O_{ALT}$  [John left **either**]

- a. Asserts:  $q_w \vee p_w$  ( $p = \llbracket \text{John left} \rrbracket$ )
- b. Alt =  $\{q_w \vee p_w, q_w, p_w, q_w \wedge p_w\}$
- c.  $O_{ALT}$  [p **either**]  
 $= [q_w \vee p_w] \wedge \neg q_w \wedge \neg p_w \wedge \neg [q_w \wedge p_w] = \perp$

Note that adopting this analysis does not affect the grammatical case where *either* is in a negative environment. Under negation, the disjunction becomes the strongest alternative, entailing all other alternatives. We have a vacuous exhaustification that results in the prejacent we started with.

(43) John didn't leave either.

(44)  $O_{ALT}$  [John didn't leave **either**]

- a. Asserts:  $\neg[q_w \vee p_w]$  ( $p = \llbracket \text{John left} \rrbracket$ )
- b. Alt =  $\{\neg[q_w \vee p_w], \neg q_w, \neg p_w, \neg[q_w \wedge p_w]\}$
- c.  $O_{ALT} \neg[p \text{ **either**}]$   
 $= \neg[q_w \vee p_w]$

The second goal of an adequate account of additive *either* was to capture and explain its NPI behavior. In this section it was shown that the NPI behavior is a possible result of the switch from conjunction to disjunction between *too* and *either* because disjunction and existentials in general are the ones that are polarity sensitive, not conjunction and universals. It was also shown that this link between asserting a disjunction and having an NPI distribution can be formally derived following the exhaustification-based account, if a natural assumption is made that *either* activates the alternatives of a regular disjunction.

Because *either*'s distribution is constrained due to the exhaustification process that leads to a contradiction in positive contexts, this account does not make the same wrong prediction that Rullmann's licensing condition makes. For example, *almost* in (45) is not predicted to license additive *either* because the alternatives in (45c) are not entailed by the prejacent in (45b), and thus need to be negated. This leads to a contradiction.

(45) \*The paper is almost finished either.

- a. almost[ $\llbracket \text{either} \rrbracket(q)(p)$ ]  $p = \llbracket \text{The paper is finished} \rrbracket$
- b. Asserts: almost ( $q \vee p$ )
- c. Alt =  $\{\text{almost}(q \vee p), \text{almost}(q), \text{almost}(p), \text{almost}(q \wedge p)\}$

## 6. Conclusion

The main proposal of this paper is that the focus particles *too* and *either* are two-place predicates that take a silent propositional anaphor *q* in addition to the host proposition *p* they adjoin to, asserting a conjunction and a disjunction, respectively. In proposing the analysis for *too*, the replacement of the generally assumed ‘additive presupposition’ with an assertion of a conjunction where one of the conjuncts is an anaphor was motivated by the fact that this modification allows us to explain cases where the additive meaning of *too* does not seem fully presuppositional. A further advantage of this account is that it gives a parallel disjunctive analysis for *either* where the sole difference between the two elements is directly relevant for both *either*’s antecedent requirement properties and its NPI behavior. As the disjunctive counterpart, additive *either* is more likely to be sensitive to polarity, and there is a formal way to derive this property under the exhaustification-based framework.

One critical question that remains is how this analysis can account for the fact that additive *either* is not simply an NPI but a Strong NPI (SNPI), further restricted to negative contexts only. The account so far predicts additive *either* to be licensed in all DE contexts through a vacuous exhaustification. Deriving the SNPI nature of additive *either* would be important in linking this analysis to other types of *either* such as the disjunctive *either* and the determiner *either*.

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# Testing the nature of variation effects with modified numerals\*

Stavroula Alexandropoulou — *Utrecht University*

**Abstract.** Variation effects, which are akin to free choice effects, are triggered when a numeral is modified by the lower-bound superlative modifier *at least* and appears in certain embedded contexts. The dominant take on the derivation of those effects is a pragmatic view whereby they arise via an implicature-generating mechanism. In this paper, I present results from two experiments that tested the availability of variation inferences with lower-bound class B numeral modifiers in the scope of a universal quantifier as well as whether those inferences have a semantic or a pragmatic strength. I show that variation effects i) do arise, and ii) are pragmatic inferences, as predicted by the pragmatic view. Moreover, the findings of this study are compatible with an alternative-introducing semantics for *at least* à la Büring (2008) and Coppock and Brochhagen (2013).

**Keywords:** modified numerals, variation effects, semantic/pragmatic inferences, experimental semantics/pragmatics

## 1. Introduction

Most of the literature on the semantics and pragmatics of superlative numeral modifiers has been dealing with the well-established ignorance or speaker insecurity (SI) inferences (Büring 2008) they give rise to (e.g., Geurts and Nouwen 2007; Cummins and Katsos 2010; Nouwen 2010; Schwarz 2013). Interestingly, those inferences are principally obviated when such modifiers appear in certain embedded contexts, and other inferences are triggered instead. The present paper is concerned with those latter, less studied and established inferences.

Take example (1) below, where the superlative modifier *at least* interacts with the universal quantifier *every*. The most preferred reading conveyed by (1) consists of the basic meaning of (1), that is, ‘for each laptop it is the case that the number of GB of memory is  $\geq 2$ ’ plus the following meaning component: ‘the number of GB varies with respect to laptops’; for instance, laptop A has 2GB *and* laptop B has 4GB *and* laptop C has 4GB *and* laptop D has 8GB, et cetera. The latter, additional meaning component constitutes an example of those inferences superseding SI inferences in the presence of an operator, such as the universal nominal quantifier in the example below.

- (1) Every laptop we sell has at least 2GB of memory. (adapted from Nouwen 2015)

Büring (2008) has attributed to the whole conveyed reading the characterisation ‘authoritative’ to

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contrast it with the least preferred, subsiding SI reading, which in (1) would be ‘there is a certain *n* of GB of memory each laptop has and the speaker is not sure whether this is 2 or more’. The authoritative reading arises when the *at least* phrase scopes below the universal quantifier, and so it is, when *at least* interacts with other operators, such as universal modals, plurals, generics (Nouwen 2015); see an example of a universal modal in (2).

(2) Sophia has to write at least fifteen pages.

As in (1), the arising inference says that ‘the number of pages can vary’, e.g., Sophia can write 15 pp, *and* she can write 17 pp, *and* she can write 20 pp, etc., which we can be represented as follows:

w<sub>1</sub>: 15 pages  
 w<sub>2</sub>: 17 pages  
 w<sub>3</sub>: 17 pages  
 w<sub>4</sub>: 20 pages  
 ...

where w stands for a deontically accessible world

In both examples (1) and (2), we observe that there is a ‘variation’ output from the interaction of *at least* with the respective present operator. Thus, in (1) we get a variety or range of pairs of laptops and numbers of GB, and of pairs of worlds and numbers of pages in (2). This is the result of the distribution of relevant numbers of GB over individual laptops in the former case and of relevant numbers of pages over deontically accessible worlds in the latter case. That latter case is known as the ‘distribution requirement’ (Kratzer and Shimoyama 2002). Note also that, independently of what the embedding operator is, the output range is expressed as a conjunction of entities/situations (notice the italicised ‘and’ in the paraphrases of (1) and (2)); for instance, in (2), the output is a conjunction of permissions or choices, depending on the perspective.

The variation effects of (1) and (2) including the conjunctive output resemble the variation output of free choice (fc) effects with disjunction (Kamp 1973; Zimmermann 2000; Nickel 2010, *inter alia*). See (3) for an illustration, where *or* interacts with a universal nominal quantifier:<sup>1</sup>

(3) Every student listens to Pepper fm or to En Lefko fm.

(3) conveys the fc reading ‘some students listen to Pepper fm and some students listen to En Lefko fm’; or in other words, (3) is true in the following variation scenario:

<sup>1</sup>Obviously, the effect in (3) is not a genuine fc effect, since there is no choice involved. A genuine fc effect arises when we are dealing with modal quantifiers. Similarly, the variation effect in (1) corresponds to the so-called ‘modal variation’ effect in the modal domain (cf. Alonso-Ovalle and Menendez-Benito 2010), which we have in example (2).

Student A listens to Pepper fm  
 Student B listens to Pepper fm  
 Student C listens to En Lefko fm  
 Student D listens to En Lefko fm  
 ...

However, the variation effect with *at least* is weaker than that in free choice, as Nouwen (2015) points out and shows by means of the example in (4):

- (4) a. **Context:** *Password policy*: For security reasons, the system will not accept passwords that are shorter than 6 characters. Moreover, it cannot handle passwords that are longer than 10 characters.  
 b. Passwords have to be at least 6 characters long.

(4-b) is true given (4-a). If the variation effect in (4-b) were the same as that of free choice, (4-b) should not be true, because it would entail that a password of *any* number of characters greater than five would be an acceptable one. Hence, this suggests that the variation effect with *at least* seems to merely say that — after meeting the requirement of  $n_{char.} > 5$  — ‘there is no specific  $n$  such that passwords need to be exactly  $n$  characters long’. For this reason I will not make use of the term ‘free choice’ or ‘free choice-like’ to refer to this — weaker/partial, as opposed to universal — effect I am studying here, but I will stick to the descriptive and plain term ‘variation effect’.

When dealing with such little studied effects, the first questions come to mind are the following: i) Do variation effects with superlatively modified numerals exist? ii) If so, what is the strength of those effects? Do they have the strength of a semantic or that of a pragmatic inference? These are the very questions the present paper seeks to answer experimentally, zooming in on variation effects with lower-bound numeral modifiers, such as *at least* and *n or more*.

In the next section I present the pragmatic view on the variation effects with superlatively modified numerals, in which Coppock and Brochhagen’s (2013) analysis features. In Section 3, I report on the experiments I conducted in order to test the predictions that follow from the pragmatic view with respect to the research questions specified above. The final section concludes.

## 2. Pragmatic view: Variation effects as implicatures

The questions posed in the previous section have dominantly been tackled from a pragmatic perspective. More specifically, according to this perspective, variation effects arise via an implicature-generating mechanism. However, within that perspective there are two kinds of accounts for the generation of variation effects as implicatures. Both kinds are Gricean, but they differ in how alternatives come about. More precisely, there are those accounts that derive the variation effects

via Gricean reasoning and crucially start off with an alternative-introducing semantics for *at least*, and those that execute the standard Gricean recipe for scalar implicatures assuming lexically determined sets of alternatives.

As to the latter camp, let us briefly see how the effect we are after is derived via a scalar implicature-generating mechanism. Consider example (1) from the Introduction; assuming the scale of natural numbers excluding 0 (i.e.,  $\mathbb{N}^*$ ) as the relevant scale and applying the scalar implicature reasoning, we get the implicature ‘not every laptop we sell has 3 or more GB of memory’. This in combination with the assertion suggests that some laptop in that shop has exactly 2GB of memory. That is, some laptop has (or some laptops have) exactly 2GB of memory and some laptops have more than 2GB. It is further entailed that ‘not all laptops of the shop have the same amount of memory’, which is exactly what the variation effect suggests. Mayr’s (2013) and Schwarz’s (2013) accounts fit in the pragmatic camp in question, and both stipulate distinct scale mates for the superlative modifier and the numeral in order to derive the scalar implicature triggered when *at least* is in an embedded environment. I will not go into the details of those accounts, but I will rather turn to the other pragmatic camp, whose more specific predictions will be tested in Experiment 2.

Proponents of the first camp are Coppock and Brochhagen (2013) and Buring (2008), and among the modified numeral literature the former have elaborately dealt with variation readings. Their account of superlative modifiers takes inspiration from Buring’s (2008) prior idea that superlative modifiers are disjunctions at some level of description. In what follows I flesh out this pragmatic view by the illustration of Coppock and Brochhagen’s (2013) more detailed account.

## 2.1. Coppock and Brochhagen (2013)

Coppock and Brochhagen (2013) assume an alternative-introducing semantics for superlative modifiers within an inquisitive semantics framework, according to which superlative modifiers denote as many possibilities as the alternatives under consideration (see Ciardelli, Groenendijk, and Roelofsen 2012, for the relevant terminology). Below you see a straightforward illustration of that idea.

- (5)  $\llbracket at\ least \rrbracket^s(n)(A)(B) = \{|A \cap B| = n, |A \cap B| = n+1, |A \cap B| = n+2, \dots\}$ , where  $s$  stands for *state*, that is, the current discourse context, and  $n \in \mathbb{N}^*$ .<sup>2</sup>

(5) shows that *at least* creates sets of propositions that encompass the alternatives being ranked as high or higher on a pragmatically defined scale. In example (6), the relevant set of alternatives would be {Magda called 5 times, Magda called 6 times, Magda called 7 times, ...}, and this constitutes the core of the semantics Coppock and Brochhagen (2013) attribute to (6).

<sup>2</sup>Here I am zooming in on the cases where *at least* takes a numeral as an argument.

- (6) Magda called at least five times.

Let us now turn to their account of variation effects, starting with a small introduction. The implication in (7) summarises the observation of arriving at a(ny) variation effect with conjunctive nature from an embedded alternative-introducing or disjunctive expression. More precisely, in the antecedent of the implication we have the basic, asserted, meaning with the alternatives/disjuncts introduced by the relevant expression, while the consequent of (7) consists of the additional meaning component of the conjoined permissible options in the case of a universal modal and of the conjoined existentially bound alternatives in the case of a universal nominal quantifier.

- (7)  $\Box/\forall (\alpha \vee \beta) \rightarrow \Diamond/\exists \alpha/\exists \wedge \Diamond/\exists \beta$  (Note that I introduce this notation for the nominal quantifiers in order to demonstrate the observed similarity independently of the operator the alternative-based expression is embedded under.)

But how do we get from the left to the right part of the implication? In other words, how is the variation effect in the consequent derived from the antecedent containing the relevant alternatives? In order to answer the above question, concerning the variation effects with superlatively modified numerals in the scope of universal quantification, and starting with an alternative-based semantics, Coppock and Brochhagen (2013) execute Kratzer and Shimoyama's (2002) Gricean recipe. This recipe was devised to account for the fc effects of the German epistemic indefinite *irgendein* in the scope of a universal modal; see (8), taken from Kratzer and Shimoyama (2002).

- (8) *Du musst dir irgendeins von diesen beiden Büchen leihen.*  
 you must you.DAT irgend-one of those two books borrow  
 'You must borrow one of those two books.'  
 $\rightsquigarrow$  You are allowed to borrow book A *and* you are allowed to borrow book B.

The translation of (8) spells out the asserted content of (8), and below that you see the fc inference that is triggered; that is, the referent of *Du* is free to choose between book A and book B. Crucially, Kratzer and Shimoyama (2002) too assume that *irgendein* is an alternative-introducing, here disjunctive, expression, with book A and book B each being a relevant stronger alternative in the discourse context of (8). They derive the fc reading by the following Gricean reasoning: Why did the speaker in (8) choose to use *irgendeins*, with an alternative-introducing/disjunctive semantics, that is, picking the widest set of relevant alternatives you see in (9-a), rather than a more specific and stronger alternative, such as  $A = \{\text{You borrow book A}\}$ ? Because it is either the case that  $\Box A$  is false or that it is true, but its exhaustivity inference in (9-b) is false. Then it follows that  $\Box A \Rightarrow \Box B$ . Applying the same reasoning to the remaining alternative in ALT, i.e.,  $B = \{\text{You borrow book B}\}$ , we arrive at  $\Box B \Rightarrow \Box A$ . Hence, we get the following:  $\Box A \Leftrightarrow \Box B$ . Combining this equivalence with the asserted meaning, as notated in (7) by the left part, it follows that  $\Diamond A \wedge \Diamond B$ . As is obvious,

we have generated the consequent of (7), which corresponds to the fc inference of (8), that is, ‘you are allowed to borrow book A and you are allowed to borrow book B’.

- (9) a.  $ALT = \{\text{You borrow book A, You borrow book B}\}$   
 b.  $\neg \Box B = \{\text{You borrow book B}\}$  *exhaustivity inference of A*

As already said, Coppock and Brochhagen (2013) apply the same rationale in order to derive the variation effect of sentences like (1), repeated below as (10).

- (10) Every laptop we sell has at least 2GB of memory.

Let us see how. Why did the speaker of (10) pick an expression with an alternative-based semantics, namely, one denoting the set in (11-a) instead of a stronger alternative, e.g.,  $A = \text{Laptop } x \text{ has 2GB}$ ? Via the same reasoning as above we arrive at  $\forall -A \Leftrightarrow \forall -B$  (notation  $\forall -A$  is introduced to abbreviate embedding under  $\forall$ ). This in combination with the basic semantics of (10) in (11-b) derives the live options of memory of laptops sold by the store of the discourse context of (10), represented as  $\exists -A \wedge \exists -B$ . Notice that this corresponds to the right part of the implication in (7).

- (11) a.  $ALT = \{\text{Laptop } x \text{ has 2GB, Laptop } x \text{ has 4GB}\}^3$   
 b.  $\forall -(A \vee B)$  (alternative-based expression in the scope of  $\forall$ , cf. left part of (7))

Before ending this section, I would like to briefly mention that Buring (2008), who proposed that *at least n* is a disjunction, being interpreted as ‘exactly *n* or more than *n*’ (also adopted by Cummins and Katsos 2010), in order to derive the variation effect (or the authoritative reading in his own terms) of *at least n* embedded under a universal modal, adopts a very similar scheme to that in (7), which he actually borrows from Klinedinst (2007).

To conclude Section 2, both Coppock and Brochhagen (2013) and Buring (2008), as well as the pragmatic camp of scalar implicatures, provide accounts for the derivation of variation effects with *at least* and they all put forth a pragmatic analysis to derive those effects; for this reason they are subsumed under the term ‘pragmatic view’. In what follows, I present an experimental investigation of the predictions stemming from the pragmatic view as regards the questions of the availability and of the semantic/pragmatic strength of the effects in question. I additionally test

<sup>3</sup>Similarly to Kratzer and Shimoyama’s (2002) example above, I am limiting the set of alternatives to two. Both in Kratzer and Shimoyama (2002) and in Coppock and Brochhagen (2013) it is implied that a straightforward generalisation in the case of three or more alternatives generates the output of  $\Diamond A \wedge \Diamond B \wedge \Diamond C \wedge \dots$ , and that of  $\exists -A \wedge \exists -B \wedge \exists -C \wedge \dots$ , respectively. However, further clarification would be in order, as the details of this generalisation are not spelled out by the aforementioned authors.

predictions of Buring's (2008) and Coppock and Brochhagen's (2013) pragmatic view with respect to an alternative-based status for *at least*.

### 3. Experiments: Test the availability and strength of variation effects with *at least*

#### 3.1. Predictions

According to the pragmatic view, it is predicted that variation effects with *at least* do arise and, more specifically, they are argued to arise via pragmatic reasoning; thus, they are predicted to be as strong as pragmatic inferences. To test these predictions, I conducted two offline experiments, both in the form of a questionnaire eliciting people's judgements.

#### 3.2. Experiment 1

##### 3.2.1. Methods

Experiment 1 was a paper and pencil questionnaire consisting of short dialogues between a person A and a person B. Person A made a statement and person B followed up with a question. Participants were tasked to judge how reasonable B's follow up was given A's statement. They did so by giving ratings on a –5 to +5 Likert scale, where –5 is 'completely unreasonable' and +5 is 'completely reasonable'. This scale has been inspired by a similar one introduced by Cummins and Katsos (2010). The rationale for using such a scale is that semantic contradictions are expected to score on the left side of the scale and close to –5, and semantically and pragmatically well-formed items are expected to score on the other side of the scale and close to +5. Pragmatic infelicities should be rated higher than the semantic contradictions, but still lower than the semantically and pragmatically well-formed items. This is arguably a way to draw a distinction between semantic contradiction and pragmatic infelicity, as Cummins and Katsos's (2010) relevant results reveal. Also, if a pragmatic inference arises less reliably or is by no means obligatory, a large variation of scores is expected. A similar scale has also been employed by McNabb and Penka (2014), suggesting a trustworthy method.

Below you find an example of my experimental sentences, in which *at least* interacted with the universal nominal quantifiers *elk* 'every' or *iedereen* 'everybody':

- (12)    **A:** *Volgens een steekproef zitten er in elk zakje minstens tweeëntwintig*  
           *according.to a random-sample sit there in every bag at.least 22*  
           *dropjes.*  
           *licorice-candies*  
           'According to a random sample every bag contains at least 22 licorice candies.'

- B:** *Zitten er evenveel dropjes in elk zakje?*  
 sit there as.much licorice-candies in every bag  
 ‘Do they all contain the same number of licorice candies?’

The asserted meaning of A’s utterance is ‘for every sack the  $n$  of licorice candies is  $\geq 22$ ’. B’s follow up constitutes a reasonable reaction to A when merely considering A’s assertion. Speaker A can additionally convey that ‘there is no specific  $n$  such that all sacks contain exactly that many licorice candies’ (variation reading). B’s question targets this latter meaning and it serves as an unreasonable and infelicitous follow up to A given that meaning, because it asks whether the exact opposite is the case. To see whether this infelicity has the strength of a contradiction or that of a pragmatic infelicity, I included semantically contradictory dialogues as well as pragmatically ill-formed/infelicitous dialogues as control items, also used as baselines. B and B’ in (13) are two respective examples. All those control items involved disjunction in interaction with the universal quantifiers *elk* ‘every’ or *iedereen* ‘everybody’, similarly to the experimental items.

- (13) **A:** *Bij de lunch heeft iedereen op het werk een salade of een kom soep besteld.*  
 at the lunch has everyone at the work a salad or a bowl soup ordered  
 ‘Everybody at work ordered salad or soup for lunch.’  
**B:** *Was er iemand van hen die geen van beide heeft besteld?*  
 was there anyone of them who none of the.two has ordered?  
 ‘Did anyone order neither of those?’ *semantic contradictions*  
**B’:** *Was er iemand van hen die een kom soep heeft besteld?*  
 was there anyone of them who a bowl soup has ordered  
 ‘Did any of them order soup?’ *pragmatic infelicities*

A’s assertion states that one of the two disjuncts is true (basic meaning of disjunction), and is true when everyone had a salad and when everyone had soup. B’s follow up in semantic contradictions is completely unreasonable, because it prompts for a proposition that contradicts A’s assertion. Speaker A can further convey the fc reading that ‘some people ordered a salad and some people ordered a soup’ (see Nickel 2010). B’s follow up in pragmatic infelicities is unreasonable as well, because it questions what the fc reading of A’s utterance states.

Semantically and pragmatically well-formed/felicitous control items were included too, being also used as a baseline. The interacting DPs in these controls were varied (that is, *every* NP/proper name \* modified numeral/disjunction/definite description) to achieve distraction and to have also well-formed/felicitous items involving the interactions *every* \* modified numeral/disjunction. (14) illustrates a semantically and pragmatically well-formed dialogue, where A’s statement contains an *every* NP (*elke student*) and a definite description (*het Van Gogh Museum*).

- (14) **A:** *Vorige maand heeft elke student kunstgeschiedenis het Van Gogh Museum*  
 previous month has every student history.of.art the Van Gogh museum  
*bezocht.*  
 visited  
 ‘Last month every history of art student visited the Van Gogh museum.’
- B:** *Vonden ze het interessant?*  
 found they it interesting  
 ‘Did they find it interesting?’

B’s question is a natural and felicitous, thus, reasonable, follow up to A’s utterance. Juxtaposing the experimental items with those controls will tell us to what extent the infelicity described above for the experimental item (12) actually arises. In other words, a comparison of our experimental items with the semantically and pragmatically well-formed/felicitous control items will indicate whether variation readings are at all available with *at least*. If it turns out that variation readings are indeed available, the comparison in question could furthermore manifest how robust those readings are. Participants were provided both with an example of a semantically contradictory case as well as with a semantically and pragmatically well-formed example in the instructions of the questionnaire. Those examples did not involve any of the configurations used in the test items or the semantically contradictory and the pragmatically ill-formed/infelicitous control items.

A version of the experimental items with the numeral modifier *meer dan* ‘more than’ was also tested, but I am not discussing here the relevant results. In the experiment there was one factor, CONDITION: AT LEAST, MORE THAN, semantic contradictions, pragmatic infelicities, and semantically and pragmatically well-formed control items. The task included six experimental items (two conditions: AT LEAST and MORE THAN conditions) and six control items with disjunction (two conditions: condition of semantic contradictions and condition of pragmatic infelicities). Each type of items was divided into two lists, so that each participant saw each item only in one condition. 14 semantically and pragmatically well-formed dialogues appeared in each of the lists, also serving as distractors. For the purpose of counterbalancing the total design, two filler items expected to score very low (involving neither numeral modifiers nor disjunction) were added (number of stimuli = 28). Each of the formed lists of items appeared in two different orders, yielding four lists to test in total. A total of 27 subjects (20 Female; Mean age: 19.3; Age range: 17–23), all bachelor students at Utrecht University and native speakers of Dutch, filled in the questionnaire voluntarily and were naive as to the purpose of the study. Overall 756 observations were obtained.

### 3.2.2. Results

The reasonability judgements, or else scores, obtained were ordinal data, so they were analysed with ordered probit models using the `ordinal` package (Christensen 2013) in R. AT LEAST was the reference level of the factor CONDITION and was compared to MORE THAN and all three types



of control items. The model also included intercept random effects for subjects and items.

Condition AT LEAST was rated significantly lower than the semantically and pragmatically well-formed control items ( $\beta = -1.776, SE = .174, p < .0001$ ). It further got scores significantly higher than the semantic contradictions ( $\beta = 1.808, SE = .225, p < .0001$ ) as well as than the pragmatic infelicities ( $\beta = 1.284, SE = .212, p < .0001$ ). These come as a statistical confirmation of the relevant differences one can see on the plot (Figure 1) between AT LEAST, on the one hand, and each of the control conditions on the other hand. Further analyses showed that the difference between semantic contradictions and pragmatic infelicities as well as the difference of the former from the well-formed control items were statistically significant ( $\beta = -.508, SE = .191, p = .008$ ;  $\beta = -3.408, SE = .236, p < .0001$ , respectively). So was the difference of the pragmatic infelicities from the well-formed control items ( $\beta = -3, SE = .242, p < .0001$ ).

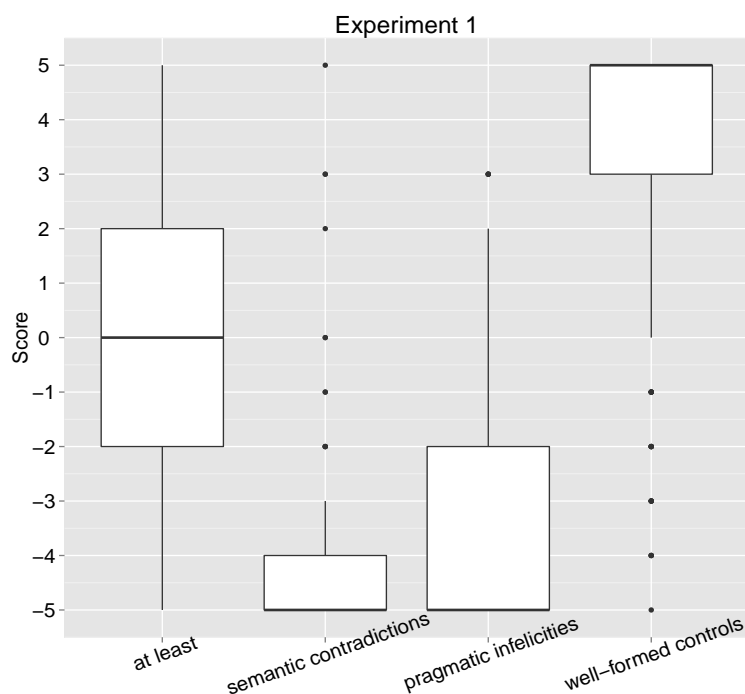


Figure 1: Boxplots of scores per condition. Experiment 1.

### 3.2.3. Discussion

The significant difference between the AT LEAST items and the well-formed control items indicates that subjects found that B's questions were not completely reasonable follow ups to A's statements, i.e., that something in B's questions gave rise to infelicity. As specified in Section 3.2.1, this would be so in case A's statements were understood as conveying a variation reading. Thus, I conclude

that variation effects were attested in the AT LEAST items. This lends support to the first prediction according to the pragmatic view I am testing, namely, that variation effects arise when *at least* interacts with the universal nominal quantifier. The question that now follows is if we can tell whether these effects have the strength of an entailment or that of a pragmatic inference. The difference of the AT LEAST condition from the semantic contradictions reported above shows that subjects did not rate the former as bad as the latter, that is, they did not treat them as contradictions. From that it is inferred that the attested variation effects with *at least* are not as strong as entailments, pointing to them having the strength of a pragmatic inference. Hence, the second prediction that variation effects are derived via a pragmatic mechanism is also borne out.

I additionally found that AT LEAST items were rated significantly higher than the pragmatic infelicities. One could speculate that this difference suggests that variation inferences with *at least* are weaker inferences than the fc effects with disjunction found in the pragmatic infelicities; that is, the former are generated less reliably than the latter.<sup>4</sup> Or rather one could interpret this difference as follows: the variation inference-generating mechanism with *at least* is different from the fc inference-generating mechanism with disjunction. This would speak against Büring's (2008) version of the pragmatic view that wants *at least* and disjunction to make use of the same mechanism in the derivation of the respective inferences. Such a conclusion would however be a remarkably weak one given the recent findings in the experimental literature on scalar inferences, cf. van Tiel, van Miltenburg, Zevakhina, and Geurts (2014).<sup>5</sup> More specifically, van Tiel et al. (2014), building on Doran and colleagues' (2009) prior work, showed that different scalar expressions, such as quantity expressions (e.g., *some*), adjectives like *warm*, *good*, *big*, adverbs like *sometimes*, *possibly*, verbs like *like*, *might*, *try*, diverge in the rate at which they give rise to scalar implicatures (via the standard Gricean reasoning). Thus, this could not permit the conclusion that the inference-generating mechanism for *at least* and for disjunction is different.

A particularly plausible interpretation of the significant difference found between the AT LEAST condition and the pragmatic infelicities was suggested to me by an anonymous reviewer and is as follows.<sup>6</sup> The difference between the conditions in question could very well signal that ignorance readings have kicked in. Experimental items and pragmatically ill-formed control items involve an interaction between *at least* and disjunction, respectively, on the one hand, and the universal quantifier *elk* 'every' or *iedereen* 'everyone', on the other hand. As mentioned already in the Introduction, the most preferred output of such an interaction is the reading derived when *at least*, or disjunction, takes narrow scope with respect to the universal quantifier. As Büring (2008) and Nouwen (2015) have pointed out, the least preferred reading is the one where *at least* and disjunction scope over the operator they interact with.<sup>7</sup> As already said, the resulting readings have been dubbed ignorance or speaker insecurity readings (Büring 2008). See below the two possible

<sup>4</sup>See a similar finding and interpretation in Cummins and Katsos (2010) with respect to the intermediate position of ignorance effects with modified numerals between their pragmatic infelicities and well-formed control items.

<sup>5</sup>Thanks to an anonymous reviewer for pointing this out.

<sup>6</sup>Thanks to this reviewer for the very useful and valuable comment.

<sup>7</sup>See McNabb and Penka (2014) for experimental work on those readings, where *at least* interacts with modals.

readings for the experimental item in (12) and the pragmatically ill-formed control item in (13).

- (15) **A:** According to a random sample every bag contains at least 22 licorice candies.  
**B:** Do they all contain the same number of licorice candies? AT LEAST  
 ~→ There is no specific  $n$  such that all bags contain exactly that many liquorice candies. *variation reading*  
 ~→ Every bag contains  $n$  candies, and as far as the speaker knows  $n$  could be 22 or more. *SI reading*
- (16) **A:** Everybody at work ordered a salad or a soup for lunch.  
**B:** Did any of them order a soup? DISJUNCTION  
 ~→ Some people ordered a salad and some people ordered a soup. *fc reading*  
 ~→ Everybody ordered the same thing, and the speaker does not know whether that was salad or soup. *SI reading*

Assuming that both readings are possible for each statement A, there is a difference in the expected judgement of question B in the two conditions, even if the respective inferences are of the same strength. In (16), question B is expected to be judged as an unreasonable follow up to A, on either reading. Take the *fc* reading; as we have already seen, in that case question B is infelicitous because, simply put, what it enquires about has just been stated by A. Now take the *SI* reading; again question B is infelicitous, because it asks the ignorant speaker A for knowledge that A lacks; that is, whether the one, and the same, thing everyone ordered for lunch — which is the only piece of knowledge A has — was a salad or a soup. Thus, regardless of what reading subjects get for A in the pragmatically infelicitous controls, they are expected to receive low scores. This is not the case for the experimental items with *at least*, because question B is more easily and straightforwardly interpreted as probing whether A meant to convey the variation reading or the *SI* reading. Notice, however, the *according to* phrase in (15); this arguably weakens the availability of an *SI* reading. Yet, this item did not score very low (mean = -.267), contrary to one's expectation that the *SI* reading weakening by the *according to* phrase would make the variation reading more salient, and thus, the item more susceptible to score low. More importantly, not all experimental items were constructed in a similar way, that is, containing such prepositional phrases or other phrases with similar function. In addition, in the experimental items, besides a general avoidance of round numbers to be modified by *at least*, which being a sign of impreciseness (cf. Krifka 2009, *inter alia*) facilitate *SI* readings, no systematic and sophisticated means of controlling for the interference of *SI* readings were employed. Consequently, it is highly plausible that the inflow of *SI* readings by the interpretive strategy recommended by the reviewer caused the relevant items to receive higher scores than expected, and thus, also higher than the pragmatically infelicitous controls with disjunction. This perfectly explains the difference I found between the *AT LEAST* items and the pragmatic infelicities and, beyond doubt, leads to conducting Experiment 2, the set up of which was modified in such a way as to weaken the *SI* readings' interference and have

participants focus on the variation readings.

### 3.3. Experiment 2

Experiment 2 was a follow up study aiming at showing whether the SI readings constituted a potential factor in driving the AT LEAST scores high in Experiment 1, getting more clear data.

#### 3.3.1. Methods

Experiment 2 consisted of lists that were randomly distributed and filled in mostly online. A few data were collected afterwards in a paper and pencil fashion, in order to balance the number of observations across lists. The lists of this experiment were created on SurveyMonkey ([www.surveymonkey.com](http://www.surveymonkey.com)), where links to each list were generated.

Subjects were instructed to read short dialogues between a researcher and an interviewer. The researcher makes a statement about the findings of a recent successful research s/he was involved in and the interviewer asks a question about them. This modification of the instructions was inspired by the instructions used in relevant work in progress by J. Dotlačil and R. Nouwen (p.c.), and already constitutes a deviation from Experiment 1, serving to hinder the interference of SI readings. To be more specific, the fact that the instructions made clear that the researcher had direct involvement in the research whose findings s/he is reporting each time, and that this was done recently and successfully, results in the undisputed conclusion that the researcher knows and remembers well what s/he is talking about. Given that, an SI interpretation of the researcher's statements would be less likely to arise. In this new setting, participants were asked to rate how well the interviewer has understood the researcher's statement. They did so on a –3 to +3 Likert scale, where –3 is 'the claim is not understood' and +3 is 'the claim is understood'.<sup>8</sup> Lastly, the instructions also included four practice items, two instructed to be rated making use of the left part of the scale (semantic contradictions) and two towards the right part (semantically and pragmatically well-formed items).

The vast majority of the items, and specifically the researcher's statements, along with the practice items used in this experiment were adapted from the afore-mentioned work by J. Dotlačil and R. Nouwen. Their items were already constructed so as to fit the researcher-interviewer context, but the interviewer's questions were modified in this experiment so as to serve its own goal. As a result, researcher's statements and interviewer's questions in Experiment 2 were constructed in the exact same way as A's statements and B's questions in Experiment 1, respectively (see indicatively an example of an experimental item from Experiment 2 in (17)).

<sup>8</sup>In Experiment 1 participants turned out not to make use of all points of the scale, so it was considered that that long a scale is not needed and that a shorter scale would work as well. This is the reason why I employed a shorter one this time. Note that the exact same scale is effectively used in the ongoing work by J. Dotlačil and R. Nouwen (p.c.).

- (17) **Onderzoeker:** *Tijdens het evenement werd elke straat door minstens zes agenten beveiligd.*  
 researcher during the event was every street by at.least six policemen guarded  
 ‘Researcher: During the event every street was guarded by at least six policemen.’  
**Interviewer:** *Werden ze allemaal door evenveel agenten beveiligd?*  
 interviewer were they all by as.many policemen guarded  
 ‘Interviewer: Were they all guarded by the same number of policemen?’

Moreover, as in Experiment 1, semantically contradictory and pragmatically ill-formed/ infelicitous control items were included, as well as semantically and pragmatically well-formed control items. Crucially, one more condition was added, in which the numeral modifier that interacts with the universal nominal quantifier was *n of meer* ‘*n* or more’. N OR MORE items only differed from AT LEAST (or MORE THAN) items in the type of numeral modifier. Let us now see what this addition serves for. *N or more* and *at least n* express the same numerical relation, both involving non-strict comparison (see Nouwen 2008), and they at the same time exhibit the same behaviour, that is, they trigger the same inferences (namely, SI inferences), and those inferences are weakened when the numeral modifiers in question appear in certain embedded environments. For this reason, Nouwen (2010) puts them in the same class of numeral modifiers, i.e., the so-called class B. As is obvious, *n or more* comes in a disjunctive form, so being similar to *at least n*, it perfectly spells out Coppock and Brochhagen’s (2013) and Buring’s (2008) alternative-based/disjunctive analysis for *at least*. Thus, by adding this condition I aim to test whether those two numeral modifiers will perform similarly, as expected according to the pragmatic view mainly discussed in this paper.

There were two factors in Experiment 2: (i) as in Experiment 1, CONDITION was one factor with N OR MORE as an additional level, and (ii) the type of question the interviewer asked (with two levels). The latter factor is not relevant for the present study, so I will not be discussing it here; the same holds for the MORE THAN condition. The task had six experimental items (three conditions: AT LEAST, N OR MORE, and MORE THAN) and six control items with disjunction (two conditions: semantic contradictions and pragmatic infelicities). Each type of items was rotated through six lists, so that each participant saw one item per condition. Moreover, 13 semantically and pragmatically well-formed control items were included in every list as well as six fillers (similar to those in Experiment 1). Every list had 29 stimuli. 97 filled questionnaires were collected; 18 were excluded, because less than half of each one was filled in, another five were excluded because those subjects were not native speakers of Dutch, and finally, data of six subjects were left out too due to mistakes in the practice items. The final number of observations was  $N=1564$ .<sup>9</sup> Last, subjects filled in the questionnaire voluntarily and were naive with respect to the purpose of the study.

<sup>9</sup> Part of the data of a semantically contradictory control item and of a semantically and pragmatically well-formed control item was not included in the subsequent analyses because of a typo. However, they were not discarded altogether, because the typo was noticed and corrected in time, and the relevant link to the respective list of the experiment was made available again.

### 3.3.2. Results

As in Experiment 1, SCORES were ordered categorical, thus the data were analysed with ordered probit models. AT LEAST was the reference level of CONDITION and was compared to N OR MORE, MORE THAN and all three types of controls. Intercept random effects for subjects and items were also included in the model.

AT LEAST was rated significantly lower than the well-formed control items ( $\beta = -2.168, SE = .214, p < .0001$ ) and significantly higher than the semantic contradictions ( $\beta = .628, SE = .273, p = .022$ ). As is also evident from Figure 2 on the next page, the difference between AT LEAST and the pragmatic infelicities has vanished ( $\beta = .082, SE = .264, p = .756$ ). This result suggests that the modification of the instructions so as to hinder the interference of the SI readings had an effect. Lastly, no significant difference was found between AT LEAST and N OR MORE ( $\beta = .0159, SE = .191, p = .404$ ). Turning now to the latter condition, quite similarly to AT LEAST's performance, N OR MORE got significantly lower scores than the well-formed control items ( $\beta = -2.368, SE = .229, p < .0001$ ), and its difference from the semantic contradictions (see relevant boxes in Figure 2) was marginally significant ( $\beta = .482, SE = .285, p = .091$ ), while it was not found to be significantly different from the pragmatic infelicities ( $\beta = -.07, SE = .277, p = .801$ ). Further analyses revealed that the difference between semantic contradictions and pragmatic infelicities was significant ( $\beta = -.554, SE = .207, p = .008$ ), with the latter receiving in general higher ratings than the former (see Figure 2), and so was the difference of both the semantically contradictory and the pragmatically ill-formed/infelicitous control items from the well-formed control items ( $\beta = -2.96, SE = .262, p < .0001$ , and  $\beta = -2.344, SE = .242, p < .0001$ , respectively), which scored at the upper part of the scale (see Figure 2), as expected and similarly to Experiment 1.

### 3.3.3. Discussion

The highly significant difference attested between AT LEAST and the well-formed control items, depicted in Figure 2, shows that subjects did not consider the interviewer's questions completely reasonable reactions to the researcher's statements. Having already discussed that this would happen in the case that the researcher's (or A's) statements have in fact given rise to variation effects, we safely draw the conclusion that variation effects do exist with *at least*, replicating the relevant result of Experiment 1, and thus, confirming the first prediction according to the pragmatic view. The second significant finding for *at least*, concerning the difference between the AT LEAST box and that of semantic contradictions one sees on Figure 2, is interpreted as follows: subjects chose not to judge the AT LEAST items similarly to contradictions, but they rather found the former significantly better in reasonableness' terms than the latter. From that I conclude that the unreasonableness or inconsistency caused due to the generation of variation effects in the AT LEAST items is less strong than the one in the case of semantic contradictions, which suggests that those effects are

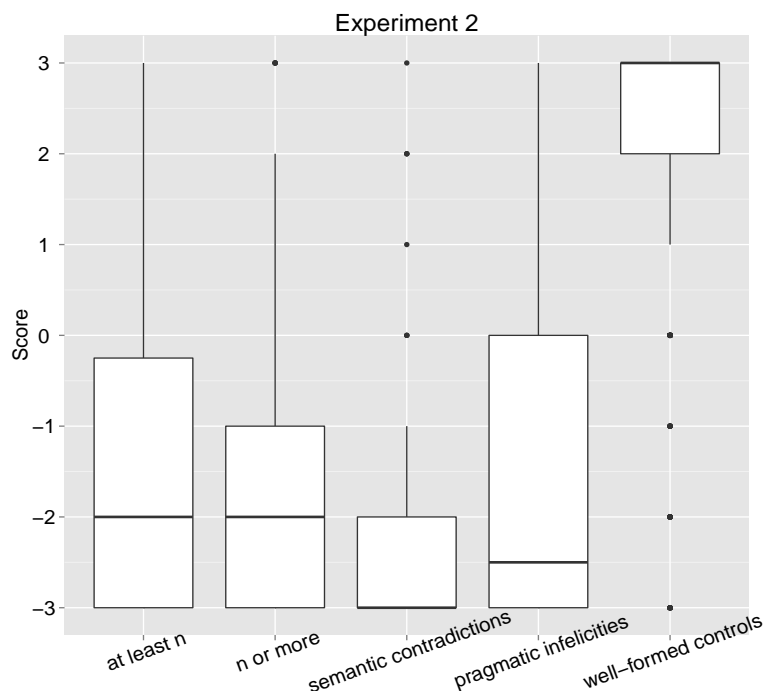


Figure 2: Boxplots of scores per condition. Experiment 2.

pragmatic inferences. This comes to confirm the second prediction of the pragmatic view and also to reinforce the similar finding in Experiment 1. To sum up the findings so far, variation effects arise when *at least* interacts with a universal nominal quantifier and they seem to be generated via a pragmatic mechanism.

As far as N OR MORE is concerned, we observe a quite similar behaviour to AT LEAST, as predicted. Thus, considering the differences found between N OR MORE and the semantically and pragmatically well-formed controls on the one hand, and its marginal difference from the semantic contradictions on the other hand, following the same rationale as above, I conclude that variation effects are available with *n or more* and there are indications that they are not semantically encoded, but rather arise as pragmatic inferences when in the scope of a universal nominal quantifier. It is worth noting that the fact that the comparison of N OR MORE with the semantic contradictions approached, although not reached, significance could perhaps be due to an effect of the low scores (contradictory and infelicitous) control items with disjunction obtained. In other words, subjects considering N OR MORE items as disjunction-seeming, treated them with lower scores, because they gave that kind of scores to the other inconsistent disjunctive items too.

Furthermore, the absence of a significant difference between N OR MORE and AT LEAST or the pragmatically ill-formed control items with disjunction is compatible with an alternative-introducing semantics for *at least* à la Büring (2008) and Coppock and Brochhagen (2013). Moreover, it is in

line with *at least* and *n or more* sharing a similar mechanism generating variation effects; similar to the fc implicature-generating mechanism with disjunction (cf. Alonso-Ovalle 2005).<sup>10</sup>

#### 4. Conclusion

In this paper I investigated experimentally the availability of variation inferences, akin to free choice inferences, which are triggered when lower-bound class B numeral modifiers, such as *at least* and *n or more*, appear in the scope of a universal nominal quantifier. In addition, I tested the semantic/pragmatic strength of those effects, that is, whether they arise as semantic or as pragmatic inferences. According to the dominant view on those inferences, i.e., the pragmatic view, they arise in certain embedded contexts and, in fact, they do so via an implicature-generating mechanism. This study, by means of two experiments, such that one replicated the results of the other, contributes evidence for the pragmatic strength of variation effects with *at least*, thereby providing strong support in favour of the pragmatic view on the derivation of those effects. Further findings this study makes available are in line with an alternative-introducing semantics for *at least* in the style of Büring (2008) or Coppock and Brochhagen (2013), and are also compatible with a common pragmatic mechanism responsible for the derivation of variation inferences with *at least* and of free choice implicatures with disjunction.

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<sup>10</sup>See also Kratzer and Shimoyama (2002), considering their example with *irgendein* in (8), with a disjunctive relevant set of alternatives.



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# Numerical Approximation Using *Some*

Curt Anderson — *Michigan State University*

**Abstract.** In this paper I investigate a use of the English determiner *some* with numerals, as in *twenty-some*. This kind of construction has an approximative interpretation, where it is interpreted as denoting a number within a range. *Some* cannot modify all numerals, with constraints that depend on the syntactic structure of the numeral. I draw parallels between this construction and epistemic indefinites, and provide an analysis based on existing analyses of Spanish *algún*.

**Keywords:** numerals, indefinites, epistemic indefinites, approximation, modification

## 1. Introduction

English *some* normally plays the role of a determiner, appearing before a noun phrase as in the examples in (1). But, *some* can also play a role as an approximator, as in the examples in (2). In these examples, *some* is used by the speaker to provide uncertainty about the precise number of individuals that satisfy the claim.

- (1) a. Some professor was dancing on the table.  
b. Some students were eating lunch.  
c. I put some apple in the salad.
- (2) a. There were twenty-some people at the party.  
b. Michigan State University has 40-some thousand students enrolled.

The uncertainty inherent in these examples with *some* modifying a numeral (what I will label *#-some* in this paper) calls up comparisons with other epistemic indefinites, indefinites which impose knowledge requirements on the speaker. Examples of these include Spanish *algún* and English *some*, which also carry the implication that the speaker is uncertain about the particular referent that makes some claim true.

In this paper, I provide an analysis of *#-some*. First, I provide a compositional syntactic and semantic analysis of the construction. Then, building off of the analysis of *algún* from Alonso-Ovalle and Menéndez-Benito (2010), I propose an analysis of the ignorance component of *#-some*, deriving the uncertainty as an implicature.

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<sup>1</sup>I thank Marcin Morzycki, Erin Zaroukian, Ai Taniguchi, Ai Kubota, Yusuke Kubota, the Michigan State University semanticists, and the audience at *Sinn und Bedeutung 19* for their helpful comments and suggestions regarding this project. All errors are my own.

## 2. Data

The interpretation for the *#-some* construction has both an “at least” component, starting at the modified numeral, and an “at most” component. For the examples in (3), this is illustrated with the paraphrase below the example.

- (3) a. Twenty-some people arrived.  
       “At least 20 and not more than 29 people arrived.”  
       b. I could have it entirely full of small icons and fit a hundred some icons on one screen.  
       “Fit at least a hundred and not more than 199 icons.”  
       c. More than half of the expenditure of eighty-some thousand dollars is for soft costs.  
       “At least eighty thousand dollars and not more than 89 thousand dollars.”

That the *#-some* construction has its lower bound starting at the modified numeral can be shown by creating situations where the truth or falsity of a statement is judged in retrospect. For instance, suppose a speaker had uttered the sentence in (4), and then later on learned that she had only seen 19 dogs during her walk. In this case, (4) is naturally thought of as being false. However, if the speaker had been in a different world and saw 23 dogs during the walk, the utterance in (4) would be judged true in retrospect. The fact that the “19 dogs” interpretation for (4) is untruthful supports the conclusion that the *#-some* construction is bounded on the lower end by the modified numeral.

- (4) I saw twenty-some dogs during my walk today.

- (5) a. *Speaker learns he saw only 19 dogs:*  
       (4) is judged to have been false.  
       b. *Speaker learns he saw 23 dogs:*  
       (4) is judged to have been true.

However, *#-some* isn’t unrestricted; the particular numeral being modified determines whether *#-some* is allowed. For instance, *ten* and *five* cannot be modified by *some* (as in (6)).

- (6) a. \*ten-some  
       b. \*five-some

The explanation for this comes from the syntax of cardinal numbers. Consider a cardinal that does allow modification with *some*, such as *twenty*. *Twenty* can combine with other numerals via addition (additively), forming more complex numbers (like *twenty-two*). *Five* and *ten* do not compose additively with other numerals, as shown in (7). The relevant description of this, then, is

(7) a. \*ten-five (expected: 15)  
b. \*five-one (expected: 6)

### 3. Epistemic indefinites and *#-some*

Cross-linguistically, there exists a class of indefinites known as epistemic indefinites, which enforce requirements on the speaker as to how much the speaker can know about the referent of the indefinite. Examples of epistemic indefinites include (but are not limited to) Spanish *algún* (Alonso-Ovalle and Menéndez-Benito 2010), Japanese *wh-ka* (Sudo 2010; Kaneko 2011; Alonso-Ovalle and Shimoyama 2014), German *irgendein* (Kratzer and Shimoyama 2002; Aloni and Port 2012), Romanian *vreun* (Farkas 2002; Fălăuş 2009), and importantly for this study, English singular *some* (Becker 1999; Farkas 2002).<sup>3</sup>

(8) #Twenty-some people came to the party. In fact, it was exactly twenty-three people.

<sup>3</sup>See Alonso-Ovalle and Menéndez-Benito (2013b) for an overview of epistemic indefinites.

This fact parallels a similar fact with *algún* and *some*, where both also have an ignorance implicature, as demonstrated in (9) and (10). For both determiners, the speaker is forbidden from having certain knowledge about the witness that satisfies the claim.

- (9) #María se casó con algún estudiante del departamento de lingüística: en concreto María SE married with ALGUN student of.the department of linguistics: namely con Pedro with Pedro  
 ‘María married a linguistics student, namely Pedro.’ (Spanish)

- (10) Some professor is dancing on the table. #Namely, Jones.

As noted by Alonso-Ovalle and Menéndez-Benito (2010), the ignorance component of *algún* does not behave like an entailment or presupposition, but behaves like a conversational implicature. Two tests are important in determining this: that conversational implicatures disappear in downward entailing environments, and that conversational implicatures can be reinforced while semantic entailments cannot be reinforced. Based on these tests, the ignorance component of *#-some* should also be analyzed as an implicature.

To demonstrate that conversational implicatures disappear in downward entailing environments, *algún* can be embedded under negation or a verb such as *dudar* “to doubt,” as in (11). Alonso-Ovalle and Menéndez-Benito argue that the ignorance implicature with *algún* disappears in these examples. The ignorance implicature also disappears in the examples with *#-some*; (12-a) expresses that it is not true that any number of people in the range of twenty-one through twenty-nine were at the party, and similarly, (12-b) expresses doubt about any number of people in that range coming to the party.

- (11) a. No es verdad que Juan salga con alguna chica del departamento de  
 not is true that Juan date:subj3s with ALGUNA girl from.the department of  
 lingüística  
 linguistics  
 ‘Juan is not dating any girl in the linguistics department.’  
 (Alonso-Ovalle and Menéndez-Benito 2010, ex. 43)
- b. Pedro duda que Juan salga con alguna chica del departamento de  
 Pedro doubts that Juan date:subj3s with ALGUNA girl from.the department of  
 lingüística  
 linguistics  
 ‘Pedro doubts that Juan is dating any girl in the linguistics department.’  
 (Alonso-Ovalle and Menéndez-Benito 2010, ex. 44)

- (12) a. It's not true that twenty-some people were at the party.  
 b. I doubt that twenty-some people came to the party.

An additional argument that the ignorance component of *algún* is an implicature (and not an entailment) is that implicatures can be reinforced, while entailments cannot be. That entailments cannot be reinforced is demonstrated in (13), where in (a) the entailment from a presupposition cannot be reinforced (*there is a king of France*), and in (b) an entailment from the assertion cannot be reinforced (*Kim was kissed*).

- (13) a. #The king of France is bald, and there is a king of France.  
 b. #Jim kissed Kim passionately, and Kim was kissed.

Alonso-Ovalle and Menéndez-Benito demonstrate that the ignorance component of *algún* can be reinforced, such as with (14). We can see that the ignorance implicit in *#-some* also can be reinforced, as in (15).

- (14) María sale con algún estudiante del departamento de lingüística, pero no  
 María goes.out with ALGUN student of.the department of linguistics, but not  
 sé con quién  
 know:pres1sg with whom.  
 'María is dating some student in the linguistics department, but I don't know who.'  
 (Alonso-Ovalle and Menéndez-Benito 2010, ex. 45d)

- (15) Mary cooked twenty-some pies, but I don't know exactly how many.

The similarities between *algún* and *#-some* suggest that they should get similar treatments. I make use of the analysis of *algún* in Alonso-Ovalle and Menéndez-Benito (2010) in building an analysis of *#-some*. The intuition behind this approach will be that *#-some* is a signal that the speaker cannot identify the particular number that satisfies an existential claim. In the next section, I discuss Alonso-Ovalle and Menéndez-Benito's analysis of *algún*.

#### 4. About *algún*

Spanish *algún* is used when the speaker cannot identify the witness that satisfies some existential claim. Alonso-Ovalle and Menéndez-Benito (2010) model the epistemic properties of *algún* in the following way. First, as a quantifier, *algún* combines with a subset selection function, which models contextual domain restrictions. Second, *algún* lexically encodes a presupposition that this subset selection function yields a non-singleton subset; when the subset selection function com-

bines with the restrictor of *algún* (the NP that *algún* combines with), it must not return a singleton subset. This is formalized in (16). The effect of this is that *algún* competes pragmatically with the determiner *un*, which does not encode the anti-singleton presupposition. Based on the competition with *un*, the hearer can draw certain inferences.

$$(16) \quad \llbracket \text{algún} \rrbracket = \lambda f_{\langle et, et \rangle} \lambda P \lambda Q : \mathbf{anti-singleton}(f). \exists x [f(P)(x) \wedge Q(x)]$$

One reason a speaker might use *algún*, argues Alonso-Ovalle and Menéndez-Benito (2010), is to avoid making a false claim.<sup>4</sup> As *algún* doesn't commit the speaker to any particular referent, a speaker might use *algún* to avoid making a false statement about some referent. To see how this works, consider the utterance in (17), which has the assertion in (a) and the presupposition in (b). Together, the speaker asserts that Juan is in some room of the house, but the anti-singleton constraint forbids the speaker from saying anything about which particular room.

- (17) Juan tiene que estar en alguna habitación de la casa.  
 Juan has to be in ALGUN room of the house
- Assertion:  $\Box [\exists x [x \in f(\mathbf{room}) \wedge \mathbf{Juan is in } x]]$
  - Anti-singleton constraint:  $|f(\mathbf{room})| > 1$

For clarity, suppose that the set of rooms is as in (18), and that Juan can be in any of these rooms. The hearer then has to consider why the speaker didn't utter any of the stronger claims in (19).<sup>5</sup> Because none of the stronger alternatives were uttered, the hearer generates the implicature that the speaker cannot commit to any of them.

- (18) {the bedroom, the living room, the bathroom}

- (19) a.  $\Box [\exists x [x \in f(\mathbf{the-bedroom}) \wedge \mathbf{Juan is in } x]]$   
 $\Box [\mathbf{Juan is in the bedroom}]$   
 b.  $\Box [\exists x [x \in f(\mathbf{the-living-room}) \wedge \mathbf{Juan is in } x]]$   
 $\Box [\mathbf{Juan is in the living room}]$   
 c.  $\Box [\exists x [x \in f(\mathbf{the-bathroom}) \wedge \mathbf{Juan is in } x]]$   
 $\Box [\mathbf{Juan is in the bathroom}]$

<sup>4</sup>Alonso-Ovalle and Menéndez-Benito (2010) also argue that a speaker may use *algún* in order to avoid an exhaustivity inference, which I won't discuss here.

<sup>5</sup> $\Box$  is notational shorthand for a covert assertoric operator. See Alonso-Ovalle and Menéndez-Benito (2010) for more details.

## 5. Representing cardinal numbers

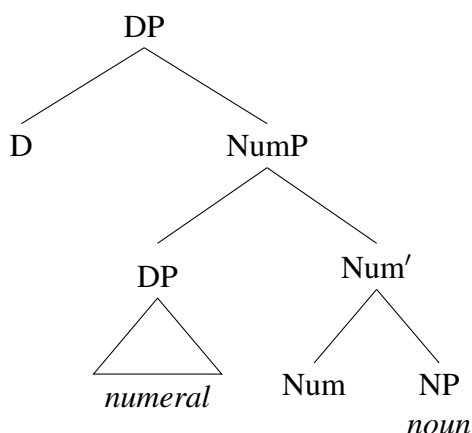
### 5.1. Simple cardinal numbers

In representing the syntax and semantics of cardinal numbers, I borrow from both Solt (2015) and Ionin and Matushansky (2006). First, I assume a degree semantics for cardinal numbers, following a similar move by Solt for quantity words such as *few* and *many*. I treat simple numerals as denoting properties of degrees, type  $\langle d, t \rangle$ , rather than degrees themselves. This makes a cardinal such as *twenty* have the denotation as in (20).

$$(20) \quad \llbracket \text{twenty} \rrbracket = \lambda d [d = 20]$$

Syntactically, numerals are inserted in the specifier of a NumP projection, as in (21). The role of the Num head is to measure the cardinality of an individual, as in (22).

(21) Structure of the DP:



$$(22) \quad \llbracket \text{Num} \rrbracket = \lambda e \lambda d [|x| = d]$$

Solt notes that there is a compositional issue in defining the Num head in this way. Under standard assumptions, the NP that Num combines with is simply a property of individuals,  $\langle e, t \rangle$ . However, Num is of the wrong type to combine with the NP, being type  $\langle e, dt \rangle$ . To solve this, Solt uses the Degree Argument Introduction rule in (23) to put the NP and Num together. The resulting function is now type  $\langle d, et \rangle$ .



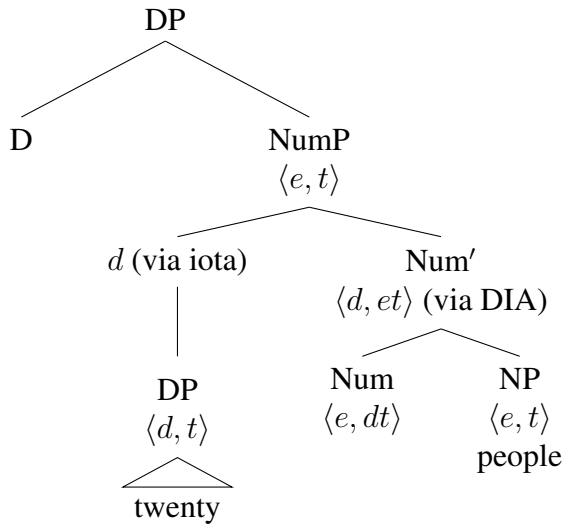
- (23) Degree Argument Introduction (DAI): Solt (2015)  
 If  $\alpha$  is a branching node,  $\{\beta, \gamma\}$  are the set of  $\alpha$ 's daughters, and  $\llbracket \beta \rrbracket = \lambda x_e.P(x)$ ,  $\llbracket \gamma \rrbracket = \lambda x_e \lambda d_d.Q(d)(x)$ , then  $\llbracket \alpha \rrbracket = \lambda d_d \lambda x_e.P(x) \wedge Q(d)(x)$ .

At this point, the denotation of a numeral and Num are incompatible (i.e., Num' needs a degree and not a property of degrees, as denoted by the numeral). This can be fixed quite readily using the iota typeshift (Partee 1987). Generalizing iota to degrees, iota can take a property of degrees to a degree so long as there is a unique degree that can satisfy that property.

- (24) Iota Typeshift (from  $\langle d, t \rangle$  to  $d$ , where  $d$  is the type of degrees):  
 Shift  $P$  to  $\iota d [P(d)]$

Simple numerals like *twenty* can have the iota typeshift applied to them; the function denoted by *twenty*, for instance, is satisfied only by the degree 20. Putting this together, a partial derivation for *twenty people* would look as in (25).

- (25) *twenty people*:



The derivation for *twenty people* would then proceed as follows in (26).

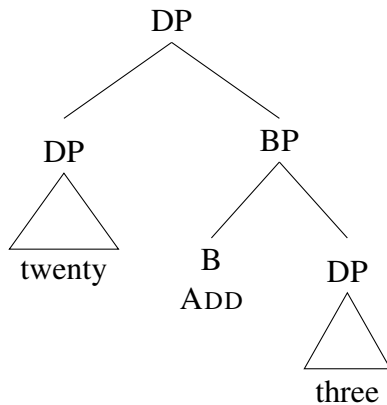
- (26) a.  $\llbracket \text{Num people} \rrbracket = \lambda d \lambda x [ |x| = d \wedge \text{people}(x) ]$  (via DIA)  
 b.  $\llbracket \text{twenty} \rrbracket = \lambda d [d = 20]$   
 c.  $\llbracket \text{twenty} \rrbracket = \iota d.d = 20$  (via iota)

$$d. \llbracket \text{twenty Num people} \rrbracket = \lambda x \left[ \begin{array}{l} |x| = (\iota d.d = 20) \wedge \\ \text{people}(x) \end{array} \right]$$

## 5.2. Complex cardinal numbers

Cardinal numbers can also be complex, such as with *twenty-two* or *eighty-nine*. Examples such as these are semantically additive; *twenty-two* intuitively is formed by the addition of 20 and 2, and *eighty-nine* is intuitively formed by adding 80 and 9. Following Ionin and Matushansky (2006), I assume that additive cardinal numbers are built up syntactically by coordinating smaller cardinal numbers. Ionin and Matushansky attempt to show how coordination naturally gives the correct semantics for additive numerals. (27) demonstrates how an additive numeral such as *twenty-three* would be constructed.

(27) Structure of an additive numeral (*twenty-three*):



A key difference between the formulation in this paper and that of Ionin and Matushansky is the use of a morpheme ADD in the head of the BP, which transparently does the work of additively composing the two numerals. ADD is defined as in (28).

$$(28) \quad \llbracket \text{ADD} \rrbracket = \lambda D \lambda D' \lambda d \exists d', d'' [d = d' + d'' \wedge D(d') \wedge D'(d'')]$$

*Twenty-three* would have the logical form in (29). Essentially, *twenty-three* is split into its component parts, a degree equal to 3 and a degree equal to 20, and the predicate is satisfied by degrees that are equal to the sum of 3 and 20.

$$(29) \quad \llbracket \text{twenty ADD three} \rrbracket = \lambda d \exists d', d'' [d = d' + d'' \wedge \llbracket \text{three} \rrbracket (d') \wedge \llbracket \text{twenty} \rrbracket (d'')]$$

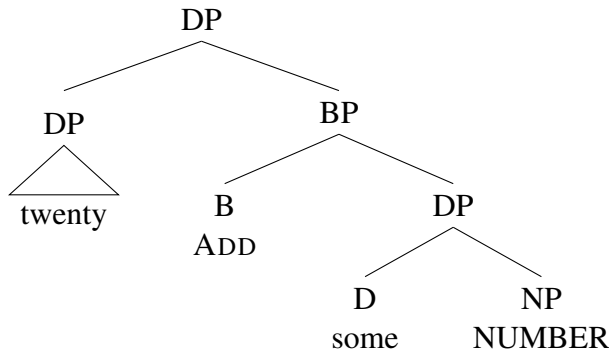
## 6. Proposal

### 6.1. Syntax and semantics of *#-some*

As demonstrated previously, *#-some* is only possible with additive numeral constructions. I analyze the *some* component of the construction as being like a numeral, albeit an indefinite numeral. In keeping with the pragmatic parallels between *#-some* and the more canonical determiner *some*, I analyze *some* here as a determiner as well, taking an NP complement.

I assume that the NP complement to *some* is a silent noun NUMBER (Kayne 2005; Zweig 2005). The meaning for NUMBER will be intentionally weak, being simply the domain of degrees,  $D_d$ .

(30) *twenty-some*:



Based on the similarities with *algún*, I propose treating *some* in a similar way, adopting the formalization for *algún* from Alonso-Ovalle and Menéndez-Benito (2010). Weir (2012) also proposes treating the determiner *some* in a way that parallels *algún*, using the denotation in (31).

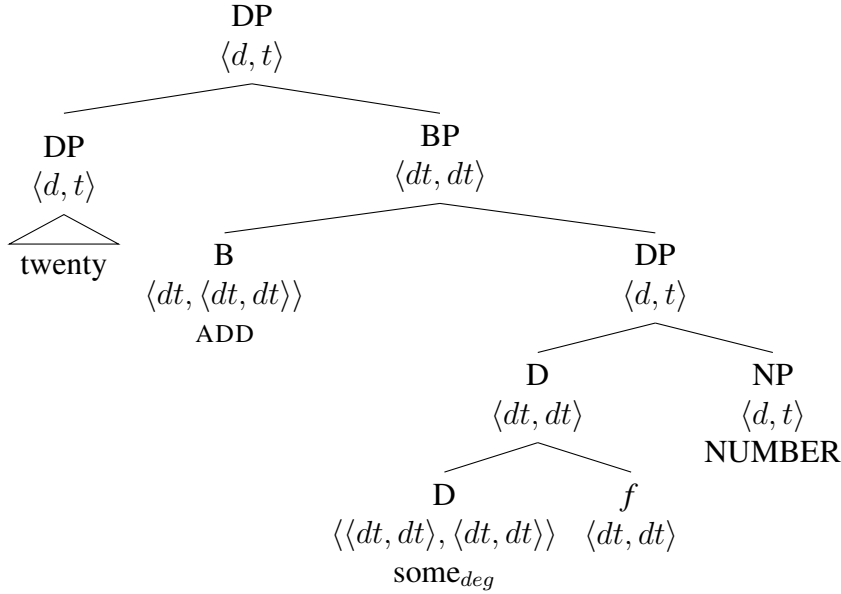
$$(31) \quad \llbracket \text{some} \rrbracket = \lambda f_{\langle et, et \rangle} \lambda P \lambda Q : \mathbf{anti-singleton}(f). \exists x [f(P)(x) \wedge Q(x)] \quad (\text{Weir 2012})$$

However, this will not quite work for *#-some*. In order to combine additively, *some* NUMBER needs to be a property of degrees (and not a generalized quantifier). The revised denotation in (32) for the *some* in *#-some* (which I will refer to as *some<sub>deg</sub>*) reflects these changes, with the existential force stripped out of *some*. Crucially, however, the anti-singleton presupposition remains, as this drives the pragmatic effects of *#-some*.

$$(32) \quad \llbracket \text{some}_{deg} \rrbracket = \lambda f_{\langle dt, dt \rangle} \lambda D \lambda d : \mathbf{anti-singleton}(f) [f(D)(d)]$$

*Twenty-some*, annotated with types, would look as below in (33). Note that the subset selection function ( $f$ ) has been represented syntactically. The logical form, after some reduction, would look as in (34). Essentially, *twenty-some* expresses twenty plus some indefinite number.

(33) *twenty-some*:



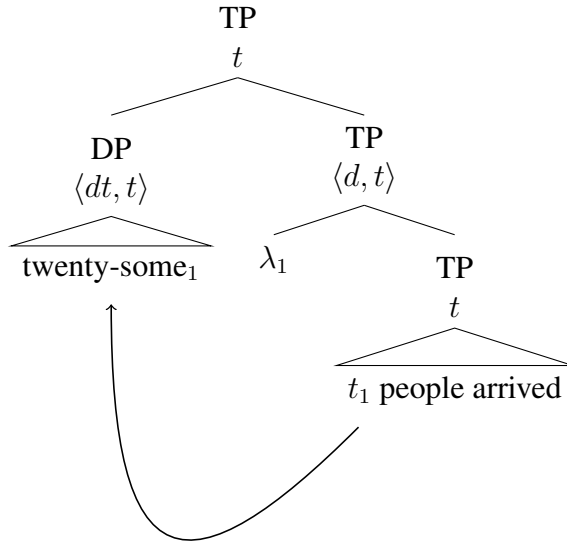
(34)  $\llbracket \text{twenty-some} \rrbracket = \llbracket \text{twenty} [\text{ADD} [\text{some}_{deg} \text{NUMBER}]] \rrbracket$   
 $= \lambda d \exists d', d'' [d = d' + d'' \wedge \llbracket \text{twenty} \rrbracket (d') \wedge \llbracket \text{some}_{deg} \text{NUMBER} \rrbracket (d'')]$

Our indefinite numeral (*twenty-some* in the example above) is still type  $\langle d, t \rangle$ , like other numerals. But, there is still a type clash between the type required of Num' (which is type  $\langle d, et \rangle$ ) and our numerals. This time the iota typeshift cannot a solution to this problem; iota requires a unique degree, but there is no such degree that can satisfy our numeral. The new strategy is to raise rather than lower the type, using the typeshift in (35) (see also Partee (1987)).

(35) Generalized Quantifier Typeshift (from  $\langle d, t \rangle$  to  $\langle dt, t \rangle$ , where  $d$  is the type of degrees):  
 Shift  $P$  to  $\lambda Q \exists d [P(d) \wedge Q(d)]$

By raising the numeral to the type of a generalized quantifier (shifting from  $\langle d, t \rangle$  to  $\langle dt, t \rangle$ ) and Quantifier Raising the numeral, we can circumvent the typeclash. The trace left behind by the movement will be interpreted as type  $d$ , precisely what is required of Num'.

(36)



The derivation for *twenty-some people arrived* proceeds as follows in (37).

- (37)
- a.  $\llbracket \text{SHIFT} \rrbracket (\llbracket \text{twenty-some} \rrbracket)$   
 $= \lambda P \exists d \llbracket \llbracket \text{twenty-some} \rrbracket (d) \wedge P(d) \rrbracket$   
 $= \lambda P \exists d, d', d'' \left[ \begin{array}{l} d = d' + d'' \wedge \llbracket \text{twenty} \rrbracket (d'') \\ \wedge \llbracket \text{some NUMBER} \rrbracket (d') \wedge P(d) \end{array} \right]$
  - b.  $\llbracket t_1 \rrbracket = d_1$
  - c.  $\llbracket \text{Num people} \rrbracket = \lambda d \lambda x [|x| = d \wedge \text{people}(x)]$
  - d.  $\llbracket t_1 \text{ Num people arrived} \rrbracket = \lambda x \left[ \begin{array}{l} |x| = d_1 \wedge \\ \text{people}(x) \wedge \\ \text{arrived}(x) \end{array} \right]$
  - e.  $\llbracket \lambda_1 \exists t_1 \text{ Num people arrived} \rrbracket = \lambda d_1 \exists x \left[ \begin{array}{l} |x| = d_1 \wedge \\ \text{people}(x) \wedge \\ \text{arrived}(x) \end{array} \right]$
  - f.  $\llbracket \text{twenty-some people arrived} \rrbracket$   
 $= \exists d, d', d'' \left[ \begin{array}{l} d = d' + d'' \wedge \llbracket \text{twenty} \rrbracket (d'') \wedge \\ f(D)(d') \wedge \exists x \left[ \begin{array}{l} |x| = d \wedge \\ \text{people}(x) \wedge \\ \text{arrived}(x) \end{array} \right] \end{array} \right]$

## 6.2. Ignorance component of *#-some*

How does the anti-singleton subset selection function create the ignorance inference with *#-some*? The analysis of this parallels that of *algún*, in that the anti-singleton constraint forces the hearer to consider why the speaker uses *#-some* and not some particular number. In doing this, the hearer considers alternatives which are represented with singleton domains. As these are stronger claims, and the speaker did not utter any of them, the hearer can draw the inference that the speaker could not commit to any of them.

To see how this works, consider the utterance in (38), with the assertion in (a). The anti-singleton constraint in (b) prevents the domain of numbers from being a singleton.

(38) Twenty-some people arrived.

- a. Assertion:  $\Box \left[ \exists d, d' \left[ \begin{array}{l} d = d' + 20 \wedge f(D)(d') \\ \wedge \exists x \left[ \begin{array}{l} |x| = d \wedge \\ \text{people}(x) \wedge \\ \text{arrived}(x) \end{array} \right] \end{array} \right] \right]$
- b. Anti-singleton constraint:  $|f(D)| > 1$

For concreteness, suppose that  $D = \{1, 2, 3\}$ . The alternatives that the hearer will consider would be represented as in (39) — namely, the hearer considers that twenty-one through twenty-three people arrived at the party.

(39) Alternatives:

- a.  $\Box \left[ \exists d, d' \left[ d = d' + 20 \wedge d' \in \{1\} \wedge d\text{-people arrived} \right] \right]$
- b.  $\Box \left[ \exists d, d' \left[ d = d' + 20 \wedge d' \in \{2\} \wedge d\text{-people arrived} \right] \right]$
- c.  $\Box \left[ \exists d, d' \left[ d = d' + 20 \wedge d' \in \{3\} \wedge d\text{-people arrived} \right] \right]$

None of the alternatives in (39) were uttered by the speaker, however — the speaker uttered the much weaker (38). From this, the hearer draws the inference that, since none of the stronger alternatives in (39) were uttered, the speaker couldn't commit to any of them, generating the implicatures in ((40)).

(40) Implicatures:

- a.  $\neg \Box \left[ \exists d, d' \left[ d = d' + 20 \wedge d' \in \{1\} \wedge d\text{-people arrived} \right] \right]$
- b.  $\neg \Box \left[ \exists d, d' \left[ d = d' + 20 \wedge d' \in \{2\} \wedge d\text{-people arrived} \right] \right]$
- c.  $\neg \Box \left[ \exists d, d' \left[ d = d' + 20 \wedge d' \in \{3\} \wedge d\text{-people arrived} \right] \right]$

The strengthened meaning of *#-some* is the conjunction of the implicatures and the assertion, deriving the ignorance effect. The hearer reasons that the speaker is ignorant about the particular number of people that arrived at the party because the speaker chose to utter a form that committed herself to no particular number of people.

### 6.3. Overgeneration issues

Although the analysis of *#-some* in the previous sections accounts for the “at least” interpretation, an issue is how to account for the “at most” interpretation. To illustrate this, consider again the example of *twenty-some*, which is analyzed as *twenty-[some NUMBER]*. *Some NUMBER* has a very weak meaning — it simply means some number in the domain of degrees, which could very well be anything. Although *twenty* naturally provides the lower bound, there’s nothing that prevents *twenty-some* from meaning thirty, or forty, or even twelve thousand three, depending on the number that *some NUMBER* refers to.

The situation isn’t hopeless, however; there are a couple preliminary options as to how we might get the “at most” interpretation for *#-some*. The first option is to derive the “at most” reading as a very strong implicature. Suppose that *twenty-some people arrived* has (41) as a set of alternatives. This set includes alternatives that an “at most” reading would rule out, such as *thirty-one people arrived*.

$$(41) \quad \left\{ \begin{array}{l} 20 + 1 \text{ (twenty-one) people arrived,} \\ 20 + 2 \text{ (twenty-two) people arrived,} \\ 20 + 3 \text{ (twenty-three) people arrived,} \\ \dots \\ 20 + 10 \text{ (thirty) people arrived,} \\ 20 + 11 \text{ (thirty-one) people arrived,} \\ 20 + 12 \text{ (thirty-two) people arrived} \end{array} \right\}$$

The use of *twenty-some* explicitly sets one of the numbers to be added as 20. From  $20 + 1$  through  $20 + 9$ , the preferred way to utter these numbers is by composing *twenty* with another number. However, for higher numbers, such as  $20 + 10$  and  $20 + 11$ , the preferred way to lexicalize these is by using *thirty* (similarly,  $20 + 20$  uses *forty*,  $20 + 30$  uses *fifty*, and so on). As the speaker went to the trouble of using *twenty-some* (and not *thirty-some*), Gricean reasoning kicks in and rules out interpretations for *twenty-some* that would preferably be expressed by *some NUMBER* composing with some other number. For example, the interpretation of *thirty-one* for *twenty-some* would be ruled out due to *thirty-some* being a more preferred way of expressing numbers higher than those in the twenties series. In other words, interpretations for *twenty-some* higher than 29 are ruled out due to the spoken forms not using the numeral that *some NUMBER* has composed with.

A second, related proposal also concerns the way the alternatives would be said. The logical form for each alternative for *twenty-some*, at some level, takes the form of  $20 + n$ , where  $n$  is some number. If we take the preferred way that  $n$  would be uttered in each case, we would have the set of alternatives in (42). Inspecting the alternatives, *twenty-one people arrived*, *twenty-two people arrived* and so on up to *twenty-nine people arrived* are all well-formed English sentences. However, *twenty-ten people arrived* and other such alternatives would not be well-formed English sentences, therefore ruling them out.

$$(42) \quad \left\{ \begin{array}{l} \text{twenty-one people arrived,} \\ \text{twenty-two people arrived,} \\ \text{twenty-three people arrived,} \\ \dots \\ \text{twenty-ten people arrived,} \\ \text{twenty-eleven people arrived,} \\ \text{twenty-twelve people arrived} \end{array} \right\}$$

## 7. Conclusion

In this paper I have provided an analysis of what I have called the *#-some* construction, where a cardinal number is affixed with the determiner *some*. This does not happen unconstrained; only particular numerals allow this, and I've argued that this is based on whether the numerals can combine additively with other numerals. Furthermore, this construction has properties which make it behave like epistemic indefinites. I draw parallels between *#-some* and *algún*, and analyze the pragmatics of *#-some* using the analysis of *algún* in Alonso-Ovalle and Menéndez-Benito (2010).

The analysis provided here is also indirect support for analyses of complex determiners in other languages that rely on deriving ignorance via implicature. One example of this is Spanish *algún que otro* (Alonso-Ovalle and Menéndez-Benito 2013a), which expresses that a speaker does not know the precise number of individuals that satisfy a claim. Like *#-some*, *algún que otro* is also constructed from an epistemic indefinite, but unlike *#-some*, *algún que otro* only has an “at least” interpretation (and does not specify a maximum).

Looking more broadly cross-linguistically, we see that other languages such as Japanese also allow for approximation based on the position within the numeral. This can be done in Japanese by inserting an indeterminate pronoun *nan* into a position in the numeral. The indeterminate pronoun behaves like a variable over numbers that could appear in that position.

- (43)    Juu -nan   -nin            -ka -ga    kita.  
           ten   -what -CL(people) -ka -NOM came  
           ‘10 plus  $x$  people came.’



- (44) Nan -juu -nin                -ka -ga    kita.  
       what -ten -CL(people) -ka -NOM came.  
       ‘*x* multiple 10 people came.’

While *#-some* is restricted in that it only appears in additive environments, Japanese allows the indeterminate pronoun to be used in both additive and multiplicative environments. As indeterminate pronouns are used in the construction of indefinites in Japanese (Kratzer and Shimoyama 2002), this represents another case of forms used in indefinites being used for numerical approximation. Further work needs to be done on what connections there are between *#-some*, investigated in this paper, data like the Japanese data above, and *algún que otro*.

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# *Coming to a doxastic agent*<sup>1</sup>

Jefferson Barlew — The Ohio State University

**Abstract.** Fillmore (1975) proposes that using the English deictic motion verb *come* to describe a motion event is acceptable if some contextually given individual is present at the destination of the motion event. In this paper, I show that the individual must only believe herself to be located at the destination. I argue that the meaning of *come* thus includes a doxastic, modal component, and develop an analysis in the dynamic semantics of AnderBois et al. (2015).

**Keywords:** Deictic motion verbs, deictic center, doxastic state, dynamic semantics, *de se*.

## 1. Introduction: The anchoring of *come*

Deictic motion verbs such as *come* denote motion on a path that is related to the location of a specific individual, typically a discourse participant (Nakazawa, 2007, 2009), as illustrated in (1).<sup>2</sup>

- (1) [Context: A is in Cleveland, OH, and B is in NYC. A says *Where is John these days?* B:]
- a. John is in Chicago. However, he is coming to New York tomorrow.
  - b. John is in Chicago. However, he is coming to Cleveland tomorrow.
  - c. #John is in Chicago. However, he is coming to Denver tomorrow.

In (1a) and (1b), *come* is used to describe John's motion to the locations of the interlocutors. In (1c), *come* cannot be used to describe John's motion to some other location. Following Fillmore (1975), the generalization is that *come* is used to describe motion ending at the location of a contextually given individual. I call this individual the **anchor** of *come*, (c.f. Levinson 2003 and Roberts 2014). I call the implication that the anchor is located at the destination the **anchoring conventional implicature** (anchoring CI) associated with *come*. Its CI (Potts 2005) status is motivated below.

Previous analyses of the anchoring of *come* assume that i) the anchoring CI is that the anchor is physically located at the destination and ii) the anchor is determined by the value of a contextual parameter. In this paper, I argue that i) the anchoring CI is that the anchor conceives of herself as being at the destination and ii) the anchor is an anaphorically retrieved discourse referent (dref). I propose an analysis of the meaning of *come* in the dynamic semantics of AnderBois et al. (2015).

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<sup>2</sup>There is also a non-deictic use of *come* in English (Radden, 1996) and *kommen* 'come' in German (Rauh 1981; Antje Roßdeutscher p.c.). This use is ignored here.

## 2. Previous accounts of the meaning of *come*

Deictic motion verbs have received considerable attention, following seminal work by Fillmore, most famously in Fillmore 1975. Cinque (1972), Gathercole (1978), Hockett (1990), Wilkins and Hill (1995), Oshima (2006a), Oshima (2006b) and Nakazawa (2007) all seek either to improve Fillmore's account or to test its applicability in other languages. Fillmore describes four relations between the anchor and the destination that license the use of *come*. The first is that the anchor is located at the destination at utterance time, as in (1). The other three relations are detailed in (2).

- (2) [Context: Ann lives in Gambier, a small town with 1 gas station. She is at the gas station talking on the phone to Beth, who is at her own home. Ann says:]
- a. **Destination is anchor's location at (motion) event time:**  
I went to see Professor Smith in Lupton Hall during his office hours earlier today. While I was there, John **came to Lupton** to meet with Professor Rogers.
  - b. **Destination is anchor's home base:**  
John **came {to my house/to Gambier}** earlier today, but I was not at home.
  - c. **Motion is with anchor:** John **came** to North Carolina **with me** last month.

If none of the relations noted in (2) hold, *come* is unacceptable (e.g. (1c)). Fillmore shows that either the speaker or the addressee is an acceptable anchor across all four relations, as in (1b) (below, for reasons of space, I ignore home base and accompaniment cases for the most part). Fillmore also demonstrates that, in general, the presence of someone other than the speaker or addressee at the destination is not sufficient to make the use of *come* acceptable, as shown in (3).

- (3) [Context: Ann and Beth are at the library chatting. Neither has been to the local gas station today, and neither works there. Neither has been to or works at Lupton Hall. Ann says:]  
# Fred is at the gas station right now. John came {there/to the gas station} earlier today.

(3) shows that anchoring of *come* requires something more than just the presence of a salient individual at the destination. Fred is salient by virtue of having been mentioned recently, but his being at the destination does not make *come* acceptable. (1)-(3) illustrate Fillmore's main empirical generalization: usually, the only acceptable anchors for *come* are speech act participants (SAPs).

Although Fillmore (1975) presents his generalization about the acceptability of different anchors in terms of the SAP/non-SAP distinction, he does not propose an analysis based on this distinction. This is due in part to examples in which the anchor of *come* is not an SAP but a "central character" (Fillmore 1975:67) in a narrative. Fillmore argues that such examples are acceptable when the SAPs do not figure in the events under discussion. To account for both the SAP generalization and central character examples, Fillmore argues, along with e.g. Talmy 1975, Wilkins and Hill 1995,

and Nakazawa 2007, 2009, that the anchor corresponds to the **deictic center**. The deictic center is either a contextually given space-time location, typically the utterance location, or an individual, typically the speaker, depending on the specific theory. On a deictic center analysis, the acceptable use of *come* requires the destination of the motion event to be the location of the deictic center.

One way to model the deictic center is as a contextual parameter in a Kaplanian (1989) context (Taylor, 1988). Though not all researchers make this move explicitly, they do assume that the value of the deictic center is fixed by the context. A non-indexical approach is taken by Sells (1987), who defines a distinguished role for a dref called the PIVOT. The PIVOT determines the anchor for deictic motion verbs and some spatial expressions. Thus Sells assumes that the anchor is anaphorically interpreted, as I do here. Without a precise definition of the deictic center, it is difficult to determine the predictions of deictic center analyses. However, Oshima (2006a) shows that deictic center analyses are empirically inadequate, regardless of the exact definition. First, he demonstrates that the speaker and addressee are not equally acceptable anchors in all contexts, an asymmetry not predicted by deictic center accounts. Second, he argues that deictic center analyses cannot account for examples with multiple anchors, e.g. (4) from Fillmore 1975:68.

- (4) [Context: A and B are talking on the phone.]  
 John will **come** to your house before he **comes** here.

In (4) each instance of *come* has a different SAP anchor. If the anchor of *come* corresponds to a deictic center contextual parameter, then examples such as (4) must involve shifted indexicals and the deictic center parameter must shift without a plausible shifting operator (e.g. an attitude predicate; see Schlenker 2003, Anand and Nevins 2004, a.o.). Examples such as (4) are less problematic for an analysis such as Sells' (1987), but would nevertheless require an account of how the PIVOT shifts from the addressee to the speaker over the course of interpretation.

To account for the speaker/addressee asymmetry and examples such as (4), Oshima proposes that the anchor is a member of a restricted set of individuals whose perspectives the speaker can adopt. He provides a contextual parameter corresponding to this set, the **reference point** (RP), and argues that the RP differs cross-linguistically. For English, the RP always includes the speaker, often includes the addressee, and may include other individuals. The asymmetry in the inclusion of speaker, addressee, and non-SAP in the RP is defined in terms of an implicational person hierarchy:  $1st < 2nd < 3rd$ . The hierarchy encodes the claim that if a person is in the RP in a given context, so are all persons to the left of it. Informally, the hierarchy represents the degree to which a given perspective is available for adoption. The speaker can always maintain her own perspective, and can often adopt the addressee's perspective, accounting for the speaker-addressee asymmetry. The perspectives of other individuals are usually less salient and relevant, and therefore unavailable. Oshima proposes that an utterance with *come* is acceptable just in case some member of the RP is located at the destination of the motion path. One problem with this approach is the claim that different languages use different RPs, since not all languages allow 2nd and 3rd person anchors

(Gathercole, 1978; Nakazawa, 2007). For example, Oshima describes the RP in Sive being merely {speaker}. This makes the RP distinct from other contextual parameters such as speaker and addressee, which are assumed not to vary across languages.

Oshima's RP analysis accounts for Fillmore's standard examples, examples with two anchors, and the speaker-addressee asymmetry. It also accounts for examples noticed but not analyzed by Fillmore (1975) and Hockett (1990) that involve embedding *come* under an attitude predicate:

- (5) [Context: Ann and Beth are in Boston. Bob is in Denver. Ann says:]
- a. Bob believes that {John/you/I} **came** to Denver last week.  
[adapted from Oshima 2006b: example (33)]
  - b. Bob said that {John/you/I} **came** to Denver last week.

In (5a), *Bob* is the subject of the attitude predicate *believes*. Motion to Bob's location, even an SAP's motion, can be described using *come*. Thus, Bob is the anchor. Similar facts obtain for a wide range of attitude and communication predicates, as in (5b). These data show that the speaker can adopt the perspective of an attitude holder even if an SAP figures in the events being discussed, contra Fillmore's claim about central characters. Oshima calls this **deictic perspective shift**.

To account for deictic perspective shift, Oshima (2006b,c) argues that attitude predicates manipulate the RP parameter. To accomplish this context change, Oshima assumes that attitude predicates are lexically ambiguous. One lexical entry does not manipulate contextual parameters. The other shifts the RP parameter from e.g. {speaker, addressee} in a matrix clause to the subject of the attitude predicate in an embedded clause. These "shifty" attitude predicates are thus "monsters" in the sense of Kaplan 1989. Oshima argues that *come* is also lexically ambiguous. It has a pure indexical version anchored to the context of utterance and a shifted indexical version anchored to the most local context, i.e. the one created by the attitude predicate that most closely precedes it. Oshima recognizes that this system predicts that it should be possible for e.g. a shifty attitude predicate to combine with the pure indexical version of *come*, yielding readings that never arise. Therefore, Oshima (2006c) proposes that both shifty attitude predicates and deictic motion verbs have a syntactic feature linking them to a particular RP, either the RP in the context of utterance or the RP in a particular embedded context. He posits a syntactic rule requiring the RP feature index of *come* to match the RP feature index of the closest c-commanding attitude predicate. This syntactic constraint blocks unattested readings. Given these assumptions, Oshima's analysis of the anchoring implication accounts not only for Fillmore's data, but also for deictic perspective shift.

Oshima's analysis significantly improves previous accounts. It suggests that a unified account of SAP and non-SAP anchoring can be developed in terms of perspective taking, which I will further motivate below. Even so, Oshima's account raises a number of theoretical questions. First, it posits an otherwise unmotivated contextual parameter, the RP, and syntactic feature, the RP

feature. Second, it assumes that English has indexical shifting, but only for the RP parameter. Finally, it requires systematic ambiguity in the meanings of attitude predicates and motion verbs.

### 3. The perspectival anchoring of *come*

Oshima argues that the meaning of *come* is perspectival. When a speaker uses *come*, she implicitly adopts the perspective of an individual located at the destination. However, the examples above do not directly motivate this intuition, and Oshima's analysis does not represent it, except by saying that the RP is a set of available perspectives. Rather, Oshima, like deictic center analyses, represents the anchoring of *come* as a set of conditions on the actual location of the anchor. These conditions can be met without making reference to the anchor's perspective at all. In contrast, in this section, I present evidence that the anchoring of *come* is perspectival because it involves the anchor's self-conceived location, not her actual location. When a speaker uses *come* to describe motion to the location of an anchor, she adopts the anchor's perspective by implicitly representing things as they are according to the anchor's conceptualization. To distinguish between these hypotheses, consider examples involving false belief, where the anchor's actual location and self-conceived location are distinct (in contrast to the examples above, where they are the same; thanks to Carl Pollard for suggesting examples similar to these).

- (6) [Context: Mark and Jeremy are in San Diego. Mark mistakenly believes that he is Louis XIV and that they have just arrived in Berlin after visiting Prague. He says:]
- a. i. Mary **is coming** to Berlin shortly.
  - ii. # Mary is coming to San Diego shortly.
  - b. i. Isn't it wonderful that Mary **came** to Prague last week.
  - ii. #Isn't it wonderful that Mary came to San Diego last week.

In (6), when Mark describes motion to a location where believes himself to be or have been, *come* is acceptable. When he describes motion to his actual location, it is not. These examples show that in order for *come* to be acceptable in a matrix clause, the destination of the motion event must be the anchor's self-conceived location. The same pattern is seen with deictic perspective shift in (7).

- (7) [Context: Identical to (6), except that Mark has already told Jeremy (6a-i) and (6b-i). Later, Jeremy is in San Jose, where he tells Amy about Mark's delusion. Then he says:]
- a. i. Mark believes that Mary **is coming** to Berlin soon.
  - ii. #Mark believes that Mary is coming to San Diego soon.
  - b. i. Mark believes that Mary **came** to Prague last week.
  - ii. #Mark believes that Mary came to San Diego last week.

(6)-(7) show that it is the anchor's self-conceived location, not her actual location, that must be the destination for a motion event described using *come*. However, in (6)-(7), the anchor and the

speaker/attitude holder are identical. Thus, the data in (6)-(7) are compatible with the competing hypothesis that it is the person whose views are being represented, i.e. the speaker or attitude holder, who must locate the anchor at the destination. (8), adapted from Oshima (2006b:177), shows that when the attitude holder and the anchor are distinct, it is the anchor's beliefs that matter.

- (8) [Context: Bob is in NYC and believes that Mary is too. However, Mary is actually in LA. Over the phone, Bob tells Mary that John flew to LA. Mary calls another New Yorker:]  
Bob believes that John **came** to LA two days ago.

In (8) the anchor, Mary, but not the attitude holder, Bob, believes that Mary is located in LA.

(6)-(8) demonstrate that the anchoring implication of *come* involves the anchor's self-conceived location, not her actual location. (9) shows that the anchor's conceptualization of her location must be *de se* (Antje Roßdeutscher p.c. observes that the same requirement exists for the anchoring of *kommen* 'come' in German and is discussed in Roßdeutscher 2000). For the implication to be *de se*, the anchor must believe of herself that she is located at the destination of the motion event, and she must know that she believes this of herself (c.f. Morgan 1970).

- (9) [Context: Last week, Chicago baseball player Ernie Banks was injured and became a lucid amnesiac. Ernie was transported to Boston for care. For all he knows, he has never been to Chicago. He has read about the baseball player Ernie Banks, but does not realize that he is Banks. He reads that President Obama was in Chicago 3 weeks ago and met Ernie Banks.]  
a. #[Ernie tells his doctor]: President Obama came to Chicago three weeks ago.  
b. #[The doctor later tells her friend]: Ernie believes that President Obama came to Chicago.

In these examples, the anchor, Ernie Banks, believes of the individual Ernie Banks that he is located at the destination of the motion event. Nevertheless, the examples are unacceptable because Ernie does not realize that he believes this about himself. His belief is not *de se*. However, in a minimally different context in which Ernie regains his memory and his belief is *de se*, the examples in (9) are good. (9b) presents a problem for Oshima's account. To see why, assume that (9b) involves Oshima's shifty *believe*, which shifts the RP to {Ernie Banks}. On Oshima's account *come* triggers the presupposition of *come* that a member of the RP is located at the destination. This presupposition is satisfied in the embedded context. Since Oshima assumes that shifty predicates are freely available, the example is predicted to be acceptable on the shifted reading.<sup>3</sup> In addition to proving problematic for Oshima's analysis the unacceptability of (9b) shows that the locational self-conception must be encoded in the meaning of *come*. The obligatoriness of the *de se* interpretation cannot arise simply because *come* is embedded under an attitude predicate. In general, attitude predicates such as *believe* allow for both *de se* and non-*de se* readings within their scopes.

<sup>3</sup>To solve this problem, Oshima might propose a contextual restriction to certain attitude predicates in certain kinds of contexts. However, it is hard to see how this restriction would be formulated.



#### 4. The anchor is anaphorically interpreted

(10)-(11) provide evidence that the anchor argument is interpreted anaphorically rather than given indexically, i.e. as the value of a contextual parameter. They show that the anchor can be quantificationally bound and participate in donkey anaphora.

- (10) a. Every mother believes that her wayward child **is coming** to Christmas dinner.  
 b. Every man **came** to his wife's surprise party.
- (11) If a man has a child, he **comes** to her room every night to check on her.

In (10a), for each child's motion event, the anchor is her mother. In (10b), for each man's motion event, the anchor is his wife. These anchors are quantificationally bound. (11) demonstrates that the anchor of *come* can participate in donkey anaphora. Donkey anaphora is an anaphoric relationship in which an indefinite inside the scope of an operator introduces a dref which is the antecedent for an expression that is not c-commanded by the indefinite but is within the scope of the operator. In (11), for each man's motion event, the anchor is his child, introduced by the indefinite *a child* in the antecedent of the conditional. Both quantificational binding and participation in donkey anaphora are tests for anaphoricity, following Partee 1984, 1989 and Condoravdi and Gawron 1996. Thus, these data suggest that the anchor of *come* is an anaphorically interpreted implicit argument. On this approach, the analysis of examples involving more than one anchor falls out.

#### 5. Anchoring is conventionally implicated

The data in this section show that the anchoring CI is neither proffered nor presupposed. Here, pre-suppositions are assumed to be conditions on the state of the common ground, following Stalnaker 1978. The fact that the anchoring CI is distinct from the proffered contents of *come* is demonstrated in (12) and (13). (12) demonstrates that the anchoring CI cannot be challenged directly, and (13) demonstrates that it cannot be targeted by entailment canceling operators such as negation.

- (12) [Context: Anna is at a call center talking to Belinda, who called on a land line:]  
 Belinda: President Obama is coming to Chicago today.  
 a. Anna: No, that's not true. He's not coming to Chicago until Friday.  
 b. #Anna: No, that's not true. I can tell by your phone number that you're in Phoenix.
- (13) [Context: Al and Betty live in New York and have been there for the past 5 days. Al says *President Obama is coming to Chicago today*. Betty replies:]  
 #President Obama is **not** coming to Chicago today.

In (12b), Anna attempts to contradict Belinda's assertion by contradicting the anchoring CI that Belinda is (technically, believes herself to be; this simplification is made throughout this section)

in Chicago. However, unlike the proffered content related to Obama's travel, the anchoring CI cannot be challenged directly. (13) illustrates another distinction between the anchoring CI and the proffered contents of *come*. Only the proffered contents can be targeted by entailment canceling operators. In (13), the possible anchors are Al and Betty, who are in NYC. The anchoring CI, in contrast, is that the anchor is Chicago. If the anchoring CI could be targeted by negation, then (13) would be acceptable and true, because the anchoring CI is false. Following Potts (2005), AnderBois et al. (2015), and others, the inability to be directly challenged or targeted by entailment canceling operators are diagnostics for differentiating CIs from proffered contents.

In (14) the anchoring CI contributes new information to the common ground. This provides evidence that it is a CI, not a presupposition.

- (14) [Context: Al and Betty live in New York, and are there today. Betty says:]
- a. #President Obama is **coming** to Chicago today.
  - b. I met this guy Ron on the internet last night. He told me that President Obama is **coming** to Chicago today.

In (14a), the available anchors are the interlocutors, who are not in Chicago. If either is taken to be the anchor, the anchoring CI—that the anchor is in Chicago—conflicts with the common ground. In the minimally different example (14b), Ron is a possible anchor due to deictic perspective shift. Nothing about Ron's location is entailed by the common ground. Nevertheless, the example is acceptable. Thus, (14b) shows that the anchoring CI is not required to be entailed by the common ground before an utterance with *come* is made. Instead, in (14b), the use of *come* contributes to the common ground the information that Ron is (or was) in Chicago. In light of this evidence, I analyze the anchoring CI as a CI. However, it might be possible instead to develop an analysis based on the assumption that the anchoring CI is an easily accommodated presupposition. Nothing about the content of the anchoring CI or its anaphoricity hinges on this distinction.

## 6. A dynamic analysis of the perspectival anchoring of *come*

In this section, I develop an analysis of *come* in the dynamic semantics of AnderBois et al. (2015) (henceforth ABH). One motivation for proposing a dynamic analysis is the observation that the anchor is anaphorically interpreted. Following Kamp (1981) and Heim (1982), one of the principle purposes of dynamic semantics is analyzing anaphora, and the ABH framework is designed to handle anaphora in CI contents. However, nothing here hinges on the choice of this framework.

Following Heim 1982, the meaning of an expression is a context change potential. For any utterance  $\phi$ , the meaning of  $\phi$  is a function from an assignment function to an assignment function. All assignments of values to variables in  $g$  are compatible with the information in the context prior to the utterance of  $\phi$ . All assignments in  $h$  are compatible with the context after it is updated by interpreting  $\phi$ . As a result, interpretation is relative to a pair of assignment functions:  $\llbracket \phi \rrbracket^{(g,h)}$ .

Among the variables that  $g$  and  $h$  assign values to is a propositional variable  $p^{cs}$ .  $p^{cs}$  stores the current context set (CS), i.e. the intersection of the propositions in the common ground, and all of its non-empty subsets. For example, if the current CS is  $\{w_1, w_2, w_3\}$ ,  $p^{cs}$  ranges over  $\{\{w_1, w_2, w_3\}, \{w_1, w_2\}, \{w_1, w_3\}, \{w_2, w_3\}, \{w_1\}, \{w_2\}, \{w_3\}\}$ . An assertion constitutes a proposal to update the common ground. This is equivalent to a proposal to restrict the possible values that  $h$ , the output assignment function, assigns to  $p^{cs}$ . In other words, an informative assertion of  $\phi$  is a proposal to shrink the CS. For example, take the common ground above a starting point. Assume that some proposition  $p$  is false in  $w_1$  and true in  $w_2$  and  $w_3$ . A proposal to update the common ground with  $p$  is a proposal to restrict the values that  $h$  assigns to  $p^{cs}$  to  $\{\{w_2, w_3\}, \{w_2\}, \{w_3\}\}$ . Thus it is a proposal to restrict CS to  $\{w_2, w_3\}$ .

The first step in the interpretation of an utterance,  $\phi$ , is the introduction of a novel propositional dref,  $p$ , to store the content of a new proposal to update the common ground. In order to ensure monotonicity in the common ground,  $p$  is required to be a subset of  $p^{cs}$ . As interpretation proceeds, the content of  $p$  is developed. Assuming  $\phi$  contains no CI content,  $p$  is the interpretation of  $\phi$ , the dynamic conjunction of  $\phi$ 's contents. As an example consider (15). In (15), the notation  $[p]$  indicates the introduction of the propositional dref  $p$ . That is to say,  $[p]$  represents the update from an assignment function  $g$  to an assignment function  $h$  such that  $g$  and  $h$  differ only in the value they assign to  $p$ . The  $[]$  notation is used to indicate dref introduction in this way regardless of the type of dref.  $\wedge$  represents dynamic conjunction. The second conjunct is a test on  $p$  requiring it to be a subset of  $p^{cs}$ . These are standard elements of every update proposal associated with an assertion.

$$(15) \quad \llbracket \text{Jerry sneezed} \rrbracket^{(g,h)} = [p] \wedge p \subseteq p^{cs} \wedge [x_p] \wedge x = \text{JERRY} \wedge \text{SNEEZE}_p(x)$$

The third and fourth conjuncts represent the interpretation of the proper name *Jerry*, following ABH's treatment of proper names. The third of these introduces a dref,  $x$ . The subscript  $p$  on  $x$  relativizes  $x$  to  $p$ . In other words, it says that the partial individual concept  $x$  (of type  $\langle s, e \rangle$ ) is defined over all of the worlds in  $p$ . In addition, ABH require that whenever a dref is introduced as part of an at-issue update proposal, as  $x$  is here, it is defined over  $p^{cs}$  worlds as well. This makes drefs introduced in proffered contents available as antecedents for CIs, which are updates to the worlds in  $p^{cs}$ . Predicates such as *sneeze* are also relativized to worlds. For a predicate to compose with its argument, the domain over which the predicate is defined must be a subset of the domain over which the argument is defined. For details, see ABH 2013:17-18; 31ff. If the utterance of *Jerry sneezed* is accepted, the common ground is updated by setting it equal to its subset  $p$ . This results in the addition of a final conjunct to (15):  $[p^{cs}] \wedge p^{cs} = p$ . With this introduction, it is possible to model the proffered component of an utterance with *come* in ABH's framework.

To model the denotations of spatial expressions, I adopt the simplified version of Kracht's (2002; 2008) framework provided in Barlew 2015:45-47. This includes a type for regions, ranged over here by the variables  $r$  and  $s$ . Following Kracht (2002), the denotations of locative spatial expressions such as *in the park* are sets of regions. AT is a simplification of Kracht's (2002:189) at'

with no time argument. For any individual,  $x$ ,  $AT(x)$  denotes the set of regions touching the region occupied by  $x$ , roughly the meaning of English *at*. I also assume a Davidsonian event semantics, and use the variable  $e$  for events. Following Zwarts (2005), a path is a directed set of locations, represented by bold-faced variables  $\mathbf{p}$  or  $\mathbf{q}$ . Technically, a path  $\mathbf{p}$  is a function from an interval of reals,  $[n, \dots, m]$  to locations in space, where  $\mathbf{p}(n)$  is the start-point and  $\mathbf{p}(m)$  is the end point. Following Talmy (1985), *MOVE* is a basic motion predicate. Following Zwarts (2005), for every motion event,  $e$ , there is a function  $TRACE(e)$  that yields the path of the theme of  $e$ .

Utterances with *come* typically involve prepositional phrases (PPs). Following Zwarts (2005), the meaning of a path-PP is a set of paths. The denotation of *through the tunnel*, for example, is the set of paths that begin outside the tunnel, move into the tunnel, and then exit the tunnel on the other side. *To Denver* denotes the set of paths that begin outside Denver, make exactly one transition to being at Denver, and end at Denver (see Zwarts 2005 for details). The meanings of path-PPs are represented as in 16, where the translation of *to* is assumed to be  $\lambda x \lambda \mathbf{p}.TO(x, \mathbf{p})$ .

- (16) *to Denver* =  $\lambda \mathbf{p}.TO(DENVER, \mathbf{p})$ ; the set of paths to Denver

This characterization of the meanings of path-PPs holds in general, but there is a relevant class of exceptions. Following Kracht (2002), when a predicate selects for a particular type of path-PP as its complement, the PP denotes merely a set of regions. The path preposition itself serves a case marking function. Semantically, such PPs have denotations equivalent in to the denotations of static locative PPs. For example, if it is selected for by a predicate, *to Denver* is translated as  $\lambda r.AT(DENVER, r)$ , the set of regions in or at Denver. Kracht handles the translation between path and static meanings with a specific proposal about the syntactic structure of path-PPs and the principles governing the syntax-semantics interface. However, it could also be handled by assuming lexical ambiguity in the meaning of prepositions. Nothing here hinges on this choice. However, the assumption that path-PPs sometimes denote merely locations is necessary to account for idiosyncratic selection properties of both motion and non-motion related predicates crosslinguistically. Assuming that in some cases path-PPs such as *to Denver* denote merely locations makes it possible to account for otherwise puzzling selectional properties of *come*. In addition to path-PPs *come* often combines with merely location denoting PPs or location denoting adverbs, as in (17).

- (17) a. Ron came in the room.  
b. Leslie came here two hours ago.

In (17), the PP argument of *come* denotes a location, technically a set of regions, rather than a path. This location is required to be the location of the anchor. The same requirement holds of locations denoted by *to*-PP arguments of *come*. For an utterance of *John came to Denver* to be acceptable, Denver must be the anchor's location. However, this restriction does not apply to PPs with prepositions other than *to* (and its variants such as *into*), as shown in (18a).

- (18) a. [Context: The interlocutors are in Salt Lake City.]  
 Tom came through Denver on his way here.  
 b. Tom came through Salt Lake City today, so we had lunch while he was here.

In (18a), the anchor (the speaker) is not in Denver, but *Tom came through Denver* is acceptable. This example thus differs from examples with *to*-PPs or locative PPs. Here, the location involved in the denotation of the PP is not required to be the anchor's location. Furthermore, when *come* combines with a *from* PP, the location involved in the PP denotation cannot be the anchor's location.

(18b) demonstrates another important point about the relation between the anchor's location and the motion path. Contrary to previous claims (Oshima 2006a,b,c; Nakazawa 2007, 2009, a.o.), the meaning of *come* does not require the final destination of the motion path to be the anchor's location. In (18b), Tom's motion path both enters and exits Salt Lake. This is encoded in the meaning of the utterance due to the composition of *through Salt Lake City* with *come*. Similar observations apply to utterances in which *come* composes with PPs with *around*, *by*, *past*, etc.

What all of the examples have in common is that in every case there is motion path with a subpath that that ends at the location of the anchor but begins elsewhere. In other words, there is a subpath of the motion path that is 'to' the anchor's location. In many examples, that subpath is a final subpath of the larger motion path. However, (18b) shows that this is not required. In (18b), the subpath ending at the anchor's location is not a final subpath of Tom's motion because he leaves Salt Lake. With this background, we can express the proffered contents of an utterance with *come*:

- (19)  $\llbracket \text{John came to Denver} \rrbracket^{(g,h)}$  (proffered contents)=  
 a. Static version:  $\exists e \exists \mathbf{p} \exists r. \text{MOVE}(\text{JOHN}, e) \wedge \mathbf{p} \leq \text{TRACE}(e) \wedge \text{TO}(r, \mathbf{p}) \wedge r \in \text{AT}(\text{DENVER})$   
 b. Dynamic version:  $[p] \wedge p \subseteq p^{cs} \wedge [x_p] \wedge x = \text{JOHN} \wedge [e_p] \wedge \text{MOVE}_p(x, e) \wedge [\mathbf{p}_p] \wedge \mathbf{p} \leq \text{TRACE}_p(e) \wedge [r_p] \wedge \text{TO}_p(r, \mathbf{p}) \wedge [y_p] \wedge y = \text{DENVER} \wedge \text{AT}_p(r, y)$

The first conjuncts in (19b) introduce a proposal to update,  $p$ , and a dref  $x$  for the subject John. Then, the interpretation of *come* introduces a dref for an event,  $e$ , and requires this event to be an event of John's motion. The interpretation of *come* also introduces a dref for a path,  $\mathbf{p}$ , which is required to be a subset of John's motion path,  $\text{TRACE}(e)$ . It introduces a dref for a region,  $r$ , and requires  $\mathbf{p}$  to be a path to  $r$ . The interpretation of *Denver* introduces the dref  $y$  and sets it equal to DENVER. The interpretation of *to Denver* contributes the set of regions at Denver. The composition of the meaning of *come* with this set of regions yields the final conjunct stating that  $r$  is at Denver.

Setting aside the doxastic component of the anchoring CI, the CI can be incorporated into the translations in (19) by adding  $\text{LOC}(z, t) = r$ , where  $\text{LOC}$  is a function from an individual and a time to that individual's location at that time (see Wunderlich 1991; Zwarts and Winter 2000; Kracht 2002, 2008; Barlew 2015 for variations on the  $\text{LOC}$  function),  $z$  is an anaphorically retrieved

dref corresponding to the anchor, and  $t$  ranges over utterance time and event time. This conjunct captures none of the generalizations developed above, but it provides starting point.

First, to capture the fact that the anchoring implicature is CI content, I follow ABH and analyze CIs as impositions on the common ground. This means is that unlike all of the content in (19b), CIs do not contribute to the update proposal,  $p$ . Rather they update the common ground automatically by restricting the context set directly. They are tests on the  $p^{cs}$ , the variable storing the context set. Thus, on this system, CIs are elements of a single dimension of content, allowing for anaphoric dependencies between CI and proffered contents. However, they contribute to the common ground in a different way than proffered contents. A translation of *John came to Denver* that continues to ignore the doxastic components of the meaning of *come* is given in (20), where the new CI content is underlined, and  $t_u$  is utterance time and  $t_e$  is event time.

$$(20) \quad \llbracket \text{John came to Denver} \rrbracket^{(g,h)} \text{ Dynamic version (first pass):}$$

$$\underline{[p] \wedge p \subseteq p^{cs} \wedge [x_p] \wedge x = \text{JOHN} \wedge [e_p] \wedge \text{MOVE}_p(x, e) \wedge [\mathbf{p}_p] \wedge \mathbf{p} \leq \text{TRACE}_p(e) \wedge [r_p] \wedge [t_{p^{cs}}] \wedge t \in \{t_u, t_e\} \wedge \text{LOC}_{p^{cs}}(z, t) = r \wedge \text{TO}_p(r, \mathbf{p}) \wedge [y_p] \wedge y = \text{DENVER} \wedge \text{AT}_p(r, y)}$$

In (20), the CI content is distinct from the proffered content in that it contributes directly to  $p^{cs}$ , not  $p$ . The anchoring CI can refer to the dref  $r$  introduced in proffered content and defined relative to  $p$  because all drefs introduced as part of a proposal to update are defined not only in  $p$  worlds but also in  $p^{cs}$  worlds, as discussed above.  $z$  remains free because it is anaphorically retrieved.

(20) incorrectly predicts that  $z$  can take as its value any anaphorically accessible dref. However, Fillmore and Oshima show that the value of  $z$  must be restricted to range over drefs corresponding to individuals whose perspectives are salient and relevant enough to be adopted by the speaker. To limit the antecedents for the anchor argument of *come*, I borrow the independently motivated notion of a **discourse center** from Roberts (2014). Informally, a discourse center is a Stalnakerian (2008) subject, an agent capable of belief, whose doxastic state is relevant in the discourse. At any given point in time, the interlocutors keep track of a limited number of such discourse centers. Minimally, this set includes drefs corresponding to the speaker and the addressee, because their doxastic states are always relevant to the construction of the common ground. In addition, Roberts describes a limited number of ways in which a discourse center corresponding to an individual can be activated. For example, the agents of attitude predicates and main characters in Free Indirect Discourse (FID) contexts correspond to discourse centers (for perspective taking in FID, see Doron 1991 and Eckardt 2011, 2014). Following Roberts, a discourse center is represented as an ordered pair consisting of a dref corresponding to a doxastic agent, written  $d_i$ , and a time,  $t_j$ :  $\langle d_i, t_j \rangle$ . The ordered pair can be abbreviated  $\odot_{i,j}$ , or just  $\odot$  where subscripts are unnecessary. Saying that  $\odot_{i,j}$  is a discourse center is equivalent to saying that  $d_i$  corresponds to an individual whose beliefs at  $t_j$  are relevant in the discourse, where relevance is defined as in Roberts (2012).

With discourse centers, the anaphoric presupposition of an utterance with *come* can be stated as the

presupposition that there is a salient discourse center, ©. Limiting the antecedents of the anchor argument of *come* in this way accounts for the limited range of available anchors. The speaker and the addressee are the anchors most often available because they always correspond to discourse centers. The speaker and addressee are asymmetrically available because, in any given context, one or the other is more salient or relevant. A non-SAP individual is available as an anchor when a drefs corresponding to that individual is the agent component of a discourse center. This happens when the agent's beliefs are under discussion, as in deictic perspective shift. Discourse centers thus serve the same purpose as Oshima's RP but allow for quantificational binding.<sup>4</sup> To represent the anaphoric retrieval of the anchor in the semantics, I assume a function, *AGENT*, from discourse centers to their first elements. The conjunct of (20) that defines the location of the anchor can thus be modified by replacing  $z$  with the underlined material:  $\text{LOC}_{p^{cs}}(\text{AGENT}_{p^{cs}}(\underline{\text{©}}), t) = r$ .

The final step is to account for the doxastic component of the meaning of *come*, i.e. the fact that it is the anchor's self-conceived location that matters for anchoring, not her actual location. To do this, I adopt Stalnaker's (2008) modification of Lewis's (1979) theory of *de se* belief, which models belief states as sets of centered worlds. A centered world consists of the interpretation of a discourse center, i.e. a doxastic agent and a time, plus a world:  $\langle\langle g(d_i), g(t_j) \rangle, w \rangle$ . Belief is modeled using a doxastic accessibility relation on centered worlds, *R*, defined informally in (21).<sup>5</sup> The doxastic state of an individual at a time in a world is the set of *R*-accessible worlds, as in (22). Following Roberts (2014), the doxastic accessibility function, *Dox*, takes a centered world and returns a doxastic state. This function is similar to a modal accessibility relation, and is given in (23). I define the function *DOX* to return only the worlds, i.e. a traditional doxastic state.

- (21) Given a dref,  $d_i$ , corresponding to an agent of belief, a time,  $t_j$ , and a base world  $w$ , and the base centered world,  $\langle\langle g(d_i), g(t_j) \rangle, w \rangle$   
 $\forall d' \forall t' \forall w'. \langle\langle g(d_i), g(t_j) \rangle, w \rangle R \langle\langle d', t' \rangle, w' \rangle$  iff it is compatible with what  $g(d_i)$  believes at  $g(t_j)$  in  $w$  that she is  $d'$  at  $t'$  in  $w'$ .<sup>6</sup>
- (22) The doxastic state of  $g(d_i)$  at  $g(t_j)$  in  $w = \{ \langle\langle d', t' \rangle, w' \rangle | \langle\langle g(d_i), g(t_j) \rangle, w \rangle R \langle\langle d', t' \rangle, w' \rangle \}$
- (23) Accessibility:  $\text{Dox}(\langle\langle g(d_i), g(t_j) \rangle, w \rangle) = \{ \langle\langle d', t' \rangle, w' \rangle | \langle\langle g(d_i), g(t_j) \rangle, w \rangle R \langle\langle d', t' \rangle, w' \rangle \}$
- (24) As uncentered worlds:  $\text{DOX}(\langle\langle g(d_i), g(t_j) \rangle, w \rangle) = \{ w' | \langle\langle g(d_i), g(t_j) \rangle, w \rangle R \langle\langle d', t' \rangle, w' \rangle \}$

<sup>4</sup>As pointed out by Regine Eckardt (p.c.), the level of activation required for discourse center status appears to be relaxed in examples involving quantification. For example, in 10b, the quantificationally bound anchor does not have the agent of an attitude predicate as its antecedent. I have no explanation for this observation.

<sup>5</sup>Carl Pollard (p.c.) points out that modeling attitudes as accessibility relations on sets of worlds causes problems such as requiring attitude holders to have consistent beliefs and to believe all necessary truths. I take these to be general problems for the technology in use in the field, and leave the development of an alternative to future work.

<sup>6</sup>Stalnaker requires *R* to be transitive, Euclidean, and serial. This has the following consequences. First, whatever  $g(d_i)$  believes in her belief worlds, she also believes in the base world (transitive). Second, whatever she believes in one belief world she also believes in the others (Euclidean). Finally, she has beliefs in every world (serial). To these conditions, Stalnaker adds the \* condition. \* requires that ignorance of where in the world one is is a type of ignorance about which world one is in. For discussion, see Stalnaker 2008 and Roberts 2014.

With these definitions in place, it is possible to write a static version of the anchoring CI as in (25). Here, LOC is intensionalized and takes a world argument as well as a time.

(25) **Anchoring CI** of *John came to Denver* (static version):

$\exists w' \in \text{DOX}(\langle \odot, w \rangle) \cdot \text{LOC}(\text{AGENT}(\odot), t, w') = r$ , where  $w$  is the world of evaluation,  $t$  ranges over event time and utterance time, and  $r$  is the location introduced in the proffered content of *come*.

The existential quantification over worlds in (25) predicts that it must merely be compatible with the anchor's doxastic state that she is located at the destination of the subpath, **p**. The doxastic state need not entail that she is there. Another way to describe this claim is to say that the anchoring CI has the force of a weak possibility modal. (26) show that this is correct.

(26) [Context: The speaker and addressee are in New York.]

I might be in France next summer. Are you **coming** to France then?

Representing doxastic possibility in the ABH framework is accomplished by creating a DOX-POSS operator, based on ABH's denotations for entailment canceling operators NOT and MIGHT. Each such operator is defined relative to a propositional variable, here the update proposal  $p$ . In addition it introduces a new propositional dref,  $p'$ , written in superscript. The material within the scope of the operator,  $\phi$ , determines what set of worlds  $p'$  ranges over. The meaning of the operator is to define a relation between  $p'$  and  $p$ . The nature of the relation determines how the content of  $p'$  impacts the update proposal. This kind of meaning is most easily illustrated using a one-place operator, such as ABH's sentential negation operator, NOT. In an utterance with the denotation  $\text{NOT}_p^{p'}(\phi)$ , the set of  $p'$  worlds is the set of worlds in which  $\phi$  holds. NOT introduces the condition  $p \cap p' = \emptyset$ . As a result, the update proposal made by e.g. an utterance of *John did not fall* is to set the common ground equal to  $p$  worlds, i.e. to remove all  $p'$  worlds: the worlds in which John did fall. Things are a bit more complicated in the case of DOX-POSS due to its additional argument, the discourse center  $\odot_{i,j}$ , but it works in essentially the same way. It is defined in (27).

- (27)  $\llbracket \text{DOX-POSS}_p^{p'}(\odot, \phi) \rrbracket^{g,h} = \top$  iff
- a.  $\llbracket \mathbf{max}^{p'}(\phi) \rrbracket^{g,h} = \top$  and
  - b. for all  $\mathbf{w} \in h(p)$ ,  $\text{DOX}_p(\odot_{i,j}, w) \cap h(p') \neq \emptyset$

(27a) requires  $p'$  to be the maximal set of  $\phi$  worlds. (27b) requires that in  $p$  worlds, the intersection of the doxastic state of  $\odot_{i,j}$  and  $p'$  is non-empty. In other words, for any world  $\mathbf{w}$  assigned to  $p$  by  $h$ ,  $\phi$  must be compatible with what  $d_i$  believes at  $t_j$  in  $\mathbf{w}$ . When the DOX-POSS takes the anchor's conceptualization of her own location as its argument, the result is (28). DOX-POSS is relativized to  $p^{cs}$ , not  $p$ , the proposed update, because the anchoring CI is a CI rather than proffered content.



(28) The implication that the anchor believes herself to be located at  $r$ :

$$\text{DOX-POSS}_{p^{cs}}^{p'}(\textcircled{c}, \text{LOC}_{p'}(\text{AGENT}_{p'}(\textcircled{c}), t) = r)$$

(28) requires that the agent of the center believes that she is located at  $r$  at  $t$ . This content is conventionally implicated, so (28) directly restricts  $p^{cs}$  to worlds in which she does. The translation of *John came to Denver* incorporating (28) is given in (29). The anchoring CI is underlined.

(29)  $\llbracket \text{John came to Denver} \rrbracket^{\langle g, h \rangle}$  Dynamic version (final):

$$\frac{[p] \wedge p \subseteq p^{cs} \wedge [x_p] \wedge x = \text{JOHN} \wedge [e_p] \wedge \text{MOVE}_p(x, e) \wedge [\mathbf{p}_p] \wedge \mathbf{p} \leq \text{TRACE}_p(e) \wedge [r_p] \wedge [t_{p^{cs}}] \wedge t \in \{t_u, t_e\} \wedge \text{DOX-POSS}_{p^{cs}}^{p'}(\textcircled{c}, \text{LOC}_{p'}(\text{AGENT}_{p'}(\textcircled{c}), t) = r) \wedge \text{TO}_p(r, \mathbf{p}) \wedge [y_p]}{\wedge y = \text{DENVER} \wedge \text{AT}_p(r, y)}$$

Providing a compositional fragment that generates (29) is beyond the scope of this paper. However, the discussion of (19b) indicates of how elements of an utterance with *come* compose. For reasons of space, representing quantificationally bound and embedded examples is also left to future work.

## 7. Extending the data set

The analysis of *come* presented here accounts for the data in Sections 2 and 3. However, these data do not include accompaniment or home base cases, or attitudes other than belief, as in (30).

- (30) [Context: A, B, and Fred are in Columbus. Fred sits with his eyes closed. A asks why.]  
B: Fred is imagining that he is in France and that you are coming to France soon.

In (30), Fred imagines but does not believe that he is in France. Such examples suggest that the anchoring implication of *come* must be revised to include a wider range of attitudes. Determining which attitudes, how they are related to doxastic states, and how they are to be represented in the translation of *come* is a task for future work. With respect to home base cases, one option is to define a function, HOME that returns the home base of an individual at a time in a world, and then to include in the anchoring CI a disjunct setting  $r$  equal to the home base (c.f. Oshima 2006c). Another option, based on the independent need to account for additional cognitive states, is to assume that individuals can always imagine their home bases and treat home base cases as a subset of imagination cases. Data distinguishing these two approaches has yet to be gathered.

## 8. Conclusion

In this paper, I have demonstrated that an utterance with *come* gives rise to an anchoring CI. The content of the anchoring CI is that the anchor, a doxastic agent whose beliefs are relevant in the discourse, believes herself to be located at the destination of a subpath of the path of the

motion event described using *come*. Previous accounts do not recognize this doxastic, or modal, component of the meaning of *come*, and cannot account for the data presented here. In contrast, the current analysis represents the doxastic component in the lexical semantics of *come* and accounts for the data involving false belief and the *de se*/non-*de se* ambiguity.

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## Double access<sup>1</sup>

Corien Bary — Radboud University Nijmegen

Daniel Altshuler — Heinrich-Heine-Universität Düsseldorf

**Abstract.** In light of counterexamples against Abusch’s analysis of double access sentences we propose a modification that abandons her Upper Limit Constraint (ULC). We then show that rather than being an ad hoc solution, this modification, in fact, fits in neatly with the semantics of the present tense proposed by Altshuler and Schwarzschild. We end the paper by exploring some of the consequences of our modification and discussing some outstanding issues.

**Keywords:** double access, temporal *de se*, tense, attitude reports, speech reports.

### 1. Introduction

This paper is about the occurrence of present tense verbs in the complement of past tense attitude verbs, as for example in (1):

- (1) John thought that Mary is pregnant.

The question that we want to address in this paper is one that has already received a lot of attention in the literature: when can we use such sentences? In addressing this question, the key intuition, going back to Carlota Smith’s work in the seventies, has been that such sentences make reference to two times. Hence the name *double access* used to describe the interpretation of (1). Intuitively, the two relevant times are:

#### TOY ANALYSIS (TO BE REVISED)

1. the time of John’s attitude
2. the utterance time

As for the first time, the time of John’s attitude, note that if Mary’s pregnancy is entirely in the future of John’s thinking, a proper report could be (2) or (3) below, but not (1):

- (2) John thought that Mary would be pregnant.

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- (3) John thought that Mary will be pregnant.

And similarly, if Mary's pregnancy is entirely in the past of John's thinking, a proper report could be (4) or (5), but again it cannot be (1).

- (4) John thought that Mary was pregnant.

- (5) John thought that Mary had been pregnant.

(1) can only be used if the time of the pregnancy includes the time of John's thinking. But the utterance time is relevant too! The use of a present tense in (1) is infelicitous if the pregnancy does not include the utterance time of the sentence. This observation, which goes back to Smith 1978, is independent of whether the pregnancy includes the time of John's thinking. To see this, consider a situation in which the pregnancy only includes the time of John's thinking and not the utterance time. In such a case, a past tense in the embedded clause (viz. sentence (4)) would be used instead of the present.<sup>2</sup>

As first noted by Enç (1987, 637), the claim that (1) involves reference to both the time of the attitude and the utterance time allows one to explain the oddity of (6):

- (6) #John thought two years ago that Mary is pregnant.

In order for (6) to be true, the pregnancy would have to include both the time of the thinking, which is two years ago, and the utterance time. However, since human pregnancy cannot possibly cover a time span of two years, (6) is odd.

Although the toy analysis presented in this section captures what is going on in (1) and (6) at an intuitive level, it has turned out that serious complications arise when these intuitions are made more precise and incorporated into a general theory of tense and attitude reports. In section 2 we will discuss these complications in light of von Stechow's (1995) and Abusch's (1997) pioneering work and see that much of what we said in this section has to be either refined or revised. Then, in section 3, we will introduce Heim's (1994) reformulation of Abusch's (1997) account of double access reports, which was designed to deal with these complications. We point to some further complications involving mistaken-time scenarios and this leads to an amendment in section 4. The amendment involves abandoning the Upper Limit Constraint, a move which we argue is not an ad hoc solution, but, in fact, follows from the semantics of the present tense. In section 5 we discuss

<sup>2</sup>Here we disregard the usage of an embedded historical present, which would yield an interpretation on a par with (4) rather than double access. We discuss such cases in the conclusion.

the consequences of giving up the Upper Limit Constraint and some outstanding issues.

## 2. Complications with the toy analysis: temporal *de se* and *de re*

### 2.1. Temporal *de se*

The first complication concerns the first time parameter of our toy analysis: the time of John's attitude. It has been known for some decennia now that – unlike what we wrote in the previous section! – there is, in fact, no direct link between the time of the event described in the complement of an attitude verb (here the pregnancy) and the time of the attitude itself (von Stechow 1995). We see this in situations where the attitude holder, John, is mistaken about the time.

Imagine that John thinks it is 10 am when it is really 9am. In such a scenario, (7), when uttered at 9 am, is true.

(7) John thinks that it is 10 am.

However, as noted by von Stechow, if we were to let the present tense refer to the time of John's thinking, namely 9 am, and assume that the object of belief is a set of possible worlds (Hintikka 1962), we would derive that John believes that 9 am is 10 am, which is a contradiction. As a consequence, he would believe in the empty set of possible worlds, which means that he would believe literally everything. In other words, we would ascribe to John a belief that is absurd whereas, in fact, he is simply mistaken about the time, something that happens to us all the time.<sup>3</sup>

To solve this puzzle, von Stechow proposed that the present tense refers to the time John *thinks* it is (at the time of his reported thinking), rather than to the actual time at which his thinking takes place. In other words, what is relevant is where the attitude holder locates himself on a time line at the time of his thinking (*the attitude holder's now*) and not where he really is. Combined with Lewis' (1979) reinterpretation of belief as the self-ascription of properties (rather than a propositional operator), we get that John ascribes the time where he locates himself the property of being 10 am, which is a natural interpretation of (7). This discussion leads us to the first modification of our toy analysis: When we interpret the present tense in the complement of an attitude verb we have to relate that to the attitude holder's now, rather than to the time of the thinking itself:

<sup>3</sup>See Bary and Maier (2009) for a discussion of the analogy between this argument and a similar argument in the nominal domain.

The event described in the complement includes:

## FIRST MODIFICATION

1. ~~the time of the attitude~~      the attitude holder's now
2. the utterance time

## 2.2. Temporal *de re*

The second complication concerns the utterance time. Here the question is not whether it plays a role, but what role it plays.

Let's start with an obvious observation. (1), repeated below as (8), describes what the world looks like *according to John*.

(8)      John thought that Mary is pregnant.

As observed by Abusch (1997, 40), (8) can be true even if Mary was never pregnant in the real world. Abusch provides evidence for this claim by observing that a report like (9) is not contradictory:

(9)      John thought that Mary is pregnant but she is simply overeating.

In light of these data, Abusch concludes that whatever the correct semantic analysis of (8) is like, it should not entail actual pregnancy of Mary (in the past, present or future).

But the sentence is not entirely a description of the world *according to John*. When he had this thought, John was not making a prediction about the utterance time (e.g. January 11, 2015 if we utter this sentence at the time of our writing this paper). That is, John was not making a prediction about a time that would be future from his point of view. He was just thinking about how things were at his time. This means that although the sentence does describe John's attitude and although the sentence is about the utterance time (and therefore that time does, in fact, play a role in the semantics of the sentence), that time need not necessarily have played a role in John's mind. Based on this intuition, Abusch proposes that in addition to a *de se* component, the interpretation of the present tense in (1) also has a *de re* component.<sup>4</sup> As a result we get:

<sup>4</sup>It should be noted that there have been arguments put forth that Abusch's intuitions don't warrant a *de re* analysis of the present tense (Gennari 2003, Smirnova 2009 and Klecha 2014). We don't take a stance on this issue here though ultimately, in section 4.2, we adopt an analysis in which the present tense is not interpreted *de re*. Until section 4.2, we



the **believed** event described in the complement includes:

**FINAL VERSION**

- |                              |                                    |              |
|------------------------------|------------------------------------|--------------|
| 1. the attitude holder's now |                                    | <i>de se</i> |
| 2. the utterance time        | but not necessarily in John's mind | <i>de re</i> |

This remarkable combination of *de se* and *de re* interpretation forms a true challenge for a semantic analysis of double access. In the next section, we outline Heim's (1994) reformulation of Abusch's (1997) analysis that attempts to meet this challenge.

### 3. Abusch's account of double access Heim-style

Abusch argues that a semantic analysis of double access sentences requires acquaintance relations about times. In this paper we follow Heim's (1994) reformulation of Abusch's (1997) account who uses the term *time concepts*. She describes time concepts as 'the meanings of descriptions by which a thinker might represent a time to herself' (Heim, 1994, 155). Technically, a time concept is a function from world time pairs to times. Here are two examples:

- the time concept of 'today' is a function that maps each  $\langle w, t \rangle$  to the day of  $t$
- the time concept of 'the last time the lights went out' is a function that maps each  $\langle w, t \rangle$  to the last  $t' \prec t$  such that the lights went out at  $t'$  in  $w$

In order to account for the observations that we discussed in the previous section, Heim proposes that (1) (= (8)) is uttered felicitously only if the context provides a time concept  $f$  that satisfies the following two constraints:

#### HEIM CONSTRAINTS

1.  $f$  evaluated with respect to the attitude holder's world and now (at the time of his attitude) should not follow the attitude holder's now completely
2.  $f$  evaluated with respect to the actual world and the time of the attitude should overlap with the utterance time

And if the felicity conditions are fulfilled, the sentence is true iff in all worlds  $w'$  and times  $t'$  compatible with John's beliefs in the actual world at the time of the attitude, the time where John locates himself has the property of being a Mary-is-pregnant time in  $w'$  at  $t'$ .

will continue to talk about the *de re* component in the interpretation of the present tense since it is vital in Abusch's analysis.

Let's see how this yields what we have labelled as **FINAL VERSION** in the previous section. The first condition captures the *de se* component: it requires that the time-concept implies non-futurity *for John*. (We will later come back to why the implication is non-futurity and not presentness). The second condition captures the *de re* component. The attitude holder has a time concept in mind and this time concept happens to yield the actual utterance time (when evaluated with respect to the actual world and time of the attitude), but the fact that it yields this time is not because the attitude encodes it.

Let's now take a look at a concrete example (from Abusch and discussed by Heim). Imagine that John sees Mary having a big belly and thinks that Mary is pregnant while the cause for right now visible big belly lasts. Then  $f$ , the time concept, is the meaning of the description 'while the cause for her right now visible big belly lasts'. This is a function that maps each  $\langle w, t \rangle$  to the maximal interval that includes  $t$  during which the cause of her big belly holds. The **HEIM** constraints now make predictions about the felicity conditions of the report in (1), given this time concept. The first constraint is satisfied trivially: we feed the function corresponding to the time concept with the attitude holder's world and now. Since the function returns an interval that includes the time of the input, i.e. the attitude holder's now, it is a fortiori an interval that is not entirely in the future for John. The second constraint is satisfied only if whatever it was that caused the state of Mary's big belly at the time of the attitude still holds at the time of the utterance, or put simpler, if Mary still has a big belly at the utterance time. In this way, Abusch and Heim, on the one hand, account for the intuition described in section 1 that the pregnancy has to include the actual utterance time and, on the other hand, avoid that the semantics assigned to the sentence entails any actual pregnancy for Mary.

Assuming the attitude holder is not mistaken about the time, the **HEIM** constraints also explain why (6), repeated here as (10), is odd irrespective of a particular (non-mistaken time) scenario and irrespective of a particular time concept.

(10) #John thought two years ago that Mary is pregnant.

The second **HEIM** constraint states that the time yielded by  $f$  when evaluated with the respect to the actual world and time of the attitude should overlap with the actual utterance time (see Figure 1 below). The past tense tells us that the time of the attitude is in the past of the utterance time and the time adverbial specifies that there is two years in between the two. The fact that we have assumed that the attitude holder is not mistaken about the time gives us that attitude holder's now is identical to the time of the attitude. And finally, the first constraint tells us that  $f$ , when evaluated with respect to the attitude holder's world and now, should not follow the attitude holder's now completely. This leaves open the possibilities that it either overlaps with the attitude holder's now (see Figure 1 below), or is entirely in the past of the attitude holder's now, but either way, for the sentence to be true, the pregnancy John believes in would have to include a time span of more than two years, which is impossible (given that John is well-informed about basic human affairs).

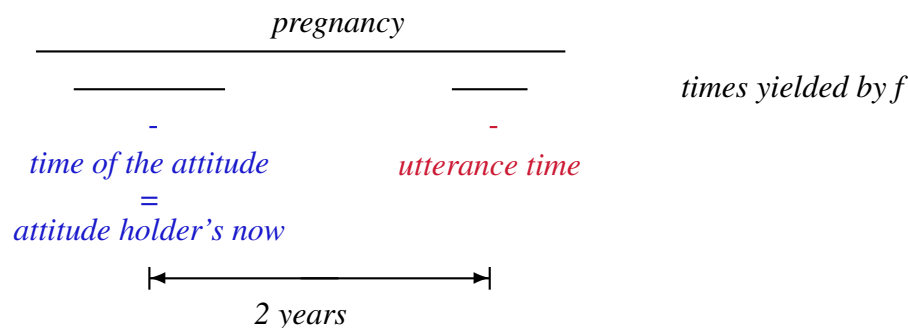


Figure 1: the infelicity of (6)

But what if the attitude holder is mistaken about the time? Recall that this is not a marginal case: we made the first modification in section 2 (from time of the attitude to attitude holder's now) exactly because people can be mistaken about the time (and often are mistaken about the time). Note also that in the concrete example that we gave, where we took for  $f$  the meaning of the description 'while the cause of her right now visible big belly holds', the two constraints did give the right predictions without any specification of whether or not the attitude holder was mistaken about the time. And it turns out that this holds for many other plausible time concepts too: they make the correct predictions irrespective of the scenario (see Heim 1994 for many such time concepts in various contexts). However, it is also possible to construct counterexamples in mistaken-time scenarios.

Imagine that today John declares: 'I think that Bill's 40th birthday was some time ago and that Mary was pregnant on that day'. Let's assume that John is mistaken. In fact, Bill's 40th birthday is today, i.e. the day of John's thinking! As noted by Heim (1994: fn. 28) there is a strong intuition that in this context, (11) could not be uttered felicitously.

(11) John thought that Mary is pregnant.

Let's now see why the wrong prediction is made by the **HEIM** constraints. In the scenario just described, it seems natural to take the time concept to be the meaning of the description 'on Bill's 40th birthday'. The scenario satisfies the first constraint: the time concept evaluated with respect to John's world and now is in the past of John's now (for John 'on Bill's 40th birthday' is in the past of where he locates himself) and hence not completely in the future. The second constraint is also satisfied in the scenario: evaluated with respect to the actual world and time the time concept yields today, a time that can overlap with the actual utterance time. Since both constraints are satisfied, the prediction is that the sentence is felicitous in this context, contra to our intuitions.

Heim suggests that we could circumvent this problematic prediction by generally banning so-called *time neutral concepts*. A concept such as 'on Bill's 40th birthday' is temporally neutral

since there is nothing about the meaning of ‘on Bill’s 40th birthday’ that tells us where it is located with respect to the utterance time. While this suggestion does, indeed, solve the problem, it is a stipulation; nothing is said about *why* time neutral concepts ought to be ruled out. In light of this, we believe that Heim’s reformulation of Abusch’s analysis has hit a serious road block, one that requires an amendment.

#### 4. An amendment to HEIM’s constraint

##### 4.1. Presentness

The attentive reader might have observed already that the counterexample could only arise because the first **HEIM** constraint had quite a relaxed temporal relation: non-futurity rather than presentness. The reader might also have noticed that so far we haven’t seen any arguments for why it should be non-futurity. In fact, purely based on the discussion in section 2.2 (viz. **FINAL VERSION**: ‘the event described *includes* ...’) the choice for presentness would have been more natural. This, in fact, is our proposed solution to the problem identified in the previous section. That is, the first **HEIM** constraint should have a stricter temporal restriction: presentness rather than non-futurity. This amendment is outlined below (in bold):

##### HEIM CONSTRAINTS, AMENDED VERSION

1. *f* evaluated with respect to the attitude holder’s world and now (at the time of his attitude) **should overlap the attitude holder’s now**
2. *f* evaluated with respect to the actual world and the time of the attitude should overlap with the actual utterance time

Let’s now see why this amendment allows us to rule out “John thought that Mary is pregnant” as a report of what happened earlier today, namely when John declared: “I think that Bill’s 40th birthday was in the past and that Mary was pregnant on that day” despite that fact that Bill’s 40th birthday is really today. As before, let’s assume that the time concept is the meaning of the description ‘on Bill’s 40th birthday’. In this case, the scenario does not satisfy the first constraint above: the time concept evaluated with respect to John’s world and now is in the past of John’s now (for John ‘on Bill’s 40th birthday’ is in the past of where he locates himself) and hence not overlapping (as is now required). The fact that the second constraint is satisfied is now besides the point.

Given the relative ease with which we were able to solve the problem, the natural question to ask is: why didn’t Abusch and Heim posit presentness rather than non-futurity? As we shall see in section 5, the reason is tied to the Upper Limit Constraint. Before discussing this constraint, we would now like to show how our amended constraints follow straightforwardly from the semantics of the present tense proposed by Altshuler and Schwarzschild (2013).

## 4.2. The meaning of the present tense

Altshuler and Schwarzschild (2013) proposed that the present tense in English is an amalgam of both a relative and an absolute present. More concretely, they proposed that the English present demands truth at: (i) the local evaluation time and (ii) at or after the utterance time. (i) is the relative tense component. It is reminiscent of the first **HEIM** constraint that we amended in the previous subsection. The key difference is that (i) incorporates the notion *local evaluation time*, which is more general than the attitude holder's now; the *local evaluation time* is also relevant for characterizing simple sentences like 'John is happy', where it is simply the utterance time (Abusch 1997). As for (ii), it is the absolute tense component. It is reminiscent of the second **HEIM** constraint. The key difference is that (ii) is more general, imposing a non-past requirement (rather than a purely present requirement). This is motivated by well-known examples such as (12), which is true if the described fish is born after (12) is uttered.

(12) John will buy a fish that is alive. (after Ogihara 1989)

Altshuler and Schwarzschild make the common assumption that the local evaluation time for the interpretation of the present tense of *is* in (12) is a time, introduced by *will*, in the future of the utterance time. Since (i) demands truth at this time and this time is in the future of the utterance time, the state of the fish being alive is in the future of the utterance time and therefore (ii) is satisfied automatically. In other words, the contribution of the absolute component of the present tense in (12) is indistinguishable from that of the relative component.

Now consider (13):

(13) John bought a fish that is alive.

Here, there is no intensional operator (e.g. an attitude verb or *will*), so the local evaluation time for the interpretation of the present tense *is* is the utterance time (just like in 'John is happy'). Since the local evaluation time is the utterance time and (i) requires truth at this time and (ii) at or after this time, the (correct) prediction is that the fish is alive at the utterance time. Note that, once again, the absolute component does not add any restrictions other than what is already demanded by the relative component: it simply requires a looser relation to the same time. So why do we need the absolute component at all? In fact, the ingenuity of Altshuler and Schwarzschild's proposal is that the relative and absolute components of the present tense are indistinguishable in all cases but one: double access reports of the kind that we have been considering.

Altshuler and Schwarzschild propose a quantificational analysis of tense with intensional domain restriction. These domain restrictions involve time concepts which are like Heim's time concepts,

with one key difference: the times that they describe are not (in any way) determined by *res* movement or some other *de re* mechanisms (as is the case in Abusch 1997, Heim 1994 and many analyses of tense thereafter<sup>5</sup>). Altshuler's and Schwarzschild's theory is thus an alternative to a *de re* analysis of double access (cf. Gennari 2003, Smirnova 2009 and Klecha 2014).

Let us consider how Altshuler and Schwarzschild would analyze our core example, repeated below in (14).

(14) John thought that Mary is pregnant.

Reformulated in terms of  $f$  to facilitate a comparison with Heim's analysis, Altshuler and Schwarzschild would capture the meaning of this report by the formulas below, in (15) and (16), where  $f$  (and  $f'$  for the location of the matrix event) continues to denote a time concept, only now functioning as the restrictor of a quantifier;  $s^*$  and  $w^*$  denote the utterance-time and the utterance-world of (14) respectively;  $w_0$  and  $t_0$  denote the (local) evaluation world and time respectively.

(15)  $\lambda w_0. \exists t (t \prec s^* \wedge t \in f'(w_0, s^*) \wedge \text{think}(\text{john}, w_0, t, \phi))$ , where  $\phi =$  (16)

(16)  $\lambda t_0 \lambda w_0: t_0 \in f(w_0, t_0) \wedge \exists t' (t' \succeq s^* \wedge t' \in f(w^*, t)) . \forall t'' (t'' \in f(w_0, t_0) \rightarrow \text{be.pregnant}(w_0, t'', \text{mary}))$

According to the formula in (15), John's thinking that  $\phi$  took place in the world of evaluation  $w_0$  at a time  $t$  that is prior to the utterance time  $s^*$ . The location of this event is further restricted by the condition  $t \in f'(w_0, s^*)$ . Since we are here mainly interested in the interpretation of the embedded present tense we simply note that the effect of this condition is similar to that of the use of *reference times* or *topic times* in much of the literature on the interpretation of tense and aspect in discourse.

As for the formula in (16), things are more complex. The crucial thing to notice is that the aforementioned **relative** and **absolute** components of the present tense are treated as presuppositional constraints on the time concept  $f$ : the **relative** component states that  $f$  evaluated at  $w_0, t_0$  must include the local evaluation time  $t_0$ ; the **absolute** component requires that this  $f$ , when evaluated with respect to  $w^*, t$  includes a time  $t'$  that is at or after the utterance time  $s^*$ . Apart from these presuppositions on  $f$ , the present tense also contributes a universal statement to the assertion, namely that Mary's pregnancy state in  $w_0$  holds throughout the time interval  $t''$  described by  $f$  in  $w_0$  at  $t_0$ . If we assume that  $f$  is the *today*-function, then given the universal statement in the assertion of (16), it must have been compatible with what John thought (in the past) that Mary continued to be pregnant throughout the day—in fact, the whole day—not just after John's utterance, but also at the

<sup>5</sup>See Bar-Lev 2014 for a recent discussion.

utterance time of (14). This is the hallmark of the double access reading that we have been after.<sup>6</sup>

At this point, it is helpful to summarize how this analysis is related to our earlier observations about Heim's reformulation of Abusch's analysis. We observed that in a particular case of mistaken identity (involving Bill's 40th birthday), the **HEIM** constraints made the incorrect predictions. To that end, we proposed the following revision (in bold):

#### HEIM CONSTRAINTS, AMENDED VERSION

1.  $f$  evaluated with respect to the attitude holder's world and now (at the time of his attitude) **should overlap the attitude holder's now**
2.  $f$  evaluated with respect to the actual world and the time of the attitude should overlap with the actual utterance time

And now we attempted to show that the above constraints follow straightforwardly from the semantics of the present tense proposed by Altshuler and Schwarzschild. The reader can check that if  $f$  in (16) is assumed to be the meaning of the description 'on Bill's 40th birthday', which is prior to the attitude holder's now (in the context considered), then we predict a presupposition failure.

### 5. ULC and beyond

While we have been able to revise Heim's reformulation of Abusch's analysis to account for the mistaken identity case (involving Bill's 40th birthday), there is a cost—one that may be considered quite significant in light of some well-known analyses of embedded tense.

To see what is at stake, consider the report in (17):

- (17) John thought that Mary was pregnant.

The intuition behind (17) is that it can be used to report John saying (18) and (19), but not (20):

- (18) Mary was pregnant.

- (19) Mary is pregnant.

- (20) Mary will be pregnant.

---

<sup>6</sup>Of course,  $f$  need not be the *today*-function. We leave it to the reader to test the predictions of (16) when  $f$  describes some other time, as determined by the context.

If we treat the embedded past tense as being absolute, we would say that Mary's pregnancy is located at some time prior to the utterance time. As such, we correctly predict that (17) is compatible with a situation in which the pregnancy held at the time of John's now (assuming he is not mistaken about the time) or prior to it. This captures the correlation between (17) and (18)-(19).

However, as noted by Abusch (1997), the absolute analysis also predicts that (17) is compatible with a situation in which the pregnancy held after John's now (assuming he is not mistaken about the time) and before the utterance time. And as noted above, (17) cannot be used to report John saying (20). This intuition can be sharpened by the contrast below:

(21) In February, John thought that Mary was pregnant the month before.

(22) ??In February, John thought that Mary was pregnant the month after.

Abusch showed that both of these contrasts can be accounted for by the Upper Limit Constraint (ULC), which says that the embedded event cannot be later than the local evaluation time.<sup>7</sup> The ULC would directly rule out (17) as a report of (20) since it would prevent Mary's pregnancy from being understood as taking place after John's now.

In addition to ruling out cases like (22), Abusch shows that the ULC could be used to constrain so-called *de re* pasts. These are cases where a past time is introduced in an extensional context and then is re-used in an intensional context, e.g.:

(23) John found an ostrich in his apartment yesterday. Just before he opened the door, he thought that a burglar attacked him (Abusch 1997: 4).

Abusch notes that without the ULC, the following would be predicted about the discourse above: the embedded tense on "attack" is anaphoric on the past tense which denotes the time of the door opening. From this it follows that John's original thought must have been: "When I open the door, a burglar will attack me". But then, if the door opening is later than John's thinking, the burglar's attack (which is co-temporal with the opening) must also be later than the thinking. The problem is that this is not a possible interpretation of "He thought that a burglar attacked him" in (23). The solution, of course, is to adopt the ULC, which directly rules out this interpretation.

At this point, it should be noted that the data discussed in this section could be used to motivate the non-futurity in the initial **HEIM** constraint, repeated below. That is, the first constraint is a version of the ULC.

<sup>7</sup>There have been various implementations of this constraint (see e.g. Schlenker 2004 for discussion). In what follows, our discussion of this constraint will apply equally to all formulations that we know of.



## HEIM CONSTRAINTS

1.  $f$  evaluated with respect to the attitude holder's world and now (at the time of his attitude) **should not follow the attitude holder's now completely**
2.  $f$  evaluated with respect to the actual world and the time of the attitude should overlap with the actual utterance time

Since the non-futurity is something that we got rid of in order to account for mistaken-time cases, we now face the question of whether our account suffers from not being able to explain the data above. The short answer is “no”. The longer answer will take some time to unpack and this is the aim of the remainder of this section.

To begin with, note that our choice to analyze the (modified) constraints above as following from the meaning of the present tense means that our proposed analysis is indifferent to the data discussed above, which centers around the behavior of an embedded past tense. In fact, the proposed analysis of double access (i.e. the embedded *present* tense cases) leaves open the possibility to use the ULC (in one way or another) to explain the past tense data discussed in this section so far. However, we don't think that this is the correct way to go. To begin with, Abusch (1997) herself points out that an analysis that treats the past tense as being absolute cannot explain examples like those in (24), regardless of whether the ULC is adopted. Here, the past tense on “were” in the most embedded clause does not denote a time prior to the utterance of (24) (and arguably does not denote a time prior to any other time alluded to in the sentence, a point to which we return below).

- (24) John decided a week ago that in ten days at breakfast he would say to his mother that they were having their last meal together (cited in Abusch 1997, after Kamp and Rohrer 1983).

Moreover, Bar-Lev (2014) has recently argued that an absolute account of the past tense that assumes the ULC has a problem with quantified examples like (25):

- (25) Every doctor said Mary was pregnant.

Bar-Lev observes that (25) is judged to be true if either all the doctors said “Mary was pregnant” or they all said “Mary is pregnant”; but not if some of them said “Mary was pregnant” and some said “Mary is pregnant”. That is, (25) does not have a “mixed reading”. However, it not clear how an absolute account of the past tense that assumes the ULC could rule out the mixed reading, since such a reading is in accordance with the ULC. In contrast, a relative past tense account could rule out the mixed reading and, crucially, such an account need not assume the ULC.

In what follows, we would like to outline how a relative past tense account could also explain the other data considered in this section, without needing to posit the ULC. The crux of the analysis is

that the past tense locates the described event prior to the local evaluation time. This straightforwardly rules out (22), where the pregnancy is understood to hold after John's now, and it explains why (17) could not be used to report John saying (20). Moreover, we could explain (23) by saying, following Altshuler and Schwarzschild 2013, that the meaning of the past tense (like the present) involves quantification with time concepts being domain restrictors. The idea would be, then, that the anaphora in (23) does not involve *de re* pasts, but rather the sharing of contextually restricted time concepts.

The one potential problem with this relative tense account is that it does not seem to account for the correlation between (17) and (19). There are two possible ways to go here. If one makes the aforementioned assumption that (17) is ambiguous (i.e. it has two truth-conditionally distinct readings corresponding to whether it is used as a report of (18) or (19)), then one could, in addition, assume that there is a Sequence of Tense (SOT) rule which ensures that the embedded past tense is interpreted as a present tense.<sup>8</sup> That is, there is a rule that optionally applies to reports like (17) and the particular reading is derivative of whether the rule applies.

Another possibility is to deny the assumption that (17) is ambiguous; the only reading of a report like (17) is one in which the pregnancy held prior to John's now. This is the conclusion defended by Altshuler and Schwarzschild (2012), who claim that no sound arguments have been made in favor of an ambiguity treatment of (17). In fact, they claim that any argument for an ambiguity treatment of (17) would be committed to some unnatural auxiliary assumptions about the nature of states and stative predication. In explaining the correlation between (17) and (19), Altshuler and Schwarzschild first ask why a speaker would not use an embedded present tense if they wanted to give a report of John saying (19). Subsequently, they answer this question by claiming (ibid: 55): "The problem is that the English PRES is indexical. Were it not, PRES would have been the resource to use here and indeed, in other languages such as Hebrew, it is used for this purpose. Speakers of English are aware of this deficit and can take it into account when interpreting these utterances." They conclude that it is perhaps this compensation, which they cash out in terms of a scalar implicature (present in some uses of (17) but not others), that encourages the idea that there are two truth-conditionally distinct readings of (17).

Regardless of which analysis is the correct one (i.e. one that posits an SOT rule or one that does not), the crucial point here is that there are plausible relative tense accounts which can explain the data in this section without positing the ULC. We end this section by noting recent arguments that the ULC is empirically inadequate to begin with. The first argument of this sort (that we know of) comes from Altshuler and Schwarzschild 2013. They consider uses of a true *de re* present in the following interaction at the Air Berlin baggage counter:

(26) a. Customer: I believe you have my bags.

<sup>8</sup>This idea goes back to at least Jespersen 1924, and has had many formulations over the years; see Grønn and von Stechow 2010; to appear, Ogiwara and Sharvit 2012, Bar-Lev 2014 and Klecha 2014 for recent overviews.

- b. Employee: Who said I have your bags?
- c. Customer: The stewardess told me you have my bags.
- d. Employee: When did she tell you that?
- e. Customer: On the flight.

In a typical *de re* fashion, the customer uses the present tensed verb *have* in (26c) to speak about a time that is present from his and the employee's perspective, but would have been future from the stewardess' perspective. The bag-having is future relative to the local evaluation time set by *told*, thereby violating the ULC.

While it is unclear how Altshuler and Schwarzschild's analysis could account for this use of the *de re* present, what is clear is that it provides strong argumentation against the ULC. We return to this example in the conclusion, where we compare it to instances of the historical present in the complement of an attitude verb.

Klecha (2014) provides further evidence against the ULC, involving the future oriented attitudes *hope* and *pray*. The following examples, cited by Klecha, come from the Corpus of Contemporary American English (Davies 2008).

- (27) But none of that has put Singh in the headlines like his comments after finishing second at the Wachovia Championship in Charlotte, two weeks before the Colonial. He said Sorenstam had no business playing the PGA Tour, **he hoped she missed the cut** and he'd withdraw if paired with her, the AP reported.
- (28) He was going to find that Guardian and do what he had to do. But his gut dropped at the thought of killing anyone in cold blood, even to save his brother. **He hoped she tried to kill him first**. Then he could behead her with a clean conscience.
- (29) "There were times when I picked one receiver and **prayed he got open**," recalled Collins, who completed 49.4 percent of his passes as a rookie out of Penn State, and finished with a quarterback rating of 61.9. "If he got open great; If not, I took the sack or threw it away."
- (30) Thirteen months and she would legally be able to walk out the door and live on her own. Her trust fund would be hers. She would no longer be dependent on her mother and Victor. Thirteen months. **She prayed she survived that long**. It wasn't that she was worried about Victor killing her. She feared her own hand.

In all these examples, the event described by the clause embedded under *hope* and *pray* respectively is understood to be located after the attitude holder's now, thereby violating the ULC. Interestingly,

Klecha concludes based on these data that “the ULC is actually a ‘lexically’ sensitive constraint, or more precisely, it is sensitive to the kind of modal base a modal quantifies over (which may vary between or within modal lexical items).” In particular, Klecha assumes that all attitude verbs are modal expressions, whose temporal orientation is dependent on their modal base: epistemic or circumstantial. Attitudes like *hope* and *pray* can take either modal base (thereby allowing a wide range of readings) and it is when they take a circumstantial base that a forward shifted reading results. In contrast, attitudes like *think* and *believe* do not take a circumstantial base, and are therefore are incompatible with forward shifting.

While remaining neutral with respect to Klecha’s analysis, we would like to point out that if, in fact, the ULC follows from the semantics of particular attitude verbs, then we have more reason to believe that our revision of the initial **HEIM** constraint is harmless.<sup>9</sup>

## 6. Conclusion

Based on a particular mistaken-time scenario, this paper proposed an amendment to Heim’s (1994) constraints. The amendment involved abandoning the Upper Limit Constraint, a move which we showed to follow from the semantics of the present tense. We discussed the consequences of giving up the Upper Limit Constraint and concluded that this is probably the right way to go. In this discussion, we noted a particularly striking case (viz. (26c)) in which a present tense is embedded under a past attitude and is interpreted *de re*. As such, there is no double access; it only has an absolute interpretation. Interestingly, there are also cases in which an embedded present tense get a purely relative interpretation when embedded under past:<sup>10</sup>

- (31) We’re standing around sipping cokes and talking about the election. Slowly, one by one, folks are walking away from me. And then **I realized that once again I’m being argumentative**. Sheila is right. It turns people off.
  
- (32) Everyone was looking at us funny. I couldn’t understand it. Then Paula came up to us, with horror in her eyes. **She whispered in my ear that we’re in a room full of anti-communists and my wife’s coat is bright red**.
  
- (33) David walked in and just stood by the door. I was puzzled by his behavior. Then **I thought that he just doesn’t recognize me**. So I went over and said hello.

<sup>9</sup>Some potential evidence for Klecha’s analysis is that (26c) involves the verb *tell*, which patterns with *hope* and *pray* in taking a circumstantial modal base. The problem, however, is that a future-shifted interpretation of *The stewardess told me you have my bags* seems only possible if the present tense is interpreted *de re*. This seems to be the key difference between (26c) and Klecha’s corpus examples above.

<sup>10</sup>These examples are due to Roger Schwarzschild (p.c.). They have been slightly altered to include a wider range of attitude predicates.

In sum, it seems to be the case that when a present tense is embedded under a past attitude, there are three possible interpretations. One is the double access interpretation, which is what this paper attempted to analyze. However, a satisfactory account of the present tense also needs to account for the purely absolute interpretation in examples like (26c), as well as for the purely relative interpretation like in the examples above. We believe that a better understanding of *perspective* is necessary to account for these kind of examples. In particular, the phenomenon of temporal *de re* for the former kind of examples, and the historical present for the latter kind.

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# 'Have' and the link between perfects and existentials in Old Catalan<sup>1</sup>

Toni Bassaganyas-Bars – Universitat Pompeu Fabra (Barcelona)

**Abstract.** This paper focuses on an aspect of the auxiliary alternation in the perfect in Old Catalan that sets this language apart from other members of the Romance family. In Old Catalan, most of the first occurrences of unaccusative verbs with *haver* ('have') instead of *ésser* ('be') show a series of peculiarities: they present a locative (or dative) PP, a definiteness effect, they are only found in third person, and they show a number mismatch between the verb and the theme-NP of the construction. Overall, they resemble existential constructions, which crucially use *haver* in the language; existential constructions, in turn, look like possessive constructions, which take *haver* as well. These data show that a standard semantics for *have*, coupled with the possibility of quirky subjects and unaccusative participles acting as secondary predicates, not only explain the occurrences of *haver* with unaccusatives in Old Catalan, but also leads to a straightforward account of why *haver* is the existential predicate in Modern Catalan.

**Keywords:** Old Catalan, auxiliary selection, have, existential predicates, unaccusativity

## 1. Introduction

Several members of the Romance and the Germanic families feature what is normally called 'split intransitivity' in the expression of the perfect: some verbs, the ones commonly labelled 'unaccusatives', take 'be' as the auxiliary to create compound tenses, whereas the rest of intransitives ('unergatives') and all transitives take 'have'. Beyond this broad characterization of the phenomenon, individual languages vary as to what features of the verb or the VP are relevant to determine the choice of either auxiliary. The historical record tells us that split intransitivity is a receding trait both in the Germanic and the Romance family. 800 years ago, practically all of these languages displayed some form of it, but nowadays only some do. The rest have lost 'be' as a perfect auxiliary and form the compound tenses only with 'have'. Catalan (like the other Romance varieties in the Iberian peninsula) exemplifies the latter case: compound tenses are always formed with *haver* ('have').

This study began as a survey of how this change took place in Old Catalan<sup>2</sup>; that is, which were the first verbs or contexts that favored the use of *haver* where *ésser* ('be') used to be the default option. The aim was to find a relatively neat pattern whereby *haver*, after sneaking into some *ésser*-taking niche (probably characterizable in terms of 'agentivity' or '(a)telicity'), would gradually take over more and more grammatical contexts until totally superseding *ésser*.

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<sup>2</sup> By 'Old Catalan' I mean the language between the 13<sup>th</sup> and the 17<sup>th</sup> century. On the other hand, 'Modern Catalan' refers to the present stage of the language.

However, the data show that the process is not as linear as one might think<sup>3</sup>: the combination of *haver* and unaccusatives is found already in the first documents, but does not seem to become more frequent as the first five centuries of the written record go by. On the contrary, some verbs that alternate between both auxiliaries at nearly 50% in the 13<sup>th</sup> century clearly favor *ésser* in the 15<sup>th</sup> (the very verb *ésser* and its variant *estar* being a case in point), until the whole system collapses by the end of the 17<sup>th</sup> century, leaving *haver* as the only choice.

Nonetheless, the study of the Old Catalan data reveals an interesting pattern which has not been noticed, to my knowledge, in other medieval Romance varieties: most of the occurrences of *haver* with a prototypical unaccusative show a series of traits that link them to existential constructions<sup>4</sup>. These features are the presence of a locative/dative PP, a definiteness effect, and a number mismatch between the theme-NP of the construction and the verb, which does not occur in any other form than 3<sup>rd</sup> person singular (even when followed by a plural NP; 1<sup>st</sup> and 2<sup>nd</sup> persons are not attested). By collating these data with other uses of *haver* in Old Catalan, namely possessive and existential constructions, this paper argues that a unified semantic account of *haver* successfully explains the Old Catalan data, unveils some connections between the different uses of *have* in Romance, and sheds light on why should a form like *haver-hi* ('there be'), a strange creature from a synchronic point of view, be the existential predicate in Modern Catalan.

The paper is organized as follows. Section 2 briefly outlines the main uses of *ésser* and *haver* in Modern Catalan, and contrasts them with their functions in its medieval stage. Section 3 details out the peculiarities of the Old Catalan data that motivate the present analysis, and section 4 puts forward a possible semantic account of them. Section 5 summarizes the main points of the paper.

## 2. Auxiliaries, existentials and possessives in Modern and Old Catalan

### 2.1. Modern Catalan

As already mentioned, *haver* is the universal auxiliary for compound tenses in present-day Catalan. This sets it apart from other Romance varieties like Italian, French, or even its closest relative, Occitan, all of which show split intransitivity. (1) shows how *haver* is used indistinctly with unaccusatives, transitives and unergatives:

- |     |           |                 |        |         |     |           |                |                 |
|-----|-----------|-----------------|--------|---------|-----|-----------|----------------|-----------------|
| (1) | <b>He</b> | <b>anat</b>     | al     | súper   | i   | <b>he</b> | <b>comprat</b> | pomes.          |
|     | I.have    | gone            | to.the | store   | and | I.have    | bought         | apples.         |
|     | <b>He</b> | <b>corregut</b> | per    | arribar |     | abans     | que            | tanquessin      |
|     | I.have    | run             | to     | arrive  |     | before    | that           | close.3.PL.SUBJ |
- I have gone to the store and I have bought some apples. I have run to get there before they closed.

<sup>3</sup> All the data used in this paper come from a morphologically-tagged corpus of Old Catalan which is currently being developed at the Universitat Pompeu Fabra (<http://parles.upf.edu/llocs/cqp/oldca/>). At the time of writing it comprises ca. 7 million words ranging from the 12<sup>th</sup> to the 18<sup>th</sup> centuries.

<sup>4</sup> In their study of auxiliary selection in Old Catalan, Mateu and Massanell (to appear) have identified the same examples and characterize them in similar, but not identical, terms. See section 3.



The modern language uses *haver* also as the verbal form in the existential predicate *haver-hi*. *Hi* is a grammaticalized locative clitic which must be obligatorily present.

- (2) **Hi ha** dues noies a la porta  
 LOC have.3.SG two.F.PL girls.PL at the.F.SG door  
 There are two girls at the door

Even though some modern dialects allow *haver* to agree in number with the theme-NP (or 'pivot', as it is normally referred to in the literature on existential constructions), this is a fairly recent innovation. In the historical record, the mismatch is systematic.<sup>5</sup>

It has to be noted that, unlike in French, Italian or Occitan, *haver* cannot be used as an independent verb in modern Catalan. Possession, for instance, is expressed with the verb *tenir*. The use of *haver* is wildly ungrammatical.

- (3) **Tens/\*Has** un cotxe nou?  
*tenir*.2.SG/have.2.SG one.M.SG car new?  
 Do you have a new car?

## 2.2. Old Catalan

By and large, medieval Catalan looked a lot more like present-day French and (specially) Italian than the modern language. Focusing firstly on the perfect, we find a full-fledged split intransitivity system, whereby unaccusatives (4a), all reflexives (4b), the perfect of the periphrastic passive (4c) and the perfect of modals *poder* ('be able to') and *voler* ('want') when the main verb was unaccusative (4d) took *ésser*. Transitives and unergatives took *haver* (4e-f).

- (4a) yo **són vengut** de molt longa terra  
 I am come.M.SG from very long land  
 I have come from a far-away land (*Descloit*, 13<sup>th</sup>)

- (4b) **s'eren amagats** en lo dit junquar  
 REFL were.3.PL hidden.M.PL in the said reed bed  
 they hid themselves in the said reed bed (*Cocentaina*, 13<sup>th</sup>)

- (4c) gran injúria **és estada feta** a él  
 great offence is been.F.SG done.F.SG to he  
 A great offence has been done to him (*Sisè seny*, 13<sup>th</sup>)

<sup>5</sup> The literature on existential constructions often cites Catalan as a language that pretty liberally allows 'strong' NPs as pivots. This is true for the modern language, but this possibility only became available in the 18<sup>th</sup> century and didn't become widespread until the 19<sup>th</sup> (Ramos, 2001). We will thus ignore this fact in the discussion about Old Catalan, in which the definiteness effect is robustly attested.

- (4d) no y **era** **volgut** **venir**  
 NOT LOC was.3.SG wanted.M.SG come  
 He had not wanted to come there (*Muntaner*, 14<sup>th</sup>)
- (4e) sí **avia** a molts cavalers grans dots **donats**  
 so had.3.SG to many.M.PL knights.PL great.M.PL gifts.PL given.M.PL  
 he had thus given great gifts to many knights (*Descloit*, 13<sup>th</sup>)
- (4f) après que **hagué parlat** del dit fet  
 after that had.3.SG talked.M.SG of.the said fact  
 after he had spoken about the said fact (*Marquès*, 14<sup>th</sup>)

Let us now focus on the expression of possession. Although the use of *tenir* pops up occasionally in Old Catalan in constructions that could receive a possessive interpretation, the expression of possession was basically a duty of *haver*.

- (5a) **han** més de terra que nós, ...  
 have.3.PL more of land than us  
 they have more land than us (*Feyts*, 14<sup>th</sup>)
- (5b) ... si emperò aquell **haurà** fill o fills  
 if however that.M.SG have.FUT.3.SG son or sons  
 ... but should he have one child or more (*València*, 15<sup>th</sup>)

There is another use of *haver* which looks very much like the possessives sentences in (5), except for the fact that the place of the possessor is occupied by a PP referring to a location (6a-b) or, in its absence, by a locative clitic *hi* referring back to a previously established location (6c).

- (6a) en Aragó **avia** I cavaller qui era  
 in Aragon had.3.SG one knight who was...  
 in Aragon there was a knight who was... (*Descloit*, 13<sup>th</sup>)
- (6b) entre los cals **avia** un cresent dels iretyes  
 among the which had.3.SG a believer of.the heretics  
 among which there was a heretic (*Sants*, 13<sup>th</sup>)
- (6c) per la qual cosa **hi ha** moltes persones abtes  
 for the which thing LOC have.3.SG many persons capable  
 for which there are many competent men (*topic location*: Valencia)  
 (*València*, 14<sup>th</sup> century)

In Modern Catalan, the sentences in (5) and in (6) would look much more different from each other; the possessive ones in (5) would use *tenir*, and the specialized existential predicate *haver-hi* would be used to express the meanings in (6). But in Old Catalan the same verb, *haver*, was

used in both constructions, which look completely parallel if we consider that the language allowed for oblique (or 'quirky') subjects (Zaenen, Maling & Thráinsson 1985), something which has been argued for independently for Old Romance (with a particular focus on Old Catalan) by Fischer (2004), and even for Modern Catalan by Rigau (1997). The presence of an oblique subject tends to trigger default agreement with the verb (3<sup>rd</sup> person singular); notice that, in (6c), the verb does not agree with the NP in the construction. Under the view defended here, this NP is the internal argument of the predicate *haver*, not the subject, so the lack of agreement is not surprising. The claim is then that there was no specialized existential predicate in Old Catalan as there is in the modern language: the same verb that expressed possession was used to convey existence assertions.

In this section we have contrasted the uses of *haver* in Old and Modern Catalan, and we have seen that the modern language formally distinguishes the expression of compound tenses, possessive and existential predicates, in a way that does not correspond to the way its medieval version worked. Bearing that in mind, in the next section we will look into the peculiarity of Old Catalan mentioned above; that is, the fact the many of the occurrences of *haver* + unaccusatives look a lot like the use of *haver* illustrated in (6a-c).

### 3. Unaccusatives with *haver* in Old Catalan and the existential construction

Among the languages that display split intransitivity, there are several grammatical contexts that can make a verb that is normally found with 'be' take 'have'. One of the key features of *be*-taking perfects cross-linguistically is that 'be' is strongly favored in sentences with a telic interpretation. This preference weakens when the verb phrase is detelicized. An Old Catalan example of this is the verb *anar* (to go). It normally appears in VPs with a telic interpretation, and therefore takes *ésser*. However, when an adjunct triggers a process-like interpretation, the auxiliary frequently changes to *haver*. Sentences (7a) and (7b) are taken from the same text:

(7a) per so cor a Roma **era** **anat** e tornat  
 for this since to Rome was.3.SG gone and returned  
 because he had gone to Rome and come back (*Sants*, 13<sup>th</sup>)

(7b) e ya **avien** **anat** per tres dies  
 and already had.IMP.3.SG gone for three days  
 and they had already marched for three days (*Sants*, 13<sup>th</sup>)

A similar behavior has been observed in other Old Romance varieties, like Old French (Burnett and Troberg 2014).

Significant though these facts are for a diachronic study of auxiliary selection, here I will concentrate on a phenomenon that seems to be more specific to Old Catalan. It involves verbs like *venir* ('to come'), *entrar* ('to go in'), *pujar* ('to go up'), *restar* and *romandre* (both meaning 'to remain'), and *arribar* ('to arrive'). Many of the occurrences of *haver* in combination with their perfects display a number of traits which differ from their equivalents with *ésser*:

With <i>haver</i>	With <i>ésser</i>
Theme NPs: indefinite NPs, downward monotone quantifiers, type-denoting NPs. Definiteness effect.	Theme NPs: no restriction, but statistical preference for personal pronouns, definite NPs, proper names.
No number agreement between the theme NP and <i>haver</i> ; gender and number agreement between the theme NP and the unaccusative past participle.	Number agreement between the theme NP and <i>ésser</i> ; gender and number agreement between the theme NP and the unaccusative past participle.
<i>Haver</i> is limited to 3rd person singular.	<i>Ésser</i> can occur in any person.
Obligatory presence of a locative or dative PP in the sentence.	No obligatory presence of a locative or dative PP in the sentence.

Table 1. Differences between the combinations *haver* + perfect and *ésser* + perfect

The types of NP that occur with *haver* pattern exactly like the kind of NPs that occur in the existential construction in English (Milsark 1974, McNally 1998), as well as with the NPs that make 'bad subjects, good pivots' cross-linguistically in Beaver, Francez and Levinson (2006), or the ones that can appear in so-called existential-*have* constructions (e.g. Keenan 1987, Partee 1999, Sæbø 2009). What is more, they are exactly the kinds of NP that appear in Old Catalan sentences with *haver* that we interpret as existential constructions, as the ones in (6a-c). The examples that follow, ranging from the 13<sup>th</sup> to the 17<sup>th</sup> century, illustrate what these data look like. The sentences in each pair from (8) to (11) belong to the same text. The first example, from the 13<sup>th</sup> century, involves a telic verb of movement like *venir* ('to come').

(8a) a l'emperadriu **ha** **venguts** II cavalers d' Espaya  
to the.empress have.3.SG come.M.PL 2 knights.M.PL from Spain  
two knights from Spain have come to the empress (*Descloit*, 13<sup>th</sup>)

(8b) l' armada de Sissília no **era** **venguda** en Catalunya  
the navy of Sicily NOT was come.F.SG in Catalonia  
The Sicilian navy had not come to Catalonia (*Descloit*, 13<sup>th</sup>)

In the 14<sup>th</sup> and 15<sup>th</sup> centuries we keep finding this alternation, here illustrated with the stative verbs *romandre* and *restar* (both meaning 'to remain'):

(9a) **a** y **romàs** II frares seus  
have.3.SG LOC remained.M.SG 2 brothers his  
two brothers of his have remained (*Muntaner*, 14<sup>th</sup>)

(9b) Et en Tunij **era** **romàs** Miraboaps  
And in Tunis was.3.SG remained.M.SG Miraboaps  
And Miraboaps had remained in Tunis (*Muntaner*, 14<sup>th</sup>)

(10a) car hòmens no n' í **avia** **restats**

since men NOT PART LOC have.IMP.3.SG remained.M.PL  
 since no man had remained (*Tirant*, 15<sup>th</sup>)

- (10b) **foren** **restats** sols ell e Tirant  
 were.3.PL remained.M.PL only he and Tirant  
 Only him and Tirant had remained (*Tirant*, 15<sup>th</sup>)

Finally, in the 17<sup>th</sup> century the same constructions are still found. Notice, however, that here *haver* starts agreeing in number with the theme NP:

- (11a) A ·l dit governador **avian** **arribats** embaxadors  
 To the said governor had.3.PL arrived.M.PL ambassadors  
 Ambassadors had come to the governor (*Pujades*, 17<sup>th</sup>)

- (11b) las galeras [...] **eran** **arribadas**  
 the.F.PL ships were.3.SG come.F.PL  
 the ships [...] had arrived (*Pujades*, 17<sup>th</sup>)

This pattern has already been identified by Mateu (2009) and Massanell and Mateu (to appear), and they have as well established a link between this kind of examples and existential constructions. Their analysis is formulated in terms of a constructional approach to argument structure. They consider that 'existential constructions' are unaccusative argument structures, but that they do not belong to the core of this class by being atelic, and less agentive and more stative than the core constructions, 'subjects of result state'. A connection is then established with the Auxiliary Selection Hierarchy put forward by Sorace (2000) (with the caveat that it should be applied to 'constructions' instead of verbs): 'existential constructions', not being in the core of unaccusativity, are less resistant to *haver*, and figure among the first ones where we see the replacement of *ésser* by *haver* at play. Under this light, the data presented in (8)-(11) are regarded as an intermediate step between a stage where all these examples would have taken *ésser*, and the modern situation, in which all verbs take *haver*.

The analysis I propose deviates from Mateu and Massanell and Mateu's in one crucial point. A key aspect of their approach is that they take for granted that the data in (8)-(11) are perfects which select *haver* that could have selected *ésser* in a previous stage of the language. By doing so, they abstract away from the fact that *haver* is not only an auxiliary for compound tenses, but also the verb that expressed possession and existence assertions in Old Catalan.<sup>6</sup> The view proposed here considers the examples under discussion as manifestations of this same *haver* which get a perfect reading by virtue of the participle of an unaccusative verb acting as a

<sup>6</sup> Here it is crucial to understand that in the framework used by Massanell and Mateu, 'existential construction' does not mean 'existential predicate' in the sense of a specialized verb used to express existence assertions. 'Existential argument structures', as a subset of 'unaccusative argument structures', are a broader concept.

secondary predicate.<sup>7</sup> They are not mere 'innovative' variants of the perfects of unaccusatives; they are a fundamentally different construction that coexisted with the perfect for at least half a millenium. This is not tantamount to say that other well-known *have*-triggering effects were not at play in the language at the same time; this is the case of (7b) above, which crucially involves a third person plural *haver*, in contrast with the invariable third person singular of (8)-(11). However, (7b) and (8)-(11) need to be kept apart: only the former is a well-behaved perfect.

If (8)-(11) exemplified the first link in a chain of replacements of *ésser* by *haver*, we would expect, on the one hand, that they gradually lost the features that separate them from the rest of perfects; that is, we would expect them to lose their restrictions as to definiteness of the theme NP, occurrence with only third persons and lack of number agreement. But these examples precisely show that this only starts happening at the end of the 17<sup>th</sup> century, just before the point where *ésser* was dropped as a perfect auxiliary. On the other hand, we would predict the use of *haver* with unaccusatives to increase century by century. The following chart, based on the corpus data I have gathered for the most frequent unaccusative verbs in the corpus, shows that this is not what we see in the texts. The lines indicate the percentage of times the participle of these verbs combines with *ésser* (as opposed to *haver*) from the 13<sup>th</sup> to the 18<sup>th</sup> century.

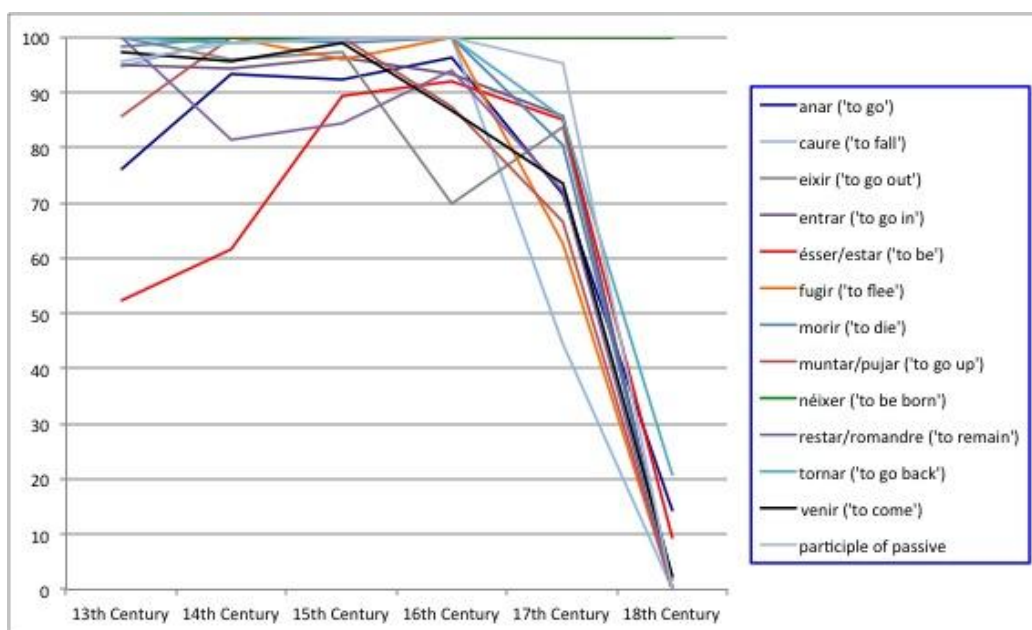


Figure 1. % of occurrence of the most frequent unaccusative participles with *ésser* (as opposed to *haver*)

The very frequent verbs *anar* and *ésser/estar* (which share the same participle, *estat*) illustrate what seems to be the tendency in Old Catalan before the 17<sup>th</sup> century: alternations such as the one exemplified in (7) above tended to be eliminated in favor of a more consistent use of *ésser*, with *haver* becoming more restricted to constructions like (8)-(11), which in fact occur in a similar

<sup>7</sup> Due to the fact that *haver-hi* is the existential predicate in Modern Catalan, and that it can easily be told apart from the perfect, a natural expectation is that an existential sentence with a bare unaccusative secondary predicate should be grammatical in Modern Catalan. The fact is that they are not (*\*hi ha dos cavallers vinguts*). At this point, I do not have an explanation for that.

proportion throughout this period. What happened in the 18<sup>th</sup> century is a subject for future research, and probably calls for a sociolinguistic explanation factoring in the influence of Spanish, which had already lost any trace of split intransitivity, and the fact that the public use of Catalan became severely restricted by that time in favor of Castilian.

At this point I have established several generalizations:

- a. *Haver* is used in Old Catalan as a perfect auxiliary for transitives and unergatives, to express possession and to convey existence assertions.
- b. There are occasional uses of *haver* with unaccusative verbs which take *ser* in the majority of cases. Some of them (7b) involve *have*-triggering traits that are known to operate cross-linguistically, and do not show any particular feature regarding agreement with the theme-NP or the classes of NPs they appear with; others (8)-(11) show the same traits as the uses of *haver* implying an existence assertion.
- c. Data show that the constructions of the kind (8)-(11) are a small but consistent minority from the 13<sup>th</sup> to the 17<sup>th</sup> centuries.

In the following section, I suggest a semantic analysis that shows that, once we have taken the step of assuming that Old Catalan allowed for oblique subjects and that what we see in most instances of *haver* + unaccusatives is actually a case of secondary predication, the Old Catalan data are amenable to a standard treatment of both *have*-predicates and secondary predicates.

## 4. Semantic analysis

### 4.1. *Haver*: a common analysis for different uses

Focusing first on *haver*, I will propose an analysis based on Barker (1991), Van Geenhoven (1998) and Partee (1999) that posits that one and the same verb *haver* is found in possessive and existential predicates (a step also taken in Fontana 2013, 2014), and in the data involving unaccusatives. Under this approach, the denotation of Old Catalan *haver* changes according to the type of NP it is combined with, thus yielding the different interpretations with which it is associated.

Let us first deal with sentences where *haver* behaves like a prototypical transitive (Partee 1999). Unlike some of the contexts where this verb appears, this use does not reject definite NPs; but, on the other hand, it is resistant to relational nouns (Barker 1991, LeBruyn et al. 2013, and references therein). Whatever it is that renders ungrammatical in English sentences like *\*she has the child* or *\*the house has the door*, it seemed to be operating in Old Catalan as well. In these cases, all that *haver* seems to do is to introduce a pragmatically controlled relation, that is sometimes represented by  $\pi$  (Barker 1991). The meaning of this relation 'depends for its value on pragmatic factors determined by the context in which the possessive is uttered' (Barker 1991, p. 53). Let's see an example:

- (12) lo            rey        hac            lo    castel   de   Xàtiva  
       the. M.SG   king   had. 3.SG   the   castle   of   Xàtiva  
       the king had the castle of Xàtiva (*Descloit*, 13<sup>th</sup>)

The denotation in these cases, which can be called 'non-incorporating' (following Van Geenhoven 1998), is  $\|haver_{\text{non-inc}}\| = \lambda y \lambda x [\pi(x, y)]$ . The derivation is rather straightforward:

- (13) a.  $\|haver_{\text{non-inc}}\| = \lambda y \lambda x [\pi(x, y)]$   
       b.  $\|\text{lo castel de Xàtiva}\| = \iota x [\text{castel}(x) \ \& \ \text{de}(x, \text{Xàtiva})]$   
       c.  $\|\text{lo rey hac lo castel de Xàtiva}\| = \pi(\iota x [\text{rei}(x)], \iota x [\text{castel}(x) \ \& \ \text{de}(x, \text{Xàtiva})])$

It might look like we do not actually need the  $\pi$ -relation here. We could claim instead that here *haver* is just a two-place predicate establishing a 'possession' relation. Nonetheless, the relation expressed in these sentences is sensitive to pragmatic determination. In context, (13) is not exactly saying that king 'possessed' the castle in question; it rather says that he came to control it after a battle. If we look at (14), *haver* refers to a completely different kind of relation:

- (14) après    ages            les    gallines   e    coguen    ab    carnsalada  
       then   have.IMPER   the    hens        and   cook.SUBJ   with   bacon fat  
       then have the hens and let them get cooked with bacon fat (*Soví*, 15<sup>th</sup>)

In this example, taken from a medieval cookbook, the imperative of *haver* is not telling the reader to start 'possessing' hens; it just tells them to go and get the ones that (presumably) they already 'possess' to put them into the stew. To account for these pragmatically-controlled readings is precisely the function of  $\pi$ .

Most examples featuring *haver* do not, however, involve a relation between two definite entities, but are instead instances of 'existential-have'. These are cases where the object is an indefinite NP which, in contrast to the previous 'non-incorporating' examples, is quite frequently headed by a relational noun. We will first focus on cases where the object is a bare noun, a quite common situation in Old Catalan, exemplified in (6a) (repeated here as 15a and 15b).

- (15a) si    emperò    aquell        haurà            fill    o    fills  
       if    however   that M.SG   have FUT.3.SG   child   or   children  
       But should he have one child or more (*València*, 15<sup>th</sup>)

- (15b) àn            pobretat    eternal    los            pecadors  
       have.M.SG   poverty    eternal    the.M.PL   sinners  
       Sinners have eternal poverty (*Doctrina*, 14<sup>th</sup>)

(15a) involves a relational noun and (15b) a non-relational one. Following standard practice (e.g. Barker 1991), the first one translates as a two-place predicate, and the second one as a one-place predicate:



- (16) a.  $\|fill\| = \lambda y \lambda x [fill(x, y)]$   
 b.  $\|pobretat\| = \lambda x [pobretat(x)]$

Following again Van Geenhoven, I will call these uses of *haver* 'incorporating'. Continuing with the composition, *haver* carries out different functions in each of these two cases. In the first case, it just selects a relation already denoted by the relational nominal, it existentially closes its internal argument, inverts it, and passes the relation to the VP level. This denotation can be termed 'relational-*have*':

- (15a') a.  $\|haver_{rel}\| = \lambda R \lambda x \exists y [R^{-1}(x, y)]$   
 b.  $\|haver\ fill\| = \lambda x \exists y [fill^{-1}(x, y)]$   
 c.  $\|aquell\ haurà\ fill\| = \exists y [fill^{-1}(z_i, y)]$  (where the value of  $z_i$  is determined by context)

In the non-relational case, the relation between the two entities is pragmatically determined, as in (12) or (14); let us then call it 'non-relational' *have*. The job of *haver* in this case is to introduce this relation, again represented by  $\pi$ , into the denotation (together with a new variable for its external argument), to link the argument of the monadic predicate to the internal argument of the  $\pi$  relation, and to existentially close it. The composition for (15b) runs then as follows:

- (15b') a.  $\|haver_{non-rel}\| = \lambda P \lambda x \exists y [\pi(x, y) \ \& \ P(y)]$   
 b.  $\|pobretat\ eternal\| = \lambda x [pobretat(x) \ \& \ eternal(x)]$   
 c.  $\|haver\ pobretat\ eternal\| = \lambda x \exists y [\pi(x, y) \ \& \ pobretat(y) \ \& \ eternal(y)]$   
 d.  $\|los\ pecadors\| = \lambda x [pecadors(x)]$   
 e.  $\|\grave{a}n\ pobretat\ eternal\ los\ pecadors\| = \exists y [\pi(\lambda x [pecadors(x)], y) \ \& \ pobretat(y) \ \& \ eternal(y)]$

We have derived the truth conditions that seem intuitively right for that sentence: 'eternal poverty' is the internal argument of a relation which is pragmatically determined (here it seems to mean something like 'bear' or 'suffer'), whose external argument is 'the sinners'.

Let's now move to cases involving indefinite determiners, like *un* ('a') or *molts* ('many'). For the present purposes I will treat indefinite articles like *un* in the object of *haver* as modifiers. Sentence (17a), with the non-relational noun *ort* (vegetable garden), and sentence (17b), with the relational *german* (brother) are an example:

- (17a) aquell          hom          havia          un          ort  
 that.M.SG      man      had.IMP.3.SG      a      garden  
 that man had a vegetable garden (*Meravelles*, 14<sup>th</sup>)

- (17a') a.  $\|haver\| = \lambda P \lambda x \exists y [\pi(x, y) \ \& \ P(y)]$   
 b.  $\|un\ ort\| = \lambda x [ort(x) \ \& \ un(x)]$   
 c.  $\|haver\ un\ ort\| = \lambda x \exists y [\pi(x, y) \ \& \ ort(y) \ \& \ un(y)]$   
 d.  $\|aquell\ hom\ havia\ un\ ort\| = \exists y [\pi((z_i \ \& \ hom(z_i)), y) \ \& \ ort(y) \ \& \ un(y)]$

- (17b) Frare Valentinian avia un german  
 Friar Valentinian had.IMP.3.SG a brother  
 Friar Valentinian had a brother (*Gregori*, 14<sup>th</sup>)

- (17b') a.  $\|haver_{rel}\| = \lambda R \lambda x \exists y [R^{-1}(x, y)]$   
 b.  $\|un\ german\| = \lambda y \lambda x [german(x, y) \ \& \ un(y)]$   
 c.  $\|haver\ un\ german\| = \lambda x \exists y [german^{-1}(x, y) \ \& \ un(y)]$   
 d.  $\|Frare\ Valentinian\ avia\ un\ german\| = \exists y [german^{-1}(Frare\ Valentinian, y) \ \& \ un(y)]$

Now we have reached the point where we can relate the semantics of possessives to that of sentences that make existence assertions (corresponding to the modern Catalan use of *haver-hi*). The analysis sketched so far can straightforwardly be extended to existential uses of *haver* by making one further assumption I have already introduced above: we must allow locative and dative prepositional phrases such as *en Ungria* ('in Hungary') in (18) below, or the one implicit in the locative clitic *hi* in (19), to be the external argument of *haver*. That is, some sentences with *haver* have quirky subjects. The intuition is that, whereas 'Hungary' denotes an entity, 'in Hungary' denotes the physical space occupied by that entity. Here we can adapt an aspect of Zwarts & Winter's (2000) semantic analysis of locative prepositional phrases. They put forward a function ( $loc(D_e)$ ) that assigns any physical entity its location in space ('a set of points'). Although a full implementation of Zwart & Winter's analysis would be beyond the scope of this paper, let us tentatively assume that the denotation of a locative/dative phrase is the physical space occupied by the entity referred to by the NP complement to the PP.

Once we have taken this step, the rest of the analysis carries over. We can deal with cases of relational nouns, such as *rey* ('king'), and non-relational cases like *casal* ('house', in the sense of 'dynasty') as in (17):

- (18) En Ungria ach un rey  
 In Hungary had.3.SG a king  
 There was a king in Hungary (*Ungria*, 14<sup>th</sup>)

- (18') a.  $\|en\ Ungria\| = loc(Ungria)$   
 b.  $\|rey\| = \lambda y \lambda x [rey(x, y)]$   
 c.  $\|un\ rey\| = \lambda y \lambda x [rey(x, y) \ \& \ un(y)]$   
 d.  $\|ach\| = \lambda R \lambda x \exists y [R^{-1}(x, y)]$   
 e.  $\|ach\ un\ rey\| = \lambda x \exists y [rey^{-1}(x, y) \ \& \ un(y)]$   
 f.  $\|en\ Ungria\ ach\ un\ rey\| = \exists y [rey^{-1}(loc(Ungria), y) \ \& \ un(y)]$

- (19) hi ha molts casals bons e honrats  
 LOC have.3.SG many houses good. M.PL and honest. M.PL  
 There are many good and honest Houses (*Feyts*, 14<sup>th</sup>)

- (19') a.  $\|hi\| = l_i$  (standing for a location determined by context)

- b.  $\| \text{molts casals bons e honrats} \| = \lambda x [\text{casals}(x) \ \& \ \text{molts}(x) \ \& \ \text{bons}(x) \ \& \ \text{honrats}(x)]$   
 c.  $\| \text{ha} \| = \lambda P \lambda x \exists y [\pi(x,y) \ \& \ P(y)]$   
 d.  $\| \text{ha molts casals bons e honrats} \| = \lambda x \exists y [\pi(x,y) \ \& \ \text{casals}(y) \ \& \ \text{molts}(y) \ \& \ \text{bons}(y) \ \& \ \text{honrats}(y)]$   
 e.  $\| \text{hi ha molts casals bons e honrats} \| = \exists y [\pi(\text{loc}(l_i), y) \ \& \ \text{casals}(y) \ \& \ \text{molts}(y) \ \& \ \text{bons}(y) \ \& \ \text{honrats}(y)]$

The presence of a locative subject is incompatible with the non-incorporating denotation ( $\lambda y \lambda x [\pi(x,y)]$ ). That is, this type of subject is tied to a definiteness effect on the object. Why exactly this is so still remains unclear. For our present purposes, suffice it to say that locative subjects seem to be compatible only with the incorporating denotations proposed above.

#### 4.2. *Haver* when an unaccusative comes in

We can now take the step of expanding the analysis to the cases we have presented involving unaccusative past participles. Let us recall what these sentences looked like:

- (20) hi        havia                vengudes                X        galeas        de        venecians  
       LOC    had.IMP.3.SG    come.F.PL        10    ships        of        Venetians  
       there had come ten Venetian ships (*Muntaner*, 14<sup>th</sup>)

The view defended here is that these sentences involve secondary predication: we have a main predicate, *haver*, and the unaccusative participle (here, *venguts*) acts as a secondary predicate. Rothstein (2011) defines a secondary predicate as a 'one-place non-verbal predicate expression which occurs under the scope of the main verb' (p. 1442). The definition says 'non-verbal', and *venguts* is the past participle of the verb *venir*. However, Old Catalan (and Old Romance in general) past participles have been argued to be of a purely adjectival nature by Fontana (2013, 2014). There are thus independent reasons to consider *venguts* as an adjective in (20). I will assume, following among others Parsons (1990) and Rothstein (2004), that adjectives introduce an event argument and assign a thematic role to their external argument.

A key feature of secondary predication structures is that the main and the secondary predicate share an argument. The analysis developed in the previous sections posits that in sentence (20), 'ten Venetian ships' is the internal argument of the *haver*-relation. Regarding (20) as an instance of secondary predication, these Venetian ships are also the external argument of the adjective *venguts*. What we have is thus an object-oriented secondary predicate. In what seems to be the reading of (20), the property expressed by *venguts* holds of its external argument while the state denoted by the *haver* is going on. *Venguts* is, then, plausibly analyzable as an object-oriented depictive secondary predicate.

Another feature of secondary predicates is that they can be dropped without yielding an ungrammatical sentence. This possibility is illustrated by (21), which parallels (20) but for the fact that no secondary predicate is present.

- (21) hi havia CXX galeas et sens nombre lenys  
 LOC had.IMP.3.SG 120 ships and without number vessels  
 there were 120 ships and an endless number of vessels (*Muntaner*, 14<sup>th</sup>)

The same operation cannot apply in those cases where *haver* appears in an atelically interpreted VP, such as (7b), repeated here as (22a). Although we obviously lack negative data or native intuitions, it is hard to imagine what (22b) could possibly mean:

- (22a) e ya **avien** **anat** per tres dies  
 and already had.IMP.3.SG gone for three days  
 and they had already gone for three days (*Sants*, 13<sup>th</sup>)
- (22b) ?\*e ya **avien** per tres dies  
 and already had.IMP.3.SG for three days  
 and they had already for three days

In order to account for these sentences, I will follow a (simplified) version of Rothstein's (2004, 2011) account of secondary predication. For the sake of clarity, I have until now omitted event predicates in the denotation of *haver*, but from here on I will make explicit that both *haver* and the secondary predicate introduce an event argument (which in both cases is, in fact, a state). In Rothstein's account, the main and the secondary predicate form a complex predicate before combining with the argument they share; the secondary predicate and its external argument do not therefore form a constituent (small clause). The secondary predicate plays the role of an aspectual modifier by introducing a new event and defining a relation between this event and the one introduced by the main predicate.

Following Rothstein, I will make two more assumptions. First, I will adopt her syntactic structure for object-oriented depictive predicates; sentence (23) will have the syntactic structure in (24), with the secondary predicate under V":

- (23) hi havia ben CC cavallers armats venguts  
 LOC have.3.SG good 200 knights armed. M.PL come. M.PL  
 there had come a good 200 armed knights (*Muntaner*, 14<sup>th</sup>)

- (24) [hi[[[[[havia]<sub>V</sub> ben CC cavallers armats]<sub>V'</sub>][venguts]<sub>AP</sub>]<sub>VP</sub>]<sub>S</sub>

Second, I will also adopt Rothstein's account of predication, whereby the external argument of predicates remains a free variable until a predicate formation operation takes place at the VP (or AP) level by lambda-abstracting over the variable for this external argument. I have not mentioned this aspect in the analysis so far, but its application to the previous sentences in this section should be straightforward.

Rothstein's account incorporates the fact that, for two predicates to combine via secondary predication, they have to share their run-time (that is,  $\tau(e_1) = \tau(e_2)$ ) and they must share an

argument; those are preconditions for the operation to be licensed. This is captured in her analysis by the Time-Participant Connected relation (or TPCONNECT), which holds if these conditions are met. The fact that predicate formation applies at the VP level and that the secondary predicate is under V" in object-oriented secondary predicates will ensure that the argument they share is the internal argument of the main predicate, not the external one. What we want is to create an eventuality  $e = {}^S(e_1 \cup e_2)$ , which is the sum of two events  $e_1$  and  $e_2$ . This is carried out by the SUM operation between two predicates  $\alpha$  and  $\beta$  (Rothstein 2004):

$$(25) \quad \text{SUM}[\alpha, \beta] = \lambda y \lambda e \exists e_1 \exists e_2 [e = {}^S(e_1 \cup e_2) \& \alpha(e_1, y) \& \beta(e_2, y) \& \text{TPCONNECT}(e_1, e_2, y)]$$

We can now present the derivation of (23). These are the two predicates we want to combine:

- (26) a.  $\| \text{haver} \|_V = \lambda P \lambda e \exists y [\pi(e, x, y) \& P(y)]$  (predicate formation has not applied yet,  $x$  remains free)  
 b.  $\| \text{venguts} \|_{AP} = \lambda x \lambda e [\text{venguts}(e, x)]$  (predicate formation has already applied)

Now we can apply the SUM operation:<sup>8</sup>

$$(27) \quad \begin{aligned} & \| \text{haver } 200 \text{ cavallers armats venguts} \|_{VP}: \\ & \text{SUM}(\| \text{haver} \|_V, \| \text{venguts} \|_{AP}) (200 \text{ cavallers armats}) \\ & = \text{SUM}(\lambda P \lambda e \exists y [\pi(e, x, y) \& P(y)], \lambda x \lambda e [\text{venguts}(e, x)]) (\| 200 \text{ cavallers armats} \|) \\ & = \lambda P \lambda e \exists e_1 \exists e_2 \exists y [e = {}^S(e_1 \cup e_2) \& \pi(e_1, x, y) \& P(y) \& \text{venguts}(e_2, y) \& \\ & \quad \text{TPCONNECT}(e_1, e_2, y)] (\lambda z [200(z) \& \text{cavallers}(z) \& \text{armats}(z)]) \\ & = \lambda e \exists e_1 \exists e_2 \exists y [e = {}^S(e_1 \cup e_2) \& \pi(e_1, x, y) \& 200(y) \& \text{cavallers}(y) \& \text{armats}(y) \& \\ & \quad \text{venguts}(e_2, y) \& \text{TPCONNECT}(e_1, e_2, y)] \end{aligned}$$

When we reach the VP level, predicate formation applies (by lambda-abstracting over the free  $x$  variable), allowing the external argument of the main verb to enter the derivation:

$$(28) \quad \begin{aligned} & \| \text{hi havia } 200 \text{ cavallers armats venguts} \|_{VP}: \\ & \lambda x \lambda e \exists e_1 \exists e_2 \exists y [e = {}^S(e_1 \cup e_2) \& \pi(e_1, x, y) \& 200(y) \& \text{cavallers}(y) \& \text{armats}(y) \& \\ & \quad \text{venguts}(e_2, y) \& \text{TPCONNECT}(e_1, e_2, y)] (\| \text{hi} \|) \\ & = \lambda e \exists e_1 \exists e_2 \exists y [e = {}^S(e_1 \cup e_2) \& \pi(e_1, \text{loc}(l_i), y) \& 200(y) \& \text{cavallers}(y) \& \text{armats}(y) \& \\ & \quad \text{venguts}(e_2, y) \& \text{TPCONNECT}(e_1, e_2, y)] \end{aligned}$$

At the end of the operation, existential quantification will apply, yielding:

$$(29) \quad \exists e \exists e_1 \exists e_2 \exists y [e = {}^S(e_1 \cup e_2) \& \pi(e_1, l_i, y) \& 200(y) \& \text{cavallers}(y) \& \text{armats}(y) \& \text{venguts}(e_2, y) \& \text{TPCONNECT}(e_1, e_2, y)]$$

<sup>8</sup> As a result of the analysis of incorporation developed in the previous subsection, note that *haver* and *venguts* are not of the same type. This technical problem could potentially be solved by a modification of the SUM operation. Another option to circumvent it would be to use another semantic analysis of incorporation such as Chung and Ladusaw's (2003).

These are the right truth-conditions for the sentence: there is an event  $e$ , which is the sum of two events  $e_1$  and  $e_2$ .  $e_1$  is the state introduced by *haver*: it denotes  $\pi$ , the pragmatically controlled relation (here loosely referring to 'being located') we have used in the previous subsection for non-relational nouns. Its internal argument is existentially quantified by means of the denotation of *haver*, thus capturing the definiteness restriction that these sentences display. On the other hand, this argument is the external argument of the event  $e_2$ , introduced by the secondary predicate. Note that, as step c above shows, the two predicates combine to form a complex predicate before being applied to the argument they share. By virtue of the Time-Participant Connected relation holding, the two events share a run time and this participant. Finally, the external argument (the locative *hi*) applies to this complex VP.

This analysis simplifies various aspects of Rothstein's account and needs further refinement, but it should give a plausible account of how the Old Catalan examples we are dealing with were interpreted. Space precludes showing the derivations for other sentences. However, if we look at a case such as (30), applying the same method should yield the truth-conditions in (30'):

- (30) A l' emperadriu ha venguts dos cavallers  
 To the. SG empress have.3.SG come. M.PL two knights  
 Two knights have come to the empress (*Descloit*, 13<sup>th</sup>)

- (30')  $\exists e \exists e_1 \exists e_2 \exists y [e =^S (e_1 \cup e_2) \ \& \ \pi(e_1, \iota x[\text{emperadriu}(x)], y) \ \& \ \text{dos}(y) \ \& \ \text{cavallers}(y) \ \& \ \text{venguts}(e_2, y) \ \& \ \text{TPCONNECT}(e_1, e_2, y)]$

## 5. Conclusions and future research

This paper has presented some data on the use of *haver* ('have') and the system of auxiliary selection in the perfect in Old Catalan. We have seen that, aside from being a perfect auxiliary, *haver* was used in possessive sentences (which would use *tenir* in modern Catalan) and in sentences making existential assertions (equivalent to modern Catalan *haver-hi*); I have put forward that the latter differ from the possessive ones only by having oblique subjects. I have shown data regarding the use of *haver* with unaccusative past participles, and I have argued that some of these examples involve *have*-triggering features that are not unique to Old Catalan. However, most cases of *haver* + unaccusatives have all the features of sentences making existential assertions, including oblique subjects. Data of this latter kind have not, to my knowledge, been found in any other Old Romance language.

I have adopted a standard treatment of *have* (based on Barker 1991, Van Geenhoven 1998 and Partee 1999) to account for the possessive uses of *haver*, as well as the ones which make an existence assertion that captures the definiteness restriction that some of these uses give rise to. Besides, I have adopted a version of Rothstein's (2004, 2011) analysis of secondary predicates to account for the examples where the unaccusative past participle seemingly appears in sentences where the unaccusative participle plays the role of the secondary predicate.

This analysis covers some of the uses of *haver* in Old Catalan, but as it is it does not extend to all of them. It does not, for instance, give an account for the much-debated issue of *have*-perfects of transitives and unergatives, which I have skipped in this analysis. This remains as a challenge for future research. Moreover, the formal implementation adopted here needs further refinement. However, I hope that the Old Catalan data I have presented and the line of analysis suggested can help improve our understanding of split intransitivity in the selection of the perfect auxiliary and the processes whereby it has vanished from many languages, as well as our comprehension of the relation between perfects, possession and existence assertions (which use the same verb in many languages) and on why *haver-hi* is the existential predicate in Modern Catalan. I also hope that this study casts some more light on the semantics of *have* cross-linguistically and on finding out the common core in all its many contexts of use.

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# From Totally Dark to Totally Old. The Formal Semantics of Subjectification.<sup>1</sup>

Andrea Beltrama — University of Chicago

**Abstract.** *Subjectification* is the process whereby meanings become increasingly based in the speakers' attitudes towards a proposition (Traugott 1989). While commonly invoked, such process has rarely been modeled in formal terms. As a consequence, it is often hard to see (i) what component of an expression undergoes change, and (ii) what semantic core persists through the shift. I present the intensifier *totally* as a case study to shed light on these issues, modeling the shift as a transition along domains with analogous scale-structure. More specifically, I analyze the trajectory as a shift from degree to speech act modification, formally modeling the transition as a change in the nature of the targeted scale ('lexical degrees' → 'speaker's commitment'). The analysis recasts subjectification as a transition between different sources of scalarity, positing effects of *slack-regulation* as a natural bridge between these two stages.

**Keywords:** intensifiers, scalarity, diachrony, subjectification, totally, precision, speaker-oriented meaning

## 1 Introduction

Semantic phenomena have been traditionally investigated from both formal and diachronic perspectives. Yet, although the two approaches have contributed important insights in the respective domains, they have mostly proceeded on parallel tracks. Scholars working in the formal perspective, on the one hand, have been concerned with providing fine-grained abstract representations of semantic phenomena and categories. Scholars within the historical tradition, instead, have mainly focused on large scale descriptive models for semantic change, emphasizing how a limited set of processes — e.g. *grammaticalization*, *subjectification*, *bleaching* — can be invoked to account for a wide array of different trajectories of semantic change. Only in recent years have semanticists finally begun to call for a methodological integration of these two perspectives. A paramount example of this research program is represented by the work of Deo 2006, where the author argues that unifying the grammaticalization perspective with a formally precise characterization of the semantic content of tense/aspect categories can significantly further the understanding of the phenomenon (see also Condoravdi and Deo To Appear, Deo To Appear). In a similar vein, Eckardt (2006) applies the formal notions of downward entailing context and scalar reasoning to the diachronic study of negation in Jespersen's cycle, contributing a novel perspective to a widely

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investigated phenomenon. The current project aims to extend this research program to the study of intensification and scalar meaning, a realm which has received considerable attention in both traditions, yet without significant integration between them. By providing a formal analysis of the trajectory involving the intensifier *totally*, this paper argues that the morpheme loosely moves from accessing lexically specified scalar domains to accessing pragmatic, speaker-oriented scalar domains, providing a formal implementation of the general process of *subjectification*.

## 2 Background

### 2.1 Synchronic approaches

The phenomenon of *intensification* manifests itself in a number of different ways.

- |  |                                |
|--|--------------------------------|
| (1) Mark is <b>very</b> tall.                  | SOURCE: Lexical scale          |
| (2) The ball is <b>perfectly</b> spherical.    | SOURCE: Precision scale        |
| (3) Try answering the <b>fucking</b> question. | SOURCE: Speaker-oriented scale |

Intuitively, all the expressions in boldface perform an intensifying function, as they strengthen the intensity of an underlying scalar dimension. Yet, the modifiers differ in the kind of scale with which they combine.

Adjectives like *tall* are considered to be *gradable* (Heim 2000, Rotstein and Winter 2004, Kennedy and McNally 2005). They *inherently* encode a scale in their lexical meaning, as shown by the fact that they felicitously combine with comparatives (in (4a)) and wh-degree questions (in (4b), Kennedy 2007).

- |   |             |
|---|-------------|
| (4) a. Mark is tall- <b>er</b> than John. | COMPARATIVE |
| b. <b>How tall</b> is Mark?               | WH-DEGREE   |

Intensifiers such as *very*, commonly referred to as *degree modifiers*, target such a lexically encoded scale, raising the degree to which the property is instantiated. Because they target scales that are encoded in the lexicon, degree modifiers achieve their effect in a straightforwardly compositional manner, changing the truth-conditions of the modified predicate. Assuming that a person counts as *tall* if her height exceeds a certain threshold value, a person will need to exceed a significantly higher threshold to count as *very tall*.

In (2) and (3), however, the following predicate does not make a scale available. In the former case, *perfectly* intuitively operates along a scale of *pragmatic precision*, specifying that the ball at stake is maximally adherent to a strict interpretation of the property, and cannot just be “more or less” spherical. Modifiers of this kind are normally referred to as *slack regulators* (Lasersohn 1999, Lauer 2012). Similarly to what we have seen for *very* in *very tall*, slack regulators also operate over an underlying scalar dimension. Yet, differently from the former modifier, they do not compositionally access the literal meaning of the modified predicate. While *very tall* has different truth conditions from *tall* in its positive form, the truth conditions of *spherical* and *perfectly spherical* are intuitively the same. What changes is the pragmatic tolerance that we are willing to apply in the interpretation of the predicate.

Finally, modifiers like *fucking* directly boost the intensity of the emotional involvement of the speaker, targeting a *speaker-oriented* scale. On par with the other modifiers, *fucking* also modulates the intensity of some scalar dimension. Here, for instance, it could be possible to paraphrase its effect by suggesting that it conveys a high degree of frustration/emotive involvement (Potts 2003, Potts 2005) on the part of the speaker with respect to the question. Yet, these modifiers have minimal semantic interaction with their complement. By directly expressing the speaker’s attitude/stance towards a certain state of affairs, they specify a kind of content that is virtually independent from the propositional content.<sup>2</sup>

As emerged from this quick overview, the category of intensification exhibits a great deal of internal diversity. Intensifiers, while presupposing the underlying presence of an ordering, can target scales of different nature and operate on them via different kinds of semantic operations. The following table summarizes two important parameters of variation. One represents their distribution, where degree modifiers are maximally restricted, speaker-oriented maximally unrestricted, and slack regulators occupy a middle ground. The other concerns the effect of the modifier on the meaning of the modified predicate. Degree modifiers modify the truth conditions of their complement, speaker-oriented intensifiers have virtually no impact on the predicate’s meaning, and slack regulators once again occupy an intermediate position. The table below summarizes this categorization.

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<sup>2</sup>Interestingly, a potential counterexample to this observation seems to come from usages in which speaker-oriented intensifiers are followed by a gradable predicate. For example, saying that “a road is *damn long*” normally gives rise to the inference that the road in question has greater length than a “regular” road, and therefore has a similar effect to a degree modifier. To solve this puzzle, a typical explanation is that *damn* brings about the boosting effect as a “side effect” (Constantinescu 2011): As the speaker has strong feelings towards the fact that the road is long, then it is natural to infer that such a road must be outstanding in length, even though the modifier does not compositionally interact with the adjective.

(5)	Intensifier	Targeted scale	Distribution	Semantic impact
	Degree Modifiers	Lexical scale	Gradable predicates	Changes truth-conditions
	Slack regulator	Scale of precision	Expressions amenable to imprecision	Changes extension
	Speaker-oriented intensifier	Speaker's attitude	Any expression	Specifies independent content

## 2.2 Diachronic approaches

From a diachronic perspective, intensifiers have been widely investigated due to their instability and the related tendency to stratify across the socioeconomic space (Kwon 2012; Macaulay 2006; Rickford 2007; Tagliamonte 2008; Tagliamonte and Roberts 2005). With respect to the semantic aspect, the scientific debate focuses on two broad processes: Grammaticalization and Subjectification.

The former, which is often conceptualized in terms of *bleaching* or *delexicalization*, can be defined as the transformation of independent lexical content words into bound, functional “grammatical” words (Eckardt 2002). Prime examples of this type of change are English *will*, which transitions from being a volitional verb to a tense marking auxiliary, or *going to*, which evolves from expressing physical movement to marking future. With respect to intensifiers, a textbook example of the shift is provided by *very*, which once featured the independent meaning of “genuine” or “true”, and has now turned into a functional morpheme, whose contribution is only meaningful in relation to the meaning of the following predicate. Similar trajectories can be pointed out for many other intensifiers, including *really*, *pure* (Macaulay 2006) and *dead* (Blanco-Suarez 2013). While insightful, the application of the grammaticalization model to the study of intensifiers raises some issues. First, the very idea of seeing bleaching as a “loss” of meaning is rather problematic (von Stechow 1995 and Eckardt 2002), and does not quite capture the intuition that a shift from the independent-to-functional meaning shift is more properly framed as a change in semantic *type*, as opposed to an erosion of *semantic content*. Second, these accounts predict that intensification represents a terminal stage of semantic change, beyond which further steps cannot be posited (Lorenz 2002), and cannot say much about the diachronic transformations of morphemes that are already functional. Third, by treating intensifiers as a homogenous category, it misses the axes of semantic variation that underlie the category of intensification, as discussed in Section 2.1.

The latter process, introduced first by the work of Traugott, refers to the process whereby meanings become increasingly based in the speaker's subjective beliefs/attitudes towards a proposition (Traugott 1989).<sup>3</sup> Countless examples of this kind of change have been discussed in the litera-

<sup>3</sup>Note that the debate is ongoing as to whether subjectification and grammaticalization should really be considered

ture, including the emergence of evaluative meanings (e.g. English *boor*, 'countryman, farmer' > 'crude person' in Traugott 2004) and of epistemic modality (e.g. *must*, Traugott 1989). According to Traugott, most intensifiers also emerged following this direction of change. Expressions like *very* and *really* have evolved to "encode the speakers assessment of the referentiality of the item selected" (Traugott 1995: 44), marking a move away from the propositional content and towards the speaker's perspective. More recently, Hoeksema 2011 delineates the trajectory of the intensifier *helemaal* in Dutch, which moves from a meaning as a degree modifier ( $\approx$  *entirely*) to a meaning of a scalar particle ( $\approx$  *especially*), where the scale is not encoded by the predicate, but is constructed on the basis of the previous discourse and pragmatic expectations. As such, the intensifier's trajectory also subtends a shift from semantics to pragmatics, and from a propositional to a more speaker-oriented kind of content.

Similarly to grammaticalization, the notion of subjectification, while empirically adequate to capture the general trajectory of the path, is not unproblematic. First, there is a general lack of discussion of what the linguistic/grammatical properties of subjective meaning are. A promising proposal to fill this gap comes from the work of Gutzmann 2013, who models subjectification as a diachronic semantic type shift from *descriptive* to *expressive* types (Potts 2003, Potts 2005). Yet, while adequate for Gutzmann's case study, shifts along these lines cannot be extended to just any instance of subjectification, especially considering that Traugott's notion of expressivity involves kinds of content that go beyond expressivity. Second, it is often not clear what semantic component undergoes change, and what semantic core persists throughout subjectification shifts. As a result, it is often hard to characterize the diachronic shifts in a precise way.<sup>4</sup> Finally, with the exception of Hoeksema 2011, no account has addressed the issue of subjectification *within* the category of intensification. While the observation that intensifiers as a whole constitute an example of "subjective meaning" is empirically sound, it remains to be seen whether and how a similar trajectory emerges in light of the different types of scalar meaning discussed above.

## 2.3 Interim summary

Intensification has received considerable attention from both a synchronic and a diachronic perspective. In synchronic semantics, research has focused on the different kinds of orderings that intensifiers can target. In diachronic investigations, instead, scholars have attempted to frame

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as distinct notions (see Traugott 1982, Traugott 1989, Traugott 2010). Because these debates are only tangentially relevant to the current paper, they will not be elaborated on any further here.

<sup>4</sup>A notable exception, in this sense, comes from Eckardt's work (Eckardt 2009, Eckardt 2002). For example, she analyzes Italian *perfino*, which comes to mean "even" after meaning "at the end", as a transition from a temporal to a pragmatic likelihood scale, where the underlying presence of an ordering is retained in the process. Moreover, Eckardt argues against using this notion as an independent explanation of the trajectory and advocates a model of semantic change in which hearers, once confronted with an expression in a novel context, re-analyze the meaning of the expression to "make things fit", originating a new meaning. I refer to Eckardt 2009 for further discussion on the topic.

intensification within broader models of semantic change, such as subjectification and grammaticalization. Yet, while scholars in either field have achieved important results, synchronic and diachronic approaches have rarely been fruitfully integrated. On the one hand, formal semanticists focused on the grammatical encoding of intensification as a crystallized phenomenon, paying little attention to the diachronic relation between different categories of scalar meaning. On the other hand, historical semanticists have explored the general patterns involving intensifiers, treating them as a largely homogenous category. As a result, they could not incorporate in their work the fine-grained semantic distinctions which have been uncovered in synchronic studies. In light of this state of affairs, integrating these two approaches represents a worthy scientific enterprise, both in the study of intensifiers, and in the study of meaning in general. In the current paper, I explore the diachronic trajectory of *totally*, aiming to provide a contribution within this spirit.

### 3 The trajectory of *totally*

Synchronically, the intensifier *totally* in American English features a striking amount of flexibility, and can represent all the kinds of intensification discussed above.

- |     |  |                        |
|-----|--|------------------------|
| (6) | a. The tank is <b>totally</b> full. ( $\approx$ full to the brim)                  | Lexical scale          |
|     | b. Dinosaurs are <b>totally</b> extinct. ( $\approx$ absolutely extinct)           | Precision scale        |
|     | c. We <b>totally</b> won the game! ( $\approx$ the speaker is maximally committed) | Speaker-oriented scale |

While the promiscuous distribution of the intensifier has been addressed in synchronic work (Irwin 2014 and McCready and Kaufmann 2013), no study has investigated the diachronic trajectory whereby such polysemy came into being. The only relevant observation, in this respect, is that speaker-oriented usages tend to be associated with younger speakers and informal varieties, and sound intuitively “more recent” to native speakers’ ears.<sup>5</sup> This paper aims to explore the historical connection between the different uses of *totally* by addressing the following question: Is there a principled diachronic ordering in which *totally* came to modify these different types of scale? If the diachronic trajectory of *totally* conforms to the direction of change posited by subjectification, we predict that uses like the one in (6c) have emerged at a later stage, consistent with the intuition that these forms sound somewhat “innovative”. If this turned out to be true, we would be in the position of recasting subjectification as a transition between different types of semantic ordering, providing a formal account of this mode of change within a theory of scalar meaning.

<sup>5</sup>This observation has been made, in anecdotal form, by various authors (Zwicky 2011 and Irwin 2014).

Relying on evidence from the Corpus of Historical American English (COHA, Davies (2010-))<sup>6</sup>, I will show that this prediction is borne out. While occurrences of the intensifier as a degree modifier and a slack regulator have been around for at least the past two hundred years, speaker-oriented usages only emerged past 1980 (roughly), and are therefore confirmed to be significantly more recent than the other two. I now proceed to discuss the semantic representations of each stage of the transition, focusing on which part of the meanings remains constant throughout the path, and which, instead, undergoes change.

### 3.1 *Totally* as a degree modifier

COHA covers a period of time ranging from 1810 to 2010. In the earliest texts, *totally* is already systematically attested as a degree modifier. That the intensified predicates are gradable is confirmed by the tests illustrated below (in (7c)).

- (7) a. It was **totally** dark about me.<sup>7</sup>  
 b. A civilization **totally** independent of true refinement, but which so smooths and polishes its disciples.<sup>8</sup>  
 c. i. ✓Room A is darker than Room B  
 ii. ✓How dark is Room A?

In this context, *totally* requires that the property denoted by the complement hold to the maximum degree. It follows that its distribution is sensitive to the kinds of scale lexicalized by the predicate (Kennedy and McNally 2005). Adjectives with upper-bounded scale (i.e. *absolute* gradable predicates in Kennedy and McNally 2005's terminology, or *total* predicates in Yoon 1996's) are a productive target. On the other hand, *relative* adjectives, which encode a scale that cannot supply a maximum to the composition, are not attested (in (8)).

- (8) Not found: ?? **totally** big/huge/hot... Relative gradable predicate

In formal terms, I follow Heim (2000) and Kennedy and McNally (2005)'s models in proposing that *totally* combines with a gradable predicate *G* of type  $\langle d, et \rangle$  and requires that the degree to which the property is instantiated correspond to the maximum degree of the scale ( $\max(S_G)$ ).<sup>9</sup> The

<sup>6</sup><http://corpus.byu.edu/coha/>

<sup>7</sup>1823 Title: Randolph: A Novel, Volume 1 Author: Neal, John, 1793-1876 Source: Randolph: A Novel, Volume 1

<sup>8</sup>1833; Title: Crayon Sketches [ed.] Volume 2; Author: Fay, Theodore S. (Theodore Sedgwick)

<sup>9</sup>Note that using degree types in the ontology is not necessary. See in particular the work by Klein (1980) and its recent revisitation by Doetjes et al. (2009) for degree-less implementations. The argument developed in the present paper is compatible with both approaches.

lack of a maximum, as in relative adjectives, generates a compositional mismatch, preventing the derivation from going through.

- (9) a.  $\llbracket \text{TOTALLY}_{DM} \rrbracket = \lambda G_{\langle d, et \rangle} \lambda x. G(x) = \max(S_G)$   
 b.  $\llbracket \text{TOTALLY DARK} \rrbracket = \lambda x. \text{dark}(x) = \max(S_{\text{dark}})$

### 3.2 *Totally* as a slack regulator

In the same time frame, *totally* is also attested with several *non-gradable* predicates, as shown in (10).

- (10) a. By that time the bison was **totally** extinct in all the region east of the Mississippi River.<sup>10</sup>  
 b. Dew is **totally** absent in some regions, as in our Death Valley.<sup>11</sup>

Here, *totally* achieves an effect very similar to the one brought about by slack regulators like *perfectly* or *absolutely*. For example, if only a few exemplars of a species are alive, we can consider the species to be *practically* extinct, adopting a loose interpretation of the predicate. The use of *totally* eliminates this tolerance, triggering a strictly truth-conditional interpretation of the predicate.

Note that this contribution of *totally* is qualitatively distinct from the use as a degree modifier, as shown in (11).

- (11) a. ?? Dodos are more extinct than Dinosaurs.  
 b. ?? How extinct are dodos?  
 c. ?? Dew in point A is more absent than dew in point B.  
 d. ?? How absent is dew here?  
 e. ✓ Room A is darker than Room B.  
 f. ✓ How dark is Room A?

Another difference is that slack regulation does not interact with the truth-conditions of the modified predicate. On the one hand, a *totally dark* object must feature a higher degree of darkness than a simply *dark* one. On the other hand, *extinct* has the same meaning as *totally extinct*: no living animals of a certain species must remain in the world. (12) illustrates this contrast.

<sup>10</sup> 1889; Title: The Extirpation of the American Bison Author Hornaday, William Temple, 1854-1937

<sup>11</sup> 1905 Publication information Harpers: 1905-03 p. 577-583 Title Plant life in the desert Author Ernest Ingersoll



- (12) a. ‘totally extinct’ = ‘extinct’ = no exemplars  
 b. ‘totally dark’  $>_{darkness}$  ‘dark’

When it comes to formalizing the slack regulation effect, two questions need to be addressed in a diachronic perspective. First, what semantic features make an expression amenable to (im)precision? Second, what is the common core shared by the semantics of *totally* as a degree modifier and *totally* as a slack regulator? Concerning the first question, I propose that expressions like *extinct* or *absent*, despite having a fixed lexical meaning, can be parameterized to different contextual restrictions, each of which determines the amount of tolerated deviance for the interpretation. Second, I argue that *totally* selects for the least tolerant of these restrictions. Notably, such contextual restrictions are similar to those that normally set the domain of universal quantifiers (von Stechow 1995), the main difference being that, for slack regulation, they target the *granularity* levels with which the expression ought to be interpreted (see Sauerland and Stateva 2007 and Sassoon and Zevakhina 2012 for further discussion of imprecision in terms of granularity).

To see how this would work, let us imagine that there are three different granularity levels  $G$  to which *extinct* can be parameterized (this, of course, represents an idealized scenario). In  $G_2$  only intervals between 0 and 10 are relevant. As a result, a species counts as extinct if it has  $< 10$  exemplars; in  $G_1$  intervals between 0 and 5 are relevant. Therefore, in  $G_1$  a species counts as extinct if it has  $< 5$  survivors. Finally in  $G_0$ , every single unit counts. Therefore, in  $G_0$  a species qualifies extinct if *zero* exemplars remain, in agreement with the actual denotation.

- (13) a.  $\llbracket \text{EXTINCT} \rrbracket_{G_2} = < 10 \text{ exemplars}$   
 b.  $\llbracket \text{EXTINCT} \rrbracket_{G_1} = < 5 \text{ exemplars}$   
 c.  $\llbracket \text{EXTINCT} \rrbracket_{G_0} = 0 \text{ exemplars}$

Let us imagine that, in our idealized world, these three species feature the following number of survivors:

- (14) a.  $| \text{BISON} | = 0$   
 b.  $| \text{BIGHORN SHEEP} | = 5$   
 c.  $| \text{AMARGOSA VOLE} | = 7$

In light of their effects on the extension of the predicate, the restrictions can be ordered according to asymmetric entailment relations. If something is in the extension of *extinct* in  $G_0$ , it will also be in the extension in  $G_1/G_2$ , but not vice-versa. This is a desirable result, as it derives the strengthening effect of slack regulation: a more precise interpretation is more informative than a less precise one, in that it asymmetrically entails it. For  $R$  being a restriction determined by the granularity level in the context, the strengthening effect can be captured in the following way.

- (15) a. If  $R_0 > R_1 > R_2$ , then  $G: \text{Extinct}_G(x)$  in  $R_0 > G: \text{Extinct}_G(x)$  in  $R_1 > G: \text{Extinct}_G(x)$  in  $R_2$   
 b. If  $R_0 > R_1 > R_2$ , then  $\llbracket \text{Extinct} \rrbracket_{R_0} \subset \llbracket \text{Extinct} \rrbracket_{R_1} \subset \llbracket \text{Extinct} \rrbracket_{R_2}$   
 c. If  $R_0 > R_1 > R_2$ , then  $\llbracket \text{Extinct} \rrbracket_{R_0} \rightarrow \llbracket \text{Extinct} \rrbracket_{R_1} \rightarrow \llbracket \text{Extinct} \rrbracket_{R_2}$

We can now sketch out a meaning for this use of *totally*. For a property  $P$ , the intensifier picks the highest restriction on the ordering, namely the one which allows for the least indifference, triggering an interpretation which is maximally adherent to the truth conditions.

- (16) a.  $\llbracket \text{TOTALLY}_{SR} \rrbracket = \lambda P \lambda x. \max R: \{P(x)_R=1\} = \max R: P(x)_R$   
 b.  $\llbracket \text{TOTALLY EXTINCT} \rrbracket = \lambda x. \max R: \{\text{extinct}(x)_R=1\} = \max R: \text{extinct}(x)_R$

The analysis shows the underlying semantic core beneath the usage of *totally* as a degree modifier and as a slack regulator. In both cases, the intensifier targets an ordered domain, selecting for its endpoint. Second, it also reveals that both degree modification and slack regulation, despite their different nature, bring about an intensification effect that is based on asymmetrical entailment relationships.

### 3.3 *Totally* as a speaker-oriented intensifier

While distinct, occurrences of *totally* as a degree modifier and a slack regulation are simultaneously attested in each period covered by the corpus. Things, however, become diachronically intriguing when one gets to the most recent years. Here, *totally* suddenly broadens its distribution. Besides being found with absolute gradable predicates or with expressions amenable to imprecision, it is now also attested with non-gradable predicates, relative adjectives (e.g. *old*), negated constituents, and noun phrases. It is also found as a stand alone expression to express agreement in response to a previous statement. (17) provides several examples.

- (17) a. I **totally** think: Have I got to go and play basketball now?<sup>12</sup> Non-gradable predicate  
 b. Because guess what? Castles are **totally** old<sup>13</sup>. Relative adjective  
 c. It's strapless - **totally** not the dress code for a suburban house in Upper Darby, RI<sup>14</sup>. Negated constituent  
 d. A: Did you ever have an awkward phase? B: **Totally**<sup>15</sup> Stand alone

<sup>12</sup> 1996, Rolling Stone: 12/12/96 Issue 749: p40, 9

<sup>13</sup> 2004, New York: HarperCollins, Edition: 1st Harper Trophy ed.

<sup>14</sup> 2004, New York: Atria, Edition: 1st Atria books hardcover ed.

<sup>15</sup> 2009 (Jun 29, 2009) Vol. 71, Iss. 25; pg. 64

It is hard to see how the intensifier, in these contexts, could have anything in common with either a degree modifier or a slack regulator. On the one hand, none of the expressions above encodes an upper-bounded lexical scale. On the other hand, they do not appear to lend themselves to the application of pragmatic tolerance. It therefore appears to be legitimate to suggest that *totally*, here, acts as a speaker-oriented modifier. By doing so, it modulates the *attitude* that the speaker has towards the expression. A few observations support this view. First, this usage of the intensifier is now sensitive to *speech act type*, as discussed in McCready and Kauffman (2013). It is felicitous in assertions, but not in direct imperatives or questions. The search on the corpus confirmed this prediction, finding no examples of speaker-oriented *totally* with these types of sentence form.<sup>16</sup>

- (18) a. ✓ I **totally** think: Have I got to go and play basketball now?  
 b. ?? **Totally** think: Have I got to go and play basketball now?  
 c. ?? Who **totally** thinks: Have I got to go and play basketball now?

Second, the adverb, consistent with the general properties of speaker-oriented meaning, is a positive polarity item (see Irwin (2014) for a thorough discussion of this property). No examples of *totally* under the scope of negation are found in the corpus. Native speaker judgments support this claim. While (19a) sounds infelicitous, occurrences of *totally* as a degree modifier or a slack regulator are fine in this environment.

- (19) a. ?? I don't **totally** think: Have I got to go and play basketball now?  
 b. ✓ Dinosaurs aren't **totally** extinct.  
 c. ✓ The room isn't **totally** dark.

Third, speaker-oriented *totally* cannot be targeted by denials. This suggests that it is not part of the asserted content, but pertains to an independent semantic level, similarly to other kinds of non at-issue content (e.g. Potts 2003 on expressive meaning, Rett and Murray 2013 on mirative evidentials). Note that an occurrence of *totally* as a degree modifier and as a slack regulator can instead be targeted by negation.

- (20) a. A: I **totally** think: Have I got to go and ...  
 B: # No, that's not true! You are not strongly committed to the fact that you think this!  
 B': ✓ No, that's not true! You don't think that.

<sup>16</sup>Interestingly, however, native speakers I consulted deemed all sentences above as acceptable. In addition, several counterexamples like the following were found on the Corpus of American English (Davies (2010-)), which is more sizeable than COHA.

- (1) **Totally** go get it

- b. A: The room was **totally** dark.  
 B: ✓No, that's not true! It was almost dark, but not completely so.
- c. A: Dinosaurs are **totally** extinct  
 B: ✓No, that's not true! They are almost extinct, but not completely so.

A fourth property is that speaker-oriented *totally*, by virtue of modifying a dimension relative to the speaker, is *perspective-dependent*. As such, it shifts whenever it is embedded under the matrix subject of a reportative verb (Irwin 2014).

- (21) a. Mark **totally** thinks... ANCHOR: the speaker  
 b. John said that Mark **totally** thinks... ANCHOR: John

In sum, the recent usage of *totally* features four main characteristics. It is sensitive to speech act type; it is exclusively licensed with positive polarity; it is not part of the asserted content, and it is perspective dependent. At this point, it is possible to address the crucial issue: what is the semantic contribution of *totally*, here? In informal terms, I propose that *totally* modifies a property of the speech act. More precisely, it modulates the degree of *commitment* that the speaker has towards the assertion.

In more formal terms, I model this contribution as a conventional implicature operating at the speech act level. Because the notion of sincerity is entirely grounded in the speaker's perspective, it is in principle always available with an assertion. In modeling the effect, I adopt a Potts style multi-tiered semantics:  $p$  is a proposition,  $\mu$  is a gradable predicate describing the speaker's commitment towards the proposition, and  $s$  is the speaker to which the degree of commitment is anchored. Finally  $t$  is a regular and  $u$  an expressive type, used to refer to content encoded at the level of conventional implicatures. *Totally* combines with  $p$ , returning a maximal value of  $\mu$  for  $p$ .

- (22) a.  $\llbracket \text{TOTALLY}_{SO} \rrbracket = \lambda p_t. [\mu(p)(s) = \max(\mu)]_u$   
 b.  $\llbracket \text{I TOTALLY THINK} \rrbracket = [\mu(\text{I think})(s) = \max(\mu)]_u$

Framing the contribution of *totally* in these terms helps us to make sense of the distributional properties discussed above. First, because commitment concerns a dimension of the speech act rather than the propositional content, we correctly predict that this use of *totally* does not interact with logical operators. Second, the incompatibility of *totally* with command imperatives and information questions can be accounted for. By virtue of being commands, imperatives do not make reference to a gradable notion of commitment. Rather, they presuppose a particular structure of authority, which is either realized or not (McCready and Kaufmann 2013). Concerning information questions, they presuppose that the speaker cannot have any precise thought or commitment with respect to the proposition. As such, intensification along this dimension results in infelicity.

Third, anchoring the contribution of *totally* to the speaker correctly accounts for the perspective-dependent nature of the meaning, as observed in (21).

### 3.3.1 *Totally*: summarizing the trajectory

*Totally* retains a common semantic core throughout its diachronic trajectory, represented by the “=Max” function in the denotations below. Both recent and non-recent uses of the modifier operate over same-structured, upper bounded orderings, selecting for the maximum point of this scale. What changes across the different usages is the nature of the scale: It starts out as being lexically encoded and ends up as being entirely rooted in the speaker’s attitude towards the speech act.

- |      |  |                  |
|------|--|------------------|
| (23) | a. $\llbracket \text{TOTALLY}_{DM} \rrbracket = \lambda G_{\langle d, et \rangle} \lambda x. G(x) = \mathbf{max}(S_G)$ | Degree modifier  |
|      | b. $\llbracket \text{TOTALLY}_{SR} \rrbracket = \lambda P \lambda x. \max D: \{P(x)_D=1\} = \mathbf{max D}: P(x)_D$    | S. regulator     |
|      | c. $\llbracket \text{TOTALLY}_{SO} \rrbracket = \lambda p_t. [\mu(p)(s) = \mathbf{max}(\mu)]_u$                        | Speaker-oriented |

## 4 Subjectification at work

As discussed in the earlier sections, the main empirical question motivating the present study can be framed as follows: Is there a principled order in which different domains of scalarity emerge in the evolution of *totally*? The emerging trajectory is one which the semantic contribution of the intensifier starts as modifying a gradable property encoded in the denotation of an adjective, and is able to modify a scale that is grounded in the speaker’s perspective. The two pathways can be summarized as follows.

- (24) **Stage 1:** Degree modifier/slack regulator → **Stage 2:** Speaker-oriented intensifier.

The notion of scalarity constitutes the common thread tying together the various diachronic stages, and captures the semantic core maintained by the intensifiers: Throughout the respective trajectories, *totally* always selects for a scalar endpoint. What changes is the nature of the modified scale, which extends to embrace an ordering grounded in the speaker’s perspective.

This pattern of semantic change carries relevant implications from both a diachronic and a synchronic perspective. Starting with diachrony, it appears to be consistent with the predictions of Traugott’s *subjectification* models. In particular, the proposed analysis suggests that, for intensification, subjectification can be modeled as a transition across similarly structured scalar domains, and as a broadening of the compositional mechanisms necessary to modify such scales. While the

ordering starts out as being exclusively grounded in the propositional content, by the end of the trajectory *totally* is able to modulate speaker-oriented scales. As a result, a more nuanced view of the diachronic status of intensifiers must be adopted. General models like bleaching and grammaticalization, while empirically insightful, simply cannot tell the whole story. Instead, intensifiers should be treated as an internally multifaceted category, within which processes of systematic semantic change are possible. Crucially, such a perspective appears to be more adequate to the consensus view in synchronic formal semantics, where scholars have long been discussing the empirical and theoretical distinctions between various types of scalarity (see in particular Lasersohn 1999, McCready and Kaufmann 2013, Bylinina 2011, Irwin 2014, Beltrama and Bochnak To appear, McNabb 2012).

From a synchronic perspective, the analysis presented here provides a novel vantage point to look at the relationship between the various manifestations of scalarity. The fact that transitions across different scalar domains are historically attested suggests that a certain diachronic permeability exists across different types of intensification, supporting a view in which the different categories of scalarity, despite their differences, are not completely independent domains. On the other hand, the fact that the flavors of *totally* enter the picture following an orderly trajectory suggests that the distinction between categories of scalar meaning, despite the underlying shared core, is indeed important, and should therefore be maintained.

(25)

+                      Constrained                      -		
Degree modifiers	Slack regulators	Speaker-oriented intensifiers
+                      Impact on complement's meaning                      -		

An intriguing puzzle, in this picture, concerns the historical status of slack regulators. In the synchronic classification illustrated above, these modifiers occupy a middle ground, both in terms of their distribution and their impact on the complement's meaning. It would be reasonable, in light of the analysis proposed, if the diachronic trajectory turned out to mirror this pattern. Simply stated, the reasoning would be the following: Once an expression makes the leap from being a degree modifier to being a modifier of precision, it can also have access to other, similarly-structured pragmatic orderings (e.g. commitment, confidence, expressivity). The trajectory of *totally*, however, does not provide direct evidence against or in support of this hypothesis. The temporal frame of COHA is simply not deep enough to check if, at some point in time, usages of *totally* as a degree modifier preceded the one as a slack regulator. We suggest that looking for more fine-grained diachronic evidence to test this claim might be desirable. In particular, it is encouraging news that slack regulation does emerge as an intermediate historical stage for other intensifiers. In the trajectory from Latin to Italian, for instance, the intensifier suffix *-issimo* goes through an initial stage in which it exclusively operates as a degree modifier, and only several centuries later begins to function as a slack regulator (Beltrama 2014).

## 5 Conclusion and Avenues for future research

By discussing the trajectory of *totally* in American English, the current paper attempts to provide a contribution to the study of intensification and scalar meaning both at a diachronic and a synchronic level. Concerning the diachronic dimension, the analysis argues that the pathway followed by the intensifier aligns with the prediction of *subjectification* models, outlining a formal implementation of the model in terms of a transition across similarly-structured scalar domains. On a synchronic level, the historical continuity between different types of scales supports the idea that the various manifestations of scalarity are closely related categories, and not independent domains. From a methodological perspective, the present study applies the toolbox of formal semantics to corpus-based work, taking a step in the direction of a much needed integration between synchronic and diachronic approaches to the investigation of meaning. This research enterprise, recently launched by several authors in the field, shows intriguing potential, and is well worth being extended to cover other phenomena in the realm of semantics.

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# Great pizzas, ghost negations: The emergence and persistence of mixed expressives<sup>1</sup>

Andrea Beltrama — University of Chicago

Jackson L. Lee — University of Chicago

**Abstract.** This paper presents two novel cases of mixed expressives: Italian *gran* ‘big’ and Cantonese *gwai2* ‘ghost’. Both mixed expressives have recently undergone a shift in truth-conditional meaning, while maintaining expressivity. We argue that (i) in contrast to theories that predict its diachronic volatility, mixed expressivity need not represent a transitional stage of semantic change, but can be a diachronically stable category, and that (ii) expressive meaning and at-issue meaning diachronically proceed in a parallel fashion, interacting very little in the process. The case studies provide empirical support to current synchronic models of mixed expressivity, which assign separate semantic representations to expressive and descriptive meaning. The data also provide important insights to the poorly understood questions with regard to the diachrony and interaction of truth-conditional and expressive meaning.

**Keywords:** expressive meaning, mixed expressivity, language change, Italian, Cantonese

## 1. Introduction

In the past ten years, the notion of *expressive meaning* has drawn considerable attention in semantics. Even more recent is linguists’ interest in *mixed expressives*, expressions which encode both a descriptive and an expressive contribution (McCready 2010; Gutzmann 2012). In the current paper we analyze the diachronic emergence of two novel cases within this category: *gran* in Emilian Italian, which acquires a quantifier use from an adjectival one; *gwai2* in Cantonese, which moves from being a quantifier to becoming a full fledged sentential negator. The analysis shows that in both cases expressive meaning survives through grammaticalization processes and is preserved on top of newly created truth-conditional meaning, suggesting that expressivity is not necessarily a diachronically volatile category, but can instead be a relatively stable type of meaning. Two main implications follow from the account. First, the data presented show that expressivity or emphasis need not disappear throughout trajectories of semantic change, contrary to what has been claimed in previous studies on expressions participating in Jespersen’s cycle (Jespersen 1917). Second, they provide empirical support to theories assigning to expressive and truth-conditional meaning independent semantic representations, which have been outlined by a variety of authors in recent synchronic semantic work (Potts 2005, 2007, McCready 2010, Gutzmann 2012). The paper is divided as follows. Section 2 introduces the notion of mixed expressivity, with particular emphasis

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on its diagnostics, as well as previous claims on its diachronic status. Sections 3 and 4 present the two case studies from Italian and Cantonese respectively. Section 5 concludes.

## 2. Background

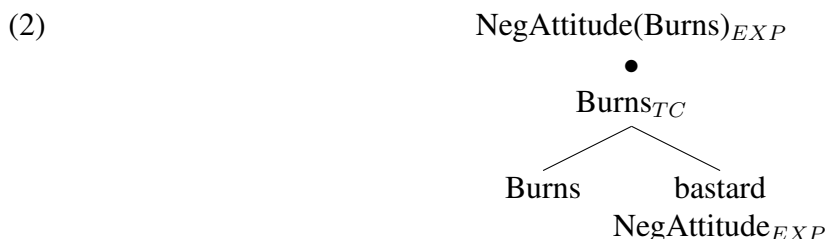
In this section, we provide an overview of previous work on *expressive* meaning and *mixed expressive* meaning, both from synchronic and diachronic perspectives.

### 2.1. Expressive content: composition and diagnostics

In formal semantics, *expressive* meaning typically refers to a specific content which conveys non at-issue, non truth-conditional information about the emotive condition of the speaker. While the nature of the feeling is usually underspecified, expressives normally indicate that the speaker is in a “heightened emotional state” (Potts 2005, 2007; Potts and Schwarz 2008). For example, the expression *bastard* below represents a well known instance of the phenomenon. As (1) shows, this form adds nothing to the propositional content of the sentence. It merely indicates that the speaker holds a negative attitude towards Burns.

- (1) That **bastard** Burns is a zombie. (Gutzmann 2011: 126)  
**Expressive content:** Speaker doesn’t like Burns.  
**Truth-conditional content:** None

To capture the independence of expressive content from the rest of the sentence, it has been suggested that expressivity composes on a separate, independent semantic dimension via a multi-tiered compositional mechanism (Potts 2005). The picture below illustrates this: The output of composition with an expressive is identical to the input on the truth-conditional level, while the specification on the speaker’s involvement is encoded on a different tier, separated by the • operator.



A number of diagnostics have been discussed in the literature to tease apart expressive meaning from other kinds of content (Potts 2005, 2007; Potts and Schwarz 2008). We now proceed to review several of them, which will then be regularly used throughout the paper to discuss the Italian and Cantonese data.

The first diagnostic is known as the *independence* test (Potts 2007). It shows that expressive content cannot be targeted by denials independently from the rest of the propositional content.

(3) A: That bastard Burns is a zombie.

# B: No! I like him!

✓ B': No! He's not a zombie.

EXPRESSIVE CONTENT CHALLENGED

PROPOSITIONAL CONTENT CHALLENGED

The second test is typically referred to as *non-displaceability*. It shows that expressive content is always bound to the here and now of the utterance situation, and cannot be shifted to the past or the future by tense operators.

(4) That bastard Burns was late for work yesterday.

✓ INTENDED: He was on time today.

# INTENDED: He's no bastard today, because today he was on time.

Third, the *non-embeddability* test shows that expressive content, even when syntactically embedded, is generally *not* semantically embedded. As a consequence, it cannot shift mid-utterance: Because the speaker, even under an attitude predicate with a different agent, is the anchor of the expressive, she has committed to its content, and cannot deny it later in the utterance.<sup>2</sup>

(5) Sue believes that that bastard Burns should be fired. #I think he's a good guy.

Finally, expressives are generally banned in predicative position, or, more generally, in any syntactic position that requires to be obligatorily filled (Potts 2007). *Fucking* and *damn*, which represent notorious instances of expressivity, clearly show this restriction.

(6) I failed the {fucking/damn} test.

(7) ?? The test is {fucking/damn}.

## 2.2. Mixed expressive content

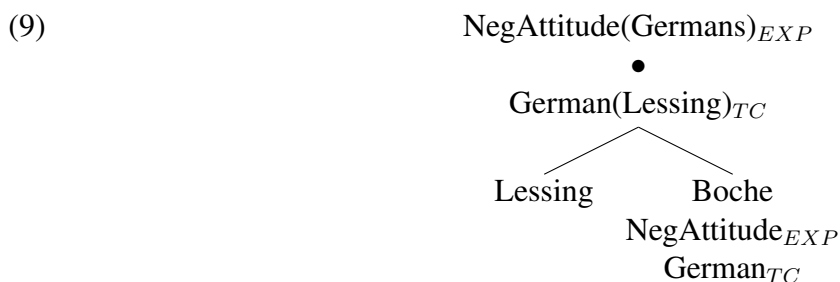
The tests above appear to suggest that the distinction between propositional and expressive content is rather clear-cut. Yet, the typology of expressive meaning has been recently enriched with the

<sup>2</sup>Note, however, that the speaker is not *always* the anchor of an expressive. While this is the default choice, it is possible to find cases where the attitude is relativized to a different agent. As an example, Potts (2007) cites the example of sarcasm, when authors can quote other people's use of expressives to mock them without obviously committing to such emotive attitudes.

novel class of *mixed expressives*. These expressions, as shown below, convey *both* expressive and truth-conditional meaning via the same morpheme (Sawada 2009; McCready 2010; Gutzmann 2011).

- (8) Lessing is a **Boche**. (Williamson 2009, discussed in Gutzmann 2011)  
**Expressive content:** Speaker has a negative attitude towards Germans.  
**Truth-conditional content:** Lessing is German.

In order to model the semantic representation of these expressions, authors have been making use of the same assumptions that govern the two-tiered compositional mechanism suggested for pure expressive terms. As the picture below shows, the output of composition with a mixed expressive is modified at both the truth-conditional and the expressive level. The two parts, however, do not interact in the composition.



Mixed expressives represent a relatively understudied class of items. Their status becomes more intriguing as instances of the category are being found in a variety of different languages, including Greek and Korean (Giannakidou and Yoon 2011), English (McCready 2010, Gutzmann 2011), Japanese (McCready 2010, Sawada 2011), German (Gutzmann 2012). Due to their recent discovery, a number of questions linger concerning the status of these expressions. On a synchronic level, more needs to be said on the nature of the compositional mechanisms that correctly derive their meaning, as well as the status of the category. In particular, the question remains open as to whether mixed expressives form a homogeneous class, or come in different flavors. On the diachronic level, little is known about the emergence of these expressions. In particular, how do expressivity and truth-conditional meaning end up co-existing in a lexical item? And what happens once both of these components become part of the lexical meaning of an expression? In the remainder of this section, we review two important models that can help us cast light on these historical questions. While geared to account for different types of phenomena and changes, such models feature an important point of convergence: In both of them, mixed expressivity emerges as a transitory stage, which is bound to be followed by a stage in which the two components no longer co-exist. The discussion will serve as the launching point for the analysis of our case studies, presented in Sections 3 and 4.

The first model which has relevant implications for mixed expressives is Traugott's *subjectification* model. Subjectification can be defined as the process whereby meaning tends to become increasingly based in the speaker's beliefs or attitudes (Traugott 1982) along a pathway which has the rise of expressive meaning as its endpoint. Note that *expressivity*, in Traugott's sense, refers to a broader semantic category than the one singled out by Potts. More specifically, she defines it as "the expression of personal attitudes to what is being talked about, to the text itself, or towards others in the speech situation". Examples include the connective *while* developing a concessive meaning out of a temporal one, or the rise of epistemic from deontic modality.

(10) Propositional > Textual > Expressive

In this trajectory, mixed expressivity has been claimed to represent an intermediate stage between propositional and expressive meaning (Gutzmann 2013). The development of the expression *boor* in English, analyzed by Gutzmann and first discussed by Traugott (2003), represents an example of this sort. The word starts out as a simple property, and ends up developing a purely derogatory/evaluative meaning, with no reference whatsoever to the original meaning. Yet, in order to get to this stage, it went through an intermediate stage, in which both the original contribution and the evaluative one were present. The trajectory is summarized below, where "A+B" represents the intermediate stage.

- (11) a. Boor(peasant)<sub>TC</sub> → Boor(peasant)<sub>TC</sub> + Neg. att.<sub>EXP</sub> → Neg. att.<sub>EXP</sub> (from Traugott (2003))  
 b. A<sub>TC</sub> → A<sub>TC</sub> + B<sub>EXP</sub> → B<sub>EXP</sub>

The second type of models carrying implications for the status of mixed expressivity are accounts of semantic change within Jespersen's cycle. In these investigations, the focus is primarily on the emergence and development of *emphatic* meaning, especially with respect to negation. A paramount example of the phenomenon is given below: the French particle *pas* moves from having the independent meaning of "step" to becoming a purely functional operator ("not") via an intermediate step in which it serves as an emphatic marker within a discontinuous negator, together with the functional, non emphatic negator *ne*. The trajectory is illustrated below:

- (12) **Noun:** *pas* → **Complex negation:** *ne...pas* → **Plain negation:** *pas*

Expressivity and emphasis are not the exact same notion. In particular, while emphasis stems from alternative-based scalar reasoning in downward entailing contexts (Krifka 1995; Eckardt 2006) performed on the basis of the propositional content, expressivity is independently encoded in the conventional meaning of the expression, and does not interact with the truth-conditional part. Yet,

we suggest that these two notions can be treated in parallel here: They both induce non truth-conditional effects, and they both—loosely speaking—mark a move by the speaker, more than a property of the propositional content. Specifically, the intermediate step in which a complex negation features two different parts, an emphatic and a plain one, is reminiscent of the structure of a mixed expressive, where a non truth-conditional, speaker-induced contribution is layered onto a truth-conditional, purely propositional one. Even more interesting is the observation that the coexistence of emphatic and plain semantic content is predicted to be transitory: the next step of the emphasis-cum-negation coexistence is one in which the carrier of emphasis is bleached out, and only a functional meaning survives.

Crucially, this prediction aligns with what has been suggested by the subjectification models discussed above. While two models posit two different outputs—expressive meaning with subjectification and plain functional meaning with Jespersen’s cycle—they both present mixed expressivity (or emphasis) as a transient category. In the current paper, however, we show that a third possibility is available. In the two case studies that we present, mixed expressivity turns out to survive semantic change and be preserved atop of newly created truth-conditional meanings, showing that this semantic category need not represent a transitional stage.

### 3. Italian *gran*

The first case study that we present is the Italian mixed expressive adjective *gran*, which develops a quantifier meaning in a variety spoken in the Emilia region, around the city of Bologna. As the data show, *gran* retains its expressive component while undergoing a shift in its propositional meaning, suggesting that, in this case, mixed expressivity is a stable category.

#### 3.1. Adjectival *gran*

In Standard Italian, the adjective *gran* can be roughly translated as *great*. While we will not explore the details of its emergence, it was originally generated via truncation from *grande* (= ‘big’), and then lexicalized as an independent morpheme which no longer makes reference to size, at least in the physical sense.

We begin by observing that, in Standard Italian, *gran* is a mixed expressive. On the truth-conditional level, it contributes a meaning paraphrasable as “outstanding”, or “of great value”. On the expressive level, it contributes an underspecified positive emotional attitude on the part of the speaker, as shown below.

- (13) Marco mangiò una **gran** pizza lo scorso mese.  
 Marco ate a *gran* pizza the last month  
**Truth-Conditional:** Marco ate an outstanding pizza last month.



**Expressive:** The speaker is excited about the pizza.

That an expressive component is layered onto the truth-conditional one is shown by the same diagnostics presented in the previous section. While the spirit of the tests is the same as those discussed before, the dynamics of the diagnostics has to be slightly modified to accommodate the presence of a truth-conditional component, which is instead lacking in pure expressives (see also Gutzmann (2011), McCready and Kaufmann (2013) for a similar issue).

First of all, the expressive part is not part of the at-issue meaning, as shown by the fact that it cannot be targeted in isolation by denials. The only felicitous way of denying the sentence below would be to deny the whole propositional content.

- (14) a. Marco mangiò una **gran** pizza lo scorso mese.  
           Marco ate a *gran* pizza the last month  
       b. No! {#Mangiò un pizza eccellente, ma non provo nulla/✓Mangiò una pizza normale}.  
           No! {#He ate an outstanding pizza, but today I don't care/✓He ate an average pizza}.

Second, the expressive component is non-displaceable. Even if we embed *gran* under a past tense operator, the expressive part does not shift. The truth-conditional one, instead, does.

- (15) Marco mangiò una **gran** pizza lo scorso mese.  
       Marco ate a *gran* pizza the last month  
       a. ✓ I'm being emotional *now*. (despite past tense)  
       b. **Not:** I was being emotional *then*.

Third, mid-utterance perspective shifts are only possible for the descriptive part, but not for the expressive one. In other words, while the “outstanding” part of the meaning does embed under the subject of the reportive predicate, and therefore allows the speaker to set up a contrast with her point of view, the expressive one does not. As a consequence, the contrast triggered by “but” fails.

- (16) a. ✓ Marco sostiene di aver mangiato una **gran** pizza, ma per me era mediocre  
           Marco says that he ate a *gran* pizza, but **I** think it was mediocre.  
       b. # Marco sostiene di aver mangiato una **gran** pizza, ma a me non interessa.  
           Marco says that he ate a *gran* pizza, but **I** am not excited.

Finally, we observe that *gran* is banned in predicative and postnominal positions. This observation is consistent with two important generalizations. The first one is that expressive meaning cannot

be found in the predicative position, as discussed in the previous section. The second one is that in Romance languages pre-nominal adjectives are generally more likely to trigger subjectively-connotated and non intersective readings, and therefore emerge as a better site for expressive meanings (Nespor 1988; Demonte 1999).

- (17) a. ✓Marco mangiò una **gran** pizza.  
 b. \*Marco mangiò una pizza **gran**.  
 c. \*La pizza mangiata da Marco era **gran**.  
 The pizza eaten by Marco was *gran*.

At the same time, it must be noted that the ban on these syntactic positions could be due to reasons that are orthogonal to expressivity. For instance, it might be a remnant of the old meaning of *gran* as a truncated form of *grande*, where erasure of the two last phonemes was due to the phonotactic interaction with the following word, and therefore made sense only in pre-nominal position. We leave investigation of this aspect to further research, and we therefore opt not to put too much weight on this data point. Yet, we believe that the syntactic restriction, in light of the properties of expressive meaning, is worth mentioning. We now move on to discuss a different use of *gran* as a quantifier, which is limited to the variety of Italian spoken in the Emilia region. As we argue in the next section, the quantifier flavor of the morpheme still features the expressive component, despite having undergone a change at the truth-conditional level.

### 3.2. Quantificational *gran*

In a colloquial variety spoken in the Emilia region (roughly from around the city of Bologna to the Lombardia border), *gran* has developed a quantificational usage with meaning similar to *a lot*, *many*, and with the same expressive component as the adjectival version.

- (18) Marco mangiò delle **gran** pizze lo scorso mese'.  
 Marco ate some *gran* pizzas last month.  
**Truth-Conditional:** Marco ate **many** pizzas last month.  
**Expressive:** The speaker is excited about such **quantity** of pizzas.

Note that adjectival and quantificational *gran* have entirely independent, though originally related, meanings. For a speaker that has both uses in her dialect, it is perfectly possible to get the quantificational reading while denying the adjectival one, as the example below shows.

- (19) Marco mangiò delle **gran** pizze lo scorso mese, ✓ ma non erano nulla di che.  
 'Marco ate some *gran* pizzas last month, ✓ but they were nothing special.'

A further important observation is that quantificational *gran* is syntactically restricted to be within the scope of quantificational determiners *dei/delle* ( $\approx$  ‘some’ in English). It cannot be licensed by definite determiners or in other environments. In light of this syntactic behavior and of the semantic connection between high quality and high quantity, a full synchronic analysis of this use of the morpheme would certainly be interesting from both a semantic and a syntactic perspective. However, given the scope of the current paper, we leave that for future research, and focus instead on the relationship between the truth-conditional and the expressive part. The crucial observation, in light of our broad questions, is that the expressive component of quantificational *gran* is also separate from the truth-conditional content, as it was the case for the adjectival version. The diagnostics discussed so far support this point.

- (20) a. Marco mangiò delle **gran** pizze lo scorso mese. INDEPENDENCE  
 Marco ate some *gran* pizzas the last month  
 b. No!{#Mangiò molte pizze, ma non provo nulla/✓Mangio’ poche pizze }  
 No!{#He ate many pizzas, but I don’t feel anything/✓He ate few pizzas }
- (21) a. Marco mangiò delle **gran** pizze lo scorso mese. N-DIS  
 Marco ate many pizzas the last month  
 ✓ I’m being emotional *now* (despite past tense)  
 b. **Not**: I was being emotional *then*.
- (22) a. ✓ Marco sostiene di aver mangiato delle **gran** pizze, ma per me erano poche. N-EMB  
 Marco says that he ate some *gran* pizzas, but I think they were few.  
 b. # Marco sostiene di aver mangiato delle **gran** pizze, ma a me non interessa.  
 Marco says that he ate some *gran* pizzas, but **I** don’t feel anything about it.
- (23) a. ✓ Marco mangiò delle **gran** pizze lo scorso mese. BAN IN PRED  
 Marco ate many pizzas the last month  
 b. \*Marco mangiò delle pizze **gran** lo scorso mese.  
 c. \*Le pizze sono **gran**.  
 The pizzas are many.

### 3.3. From mixed-predication to mixed-quantification

Unfortunately, because quantificational *gran* is mostly used in oral varieties of Italian, no corpus data is available to track its trajectory in a fine-grained manner. Yet, there is at least plausible evidence to assume that quantificational and adjectival usage are diachronically related. First, quantificational usage is only common in a region, while adjectival one is spread throughout the country. Second, speakers outside the Emilia region have a hard time getting the quantificational reading. This suggests that this particular meaning of the expression has fully grammaticalized in a particular variety, and is simply not available to speakers of different dialects. As such, it

counts as a full-fledged instantiation of semantic change, and not as the output of an “on the spot” cross-domain inference from qualities to quantities. We summarize the change in the following way.<sup>3</sup>

- (24) **Truth-conditional meaning:** CHANGED. From individuals to cardinalities.

$$\text{OUTSTANDING}(x) \rightarrow |x| > n$$

- (25) **Expressive meaning:** PRESERVED. The excitement component survives.

$$\text{excited}_{\text{speaker}}(x) \rightarrow \text{excited}_{\text{speaker}}(|x|)$$

For the purpose of the current paper, the crucial observation is that, while the truth-conditional component of *gran* undergoes a shift, the expressive part survives through the change. This trajectory stands out with respect to the generalizations provided by subjectification and Jespersen’s cycle models, which both posit mixed expressivity as a transitory stage along the emergence of purely expressive or functional meaning. The trajectory is summarized below, where *u* denotes an *expressive type* (see Gutzmann 2011, 2012) and *e, t* are regular descriptive types.

- (26) Diachronic trajectory of *gran*

$$\begin{array}{lcl} \text{‘big’}: & \text{‘outstanding’ + expressive:} & \text{‘many’ + expressive:} \\ \llbracket \text{grande} \langle e, t \rangle \rrbracket & \Rightarrow \llbracket \text{gran} \langle e, t \rangle \bullet \langle e, u \rangle \rrbracket & \Rightarrow \llbracket \text{gran} \langle et, t \rangle \bullet \langle et, u \rangle \rrbracket \end{array}$$

#### 4. Cantonese *gwai2*

The second case study is concerned with the word *gwai2* in Cantonese, which literally means “ghost”. In this paper, the focus is the non-literal usage of *gwai2*. Yet, its literal meaning is relevant to the emergence of its non-literal meaning of interest here, as we shall see below.

In its non-literal and productive usage, *gwai2* is invariably an expressive of some sort, in the sense that has been discussed throughout this paper; its expressive meaning can be paraphrased as “god-damn” in English. There are two types of *gwai2* as an expressive, and their distribution appears to be correlated with factors such as morphophonology: when *gwai2* is an infix, it is a *pure* expressive with no truth-conditional semantic contribution (cf. *bastard*, *damn* discussed in Section 1), but when it is not infixal, it is a *mixed* expressive with both at-issue and expressive meaning (cf. Italian *gran* in the previous section). While a comprehensive analysis of *gwai2* is beyond the scope of the present paper (Lee 2014), the descriptive facts of interest pertaining to *gwai2* have been well documented (Yip and Matthews 2001: 157-160, Lee and Chin 2007, Yu 2007: 134-135, and Matthews and Yip 2011: 52-54, 184).

<sup>3</sup>Note that, while we give a denotation of *gran* in terms of a cardinality predicate (Solt 2009), other formalizations of quantifiers would be equally consistent with our account.

We focus on *gwai2* as a mixed expressive. Crucially, there are two distinct flavors, both of which simultaneously provide a truth-conditional and an expressive contribution. As we argue below, the two versions are diachronically related, which demonstrates our central thesis that mixed expressivity is not necessarily a diachronically unstable category.

#### 4.1. *Gwai2* = ‘nobody’ + expressive

The first version of *gwai2* as a mixed expressive is the one that can be thought of as meaning ‘nobody’ plus expressive meaning, i.e., *gwai2* carries the truth-conditional meaning as a negative quantifier (= *nobody*) as well as the expressive meaning that the speaker is in a ‘heightened emotional state’ (Potts 2007).

- (27) **Gwai2** ho2ji5 loeng5 lin4 duk6 jyun4 bok3si6.  
 GHOST can two year study finish PhD  
 ‘No goddamn person can get a PhD in two years.’

- (28) **Gwai2** sik1  
 GHOST know  
 ‘Nobody knows shit.’ / ‘God knows.’ (cf. “vulgar minimizers” like *shit*, Postal (2002))

To show that *gwai2* is a mixed expressive, diagnostic tests are run as follows. Akin to the discussion on Italian *gran* above, these tests tap into (i) the co-existence of both truth-conditional meaning and expressivity, and (ii) the specific properties of expressivity.

First, the independence test shows truth-conditional meaning and expressive meaning are separate. Third-party objection to (28) can deny the truth-conditional content but not the expressive meaning.

- (29) a. ✓ M4hai6, kei4sat6 ngo5 sik1  
 No actually I know  
 ‘No, I know actually.’  
 b. # Lei5 m4 lau1  
 you not mad  
 ‘You’re not mad.’

Second, non-displaceability shows that expressivity is anchored to the time of utterance, regardless of temporal displacement by tense or other grammatical/lexical means.

- (30) a. **Gwai2** wui5 ting1jat6 heoi3  
 GHOST will tomorrow go  
 ‘No goddamn person will go tomorrow.’  
 ✓I’m being emotional *now* (despite future reference).  
 # I will be emotional *tomorrow*.

Third, mid-utterance perspective shifts are disallowed for expressivity, but entirely possible for truth-conditional meaning.

- (31) a. ✓ Keoi5 waa6 **gwai2** sin1 zi1, daan6hai6 ngo5 kok3dak1 kei4sat6 keoi5 zi1  
 s/he say GHOST only know but I think actually s/he know  
 ‘She wonders who the hell would know, but I think she actually does.’  
 b. # Keoi5 waa6 **gwai2** sin1 zi1, daan6hai6 ngo5 m4 gik1dung6  
 s/he say GHOST only know but I not emotional  
 ‘She wonders who the hell would know, but I am not mad.’

Finally, specifically to the Cantonese data, a negation test shows that the default sentential negator in Cantonese *m4* ‘not’ interacts with the truth-conditional meaning of *gwai2* only and flips the polarity (leading to logical double negation) while the expressive meaning remains.

- (32) **Gwai2 m4** sik1  
 GHOST not know  
 ‘Every goddamn person knows.’  
 (It cannot mean ‘No goddamn person knows’, cf. (28).)

This test also demonstrates that expressivity takes the widest scope. Furthermore, as an example of logical double negation, this example shows the general property of natural language that there is some extra meaning (expressivity, in this example) that comes in addition to what appears to be purely logical cancellation of two negating operations at the truth-conditional level (cf. English *not un-X*, Horn 1991).

We now move on to the second version of *gwai2* as a mixed expressive, which is closely connected to the first one just discussed here.

#### 4.2. *Gwai2* = ‘not’ + expressive

Synchronically, *gwai2* as a mixed expressive has a version different from but related to the negative quantifier usage discussed in the previous section. More concretely, this second version is a

sentential negator and, similar to the first version, carries expressivity.

- (33) a. Keoi5 **gwai2** ho2ji5 loeng5 lin4 duk6 jyun4 bok3si6.  
 s/he GHOST can two year study finish PhD  
 ‘He can’t goddamn get a PhD in two years.’  
 b. Compare (without *gwai2*):  
 Keoi5 ho2ji5 loeng5 lin4 duk6 jyun4 bok3si6.  
 s/he can two year study finish PhD  
 ‘He can get a PhD in two years.’

- (34) Keoi5 **gwai2** sik1  
 s/he GHOST know  
 ‘He doesn’t goddamn know.’

For consistency, the exact same diagnostic tests as in section 4.1 above can be run for this version of *gwai2* to establish its mixed expressivity:

- (35) **Independence:** At-issue meaning, but not the expressive component, can be questioned.

- a. Keoi5 **gwai2** sik1  
 s/he GHOST know  
 ‘He doesn’t goddamn know.’  
 b. i. ✓ M4hai6 – kei4sat6 keoi5 sik1  
 No – actually he knows. (Challenging the truth-conditional content)  
 ii. # Lei5 m4 lau1  
 You’re not mad. (Unable to deny expressivity)

- (36) **Non-displaceability:** Expressivity has a here-and-now reference only and cannot be shifted.

Keoi5 **gwai2** wui5 ting1jat6 heoi3  
 s/he GHOST will tomorrow go  
 ‘He won’t goddamn go tomorrow.’  
 ✓ I’m being emotional *now* (despite future reference).  
 # I will be emotional *tomorrow*.

- (37) **Mid-utterance perspective shift:** Impossible for expressive meaning

- a. ✓ Keoi5 waa6 keoi5dei6 **gwai2** sin1 zi1, daan6hai6 ngo5 kok3dak1 kei4sat6  
 s/he say they GHOST only know but I think actually  
 keoi5dei6 zi1  
 they know  
 ‘She wonders how on earth they would know, but I think they actually do.’
- b. # Keoi5 waa6 keoi5dei6 **gwai2** sin1 zi1, daan6hai6 ngo5 m4 gik1dung6  
 s/he say they GHOST only know but I not emotional  
 ‘She wonders how on earth they would know, but I am not mad.’

(38) **Negation:** Expressivity remains unaltered despite interaction of at-issue meaning

Keoi5 **gwai2** m4 sik1  
 s/he GHOST not know

‘He goddamn knows.’

In the following, we discuss the connection of the two versions of *gwai2*, particularly in terms of the broader questions on the emergence and persistence of mixed expressivity.

#### 4.3. The emergence and persistence of mixed expressivity of *gwai2*

The data with Cantonese *gwai2* offers an interesting case study with regard to the recent growing interest in mixed expressives, because *gwai2* has left clear traces in its diachronic development, thereby shedding a good deal of light on the hitherto poorly understood aspects about the diachrony of mixed expressivity. In this section, we address the emergence and persistence of mixed expressives, as evidenced by Cantonese *gwai2*. We argue that *gwai2* started out with its literal meaning of “ghost”, became interpreted as a negative quantifier by way of pragmatic reasoning, and subsequently acquired the usage of sentential negation through reanalysis. Throughout this diachronic development, expressivity has remained an integral component of the grammar of *gwai2*.

First, with respect to the *emergence* of mixed expressives, an important question is how a mixed expressive comes into being in the first place. Or, as introduced in section 2, how does expressivity and truth-conditional meaning end up co-existing at the same lexical item? Cantonese *gwai2* provides an answer to just this question.

- (39) Gwai2 sik1  
 GHOST know  
 Literal: ‘Ghosts know.’  
 Idiomatic: ‘No goddamn person knows’.



In (39), the utterance can be literally understood as if it were a canonical subject-predicate sentence, i.e., “ghosts know”. But this is not the most common reading: in most communicative contexts, in fact, the literal “ghost” is hardly relevant. What must have given rise to the non-literal interpretation is a pragmatic reason. Specifically, implicatures are at work here. “Ghost” implicates “no human beings” (= nobody), by virtue of shared knowledge that ghosts do not exist, as well as the Maxim of Relation (Grice 1975) that the utterance of “ghosts know” has to contextually make sense. As for its expressive dimension, *gwai2* in all its non-literal usage in Cantonese—productive or otherwise, and beyond mixed expressives—has a strong flavor of expressiveness (= *goddamn*). Intuitively, one could compare *gwai2* with English *God* (as in *God knows*) in a similar fashion.

The other central question to address in this paper is concerned with the *persistence* of mixed expressives. Section 2 describes current approaches relevant to expressivity, all of which converge on the prediction that mixed expressives are diachronically unstable, and either the expressivity or truth-conditional content will be lost subsequently. Similar to Italian *gran* discussed above, Cantonese *gwai2* is a case that suggests the possibility that a mixed expressive may undergo diachronic changes for its truth-conditional meaning with its expressive meaning intact. The approach taken here is that we show the mixed expressive of interest did undergo diachronic changes, but instead of turning into a pure expressive or a non-expressive lexical item, it has become another mixed expressive with distinct at-issue meaning.

For Cantonese *gwai2*, our analysis is that the version which means “not” plus expressive meaning (section 4.2) is diachronically derived from the reanalysis of the one which means “nobody” plus expressivity (section 4.1). The details of the reanalysis are as follows.

First, an utterance with *gwai2* meaning “nobody” was reanalyzed as having a null subject. This possibility is supported by the fact that Cantonese, like other Chinese languages, very often allows utterances with no overt but contextually understood topics, subjects, or other arguments (cf. *pro drop* in Romance languages). As background for null subjects in Cantonese, below is an example with the default negator *m4*.

- (40) a. M4 zi1.  
not know  
‘[Someone contextually known or salient] doesn’t know.’ (null subject)
- b. Keoi5 m4 zi1.  
s/he not know  
‘She doesn’t know.’ (“she” as the overt subject)

Replacing *m4* in (40a) with *gwai2* leads to the first version of *gwai2* as a mixed expressive which means “nobody” plus expressivity, as in (41a) below. In section 4.1 on this usage of *gwai2*, the discussion was abstracted away from the context. In a canonical situation, *gwai2* here means “nobody” truth-conditionally, as has been discussed. But if there are strong contextual cues for a

specific subject or topic, then the utterance in (41a) can be interpreted as one with a null argument in the same vein as (40a). This encourages a reanalysis of the precise truth-conditional meaning of *gwai2* from ‘nobody’ to a sentential negator ‘not’, which can be further reinforced by filling in the null argument, as in (41b).

- (41) a. **Gwai2** zi1.  
GHOST know  
1. ‘No goddamn person knows.’ (Context not pointing to anyone specific)  
2. ‘[Someone] doesn’t goddamn know.’ (Context pointing to a particular subject)
- b. Keoi5 **gwai2** zi1.  
s/he GHOST know  
‘She doesn’t goddamn know.’ (“she” as the overt subject)

Bringing together the two versions of *gwai2* as a mixed expressive, our analysis is that *gwai2* as a negator quantifier became a sentential negator, while expressivity has always remained throughout the diachronic development. As supporting evidence for this story, corpus data from early and mid 20th century colloquial Cantonese (Chin 2013) displays wide attestation of *gwai2* used in the sense of “nobody” but no instances at all for the usage as a sentential negator. This suggests that *gwai2* as “not” did not emerge until quite recently.

The diachronic trajectory of *gwai2* is summarized as follows:

- (42) ‘ghost’:  $\llbracket \text{gwai2} \langle e, t \rangle \rrbracket \Rightarrow \llbracket \text{gwai2} \langle et, t \rangle \bullet \langle t, u \rangle \rrbracket \Rightarrow \llbracket \text{gwai2} \langle t, t \rangle \bullet \langle t, u \rangle \rrbracket$   
‘nobody’ + expressive:      ‘not’ + expressive:

Before the discussion on Cantonese *gwai2* ends, we remark briefly on two questions. First, if one of our major claims is that mixed expressives are not necessarily diachronically volatile, how can we be certain that Cantonese *gwai2*, for instance, will maintain its mixed expressivity, given that there have only been two attested stages as discussed? In other words, would it be possible for *gwai2* to lose either its truth-conditional meaning or its expressive component? While this is logically possible, it is empirically unlikely. Expressivity as part of the meaning of *gwai2* is a general property for all non-literal uses of *gwai2* and is far from being confined to the two versions of mixed expressives, which makes it hard to fade away without drastic changes unimaginable at this point. It is also unclear how the truth-conditional component for negation might be diachronically altered or even removed without any synchronic potential triggers.

The second question is how the case of Cantonese *gwai2* differs from those following Jespersen’s cycle, given that *gwai2* intuitively has a great deal to do with negation and with the interaction between emphatic and plain types of semantic contribution. It is instructive to consider French *pas* ‘step’ as a point of comparison. Eckardt (2006) sheds new light on this classic case of negation

emergence and, crucially, argues that there is emphatic focus in negative polarity contexts, thereby accounting for the “puzzling usages” (neither literal meaning nor part of a negation). Contrary to French *pas*, Cantonese *gwai2* can be perfectly used in positive polarity utterances (*ghosts know* = “No goddamn person knows”; *ghosts don’t know* = “Every goddamn person knows”). This is related to the fact that the emergence of French *pas* for negation is by *quantity*-based reasoning (cf. other minimizer-type negators) while Cantonese *gwai2* negation is more of the quality type, where the world knowledge about the (non-)existence of ghosts underlies the development of a negative meaning. This, in turn, is connected to the difference that French *pas* has emphasis tightly connected to other levels of semantic content (truth conditions, scalar reasoning, etc.), whereas Cantonese *gwai2* has its truth-conditional content independent of its expressive component.

## 5. Conclusions and implications

This paper has presented two novel cases of mixed expressives: Italian *gran* ‘big’ and Cantonese *gwai2* ‘ghost’. Both mixed expressives have recently undergone a shift in truth-conditional meaning, while maintaining expressivity. Several implications follow. First, mixed expressivity need not represent just a transitional stage of semantic change, but can be a stable category, capable of persisting through semantic shifts. Second, our data show that expressive meaning and at-issue meaning diachronically proceed in a parallel fashion, interacting very little in the process. Such diachronic independence provides empirical support to current synchronic models of mixed expressivity (McCready 2010; Gutzmann 2012), which assign separate semantic representations to expressive and descriptive meaning. Our data also provide key insights into the poorly understood questions regarding the diachrony and interaction of truth-conditional and expressive meaning. Further work includes a more detailed characterization of expressive or emphatic content as well as the synchronic nature of the expressive computation. In particular, the observation that in our case studies expressivity appears to operate on the output of the truth-conditional one, and not on an independent input, appears to question the separation between the two components and calls for further scholarly attention.

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# Alternatives in Montague Grammar<sup>1</sup>

Ivano Ciardelli — *Institute for Logic, Language, and Computation, University of Amsterdam*

Floris Roelofsen — *Institute for Logic, Language, and Computation, University of Amsterdam*

**Abstract.** The type theoretic framework for natural language semantics laid out by Montague (1973) forms the cornerstone of formal semantics. Hamblin (1973) proposed an extension of Montague’s basic framework, referred to as *alternative semantics*. In this framework, the meaning of a sentence is not taken to be a single proposition, but rather a *set* of propositions—a set of *alternatives*. While this more fine-grained view on meaning has led to improved analyses of a wide range of linguistic phenomena, it also faces a number of problems. We focus here on two of these, in our view the most fundamental ones. The first has to do with how meanings are *composed*, i.e., with the type-theoretic operations of function application and abstraction; the second has to do with how meanings are *compared*, i.e., the notion of entailment. Our aim is to reconcile what we take to be the essence of Hamblin’s proposal with the solid type-theoretic foundations of Montague grammar, in such a way that the observed problems evaporate. Our proposal partly builds on insights from recent work on inquisitive semantics (Ciardelli et al. 2013), and it also further advances this line of work, specifying how the inquisitive meaning of a sentence, as well as the set of alternatives that it introduces, may be built up compositionally.

**Keywords:** alternative semantics, inquisitive semantics, compositionality, entailment.

## 1. Introduction

Alternative semantics (Hamblin 1973; Rooth 1985; Kratzer and Shimoyama 2002, among others) diverges from the standard, Montagovian framework for natural language semantics in that the semantic value of an expression is taken to be a *set* of objects in the expression’s usual domain of interpretation, rather than a single object. For instance, the semantic value of a complete sentence is not a proposition but a *set* of propositions, the semantic value of an individual-denoting expression is not an individual but a *set* of individuals, and so on. Alternative semantics has been fruitfully applied to a range of linguistic phenomena, including questions (Hamblin 1973),

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focus (Rooth 1985), indeterminate pronouns (Shimoyama 2001; Kratzer and Shimoyama 2002), indefinites (Kratzer and Shimoyama 2002; Menéndez-Benito 2005; Aloni 2007), and disjunction (Simons 2005; Alonso-Ovalle 2006; Aloni 2007).<sup>2</sup> While this wealth of applications shows that alternatives are a useful tool in the semantic analysis of natural language, the move from the basic Montagovian framework to an alternative-based one also raises some fundamental issues. In this paper, we will be concerned with two such issues, in our opinion the most basic ones. The first issue, which we will refer to as the *compositionality issue*, has to do with the fact that in alternative semantics, meanings can no longer be composed by means of the standard type-theoretic operations of function application and abstraction. The second, which we will refer to as the *entailment issue*, has to do with the fact that meanings in alternative semantics can no longer be compared by means of the standard type-theoretic notion of entailment. Both problems concern very fundamental features of the semantic framework, and moreover, as we shall see, neither of them has a straightforward direct solution.

Rather than looking harder for a solution, our strategy will be to take a step back and examine why these problems arise in the first place. We will argue that it is not the presence of alternatives *per se* that is to be held responsible, but rather some specific features of the architecture of alternative semantics. We argue that these features are not essential, and that by making different architectural choices it is possible to obtain a framework in which the observed problems do not arise.

The paper has a straightforward structure: Section 2 is concerned with the compositionality issue, Section 3 with the entailment issue, and Section 4 concludes.

## 2. Compositionality

In the standard Montagovian framework, the semantic value of an expression  $\alpha$  of type  $\tau$  (notation:  $\alpha : \tau$ ) relative to an assignment  $g$  is an object  $\llbracket \alpha \rrbracket_g$  in the corresponding domain  $D_\tau$ , where the basic types  $e$ ,  $t$ , and  $s$  correspond to primitive domains of individuals, truth-values and possible worlds, respectively, and a derived type  $\langle \sigma, \tau \rangle$  corresponds to the domain  $D_{\langle \sigma, \tau \rangle} = \{f \mid f : D_\sigma \rightarrow D_\tau\}$  of functions from objects of type  $\sigma$  to objects of type  $\tau$ . This setup allows us to compose meanings through the basic type-theoretic operations of function application and abstraction:

- (1) **Function Application:** if  $\alpha : \langle \sigma, \tau \rangle$  and  $\beta : \sigma$  then  $\llbracket \alpha(\beta) \rrbracket_g = \llbracket \alpha \rrbracket_g(\llbracket \beta \rrbracket_g) \in D_\tau$
- (2) **Abstraction:** if  $\alpha : \tau$  and  $x : \sigma$  then  $\llbracket \lambda x. \alpha \rrbracket_g$  is the function mapping any  $x \in D_\sigma$  to  $\llbracket \alpha \rrbracket_{g[x/x]}$   
In the meta-language we will use  $\lambda x. \llbracket \alpha \rrbracket_{g[x/x]}$  as a shorthand description of this function.<sup>3</sup>

<sup>2</sup>We will concentrate here on the role of alternatives at the level of *ordinary semantic values*; the use of alternative semantics to represent *focus semantic values* (Rooth 1985) is beyond the immediate scope of the paper.

<sup>3</sup>Our general typographic convention is to use boldface for expressions in the object language ('logical form'), and the standard font for meta-language descriptions of semantic objects.

By contrast, in alternative semantics the semantic value  $\llbracket \alpha \rrbracket_g$  of an expression  $\alpha : \tau$  is no longer a single object in  $D_\tau$ , but rather a *set* of such objects:  $\llbracket \alpha \rrbracket_g \subseteq D_\tau$ .<sup>4</sup> As a consequence, meanings can no longer be composed by means of the standard type theoretic operations. Let us see why.

## 2.1. Composition in alternative semantics

**Function application.** First consider the operation of function application. Suppose  $\alpha$  is an expression of type  $\langle \sigma, \tau \rangle$  and  $\beta$  an expression of type  $\sigma$ . In alternative semantics, we have that  $\llbracket \alpha \rrbracket_g \subseteq D_{\langle \sigma, \tau \rangle}$  and  $\llbracket \beta \rrbracket_g \subseteq D_\sigma$ . Now suppose we want to compute the meaning of  $\alpha(\beta)$ . We can no longer obtain  $\llbracket \alpha(\beta) \rrbracket_g$  by simply applying  $\llbracket \alpha \rrbracket_g$  to  $\llbracket \beta \rrbracket_g$ , because  $\llbracket \alpha \rrbracket_g$  is not a function.<sup>5</sup> Thus, the type-theoretic rule of function application cannot be used to compute  $\llbracket \alpha(\beta) \rrbracket_g$ .

Instead,  $\llbracket \alpha \rrbracket_g$  is now a *set* of functions from objects of type  $\sigma$  to objects of type  $\tau$ . Since  $\llbracket \beta \rrbracket_g$  is a set of objects of type  $\sigma$ , what we *can* naturally do is apply each function  $f \in \llbracket \alpha \rrbracket_g$  to each object  $d \in \llbracket \beta \rrbracket_g$ . The set of all objects  $f(d)$  obtained in this way is a subset of  $D_\tau$ , and thus a suitable semantic value for  $\alpha(\beta)$ . This operation, known as *pointwise function application*, is indeed taken to be the fundamental composition rule in alternative semantics.

- (3) **Pointwise function application:** if  $\alpha : \langle \sigma, \tau \rangle$  and  $\beta : \sigma$   
then  $\alpha(\beta) : \tau$  and  $\llbracket \alpha(\beta) \rrbracket_g = \{f(d) \mid f \in \llbracket \alpha \rrbracket_g \text{ and } d \in \llbracket \beta \rrbracket_g\}$

However, this rule has an important drawback. In computing the meaning of a complex expression  $\alpha(\beta)$  using pointwise function application, the functor  $\alpha$  only has access to each alternative for  $\beta$  in isolation; it does not have access to the whole set at once. But in fact, many functors in natural language *do* need access to the whole set of alternatives introduced by their argument at once. Take for instance negation. The standard treatment of sentential negation in alternative semantics is as follows (see, e.g., Kratzer and Shimoyama 2002):

- (4)  $\llbracket \text{not } \beta \rrbracket_g = \{\overline{\bigcup \llbracket \beta \rrbracket_g}\}$  where  $\overline{\bigcup \llbracket \beta \rrbracket_g}$  denotes the set-theoretic complement of  $\bigcup \llbracket \beta \rrbracket_g$

To determine  $\overline{\bigcup \llbracket \beta \rrbracket_g}$ , **not** clearly needs access to all the alternatives for  $\beta$  at once. This result is impossible to obtain by associating negation with a set of objects  $\llbracket \text{not} \rrbracket_g \in D_{\langle t, t \rangle}$  and letting them

<sup>4</sup>In some work on alternative semantics, the types that expressions are usually taken to have are systematically adapted: expressions that are usually taken to be of type  $\tau$  are now rather taken to be of type  $\langle \tau, t \rangle$  (see, e.g., Shan 2004; Novel and Romero 2010). The usual correspondence between the type of an expression and its semantic value is then preserved. In other work, the usual types are preserved: expressions that are usually taken to be of type  $\tau$  are still taken to be of type  $\tau$  (see, e.g., Kratzer and Shimoyama 2002; Alonso-Ovalle 2006). In this case, the correspondence between the type of an expression and its semantic value changes: the semantic value of an expression of type  $\tau$  is no longer a single object in  $D_\tau$ , but rather a set of such objects. The choice between these two options seems immaterial; for concreteness we assume the second, but our arguments do not hinge on this assumption.

<sup>5</sup>To be more precise, the problem is that  $\llbracket \alpha \rrbracket_g$  is not a function of the *right type*. We can of course construe the set  $\llbracket \alpha \rrbracket_g \subseteq D_{\langle \sigma, \tau \rangle}$  as a function from  $D_{\langle \sigma, \tau \rangle}$  to  $\{0, 1\}$ ; but since  $\llbracket \beta \rrbracket_g \notin D_{\langle \sigma, \tau \rangle}$ , this does not help.

combine with the alternatives for  $\beta$  by pointwise function application. Thus, negation needs to be treated *syncategorematically*, that is, by means of a tailor-made rule in the grammar.

This problem is not confined to a few exceptional cases: in fact, the class of operators that need access to the whole set of alternatives for their argument includes virtually all operators that are interesting from an alternative semantics perspective: modals (e.g., Simons 2005; Aloni 2007), conditionals (e.g., Alonso-Ovalle 2006), exclusive strengthening operators (e.g., Menéndez-Benito 2005; Alonso-Ovalle 2006; Roelofsen and van Gool 2010), existential and universal closure operators (e.g., Kratzer and Shimoyama 2002), and even question-embedding verbs. Adopting pointwise function application as our fundamental composition rule implies that none of these operators can be given a meaning of their own. Instead, they all have to be treated by means of tailor-made, syncategorematic composition rules. Clearly, this is undesirable: we would like our grammar to contain only a few, general composition rules, and we would like the contribution of a specific linguistic item to be derived from its lexical meaning, based on these general rules.

**Abstraction.** Now let us consider abstraction. Suppose  $\alpha : \tau$  contains a variable  $x : \sigma$ , and suppose we want to abstract over  $x$  to obtain an expression  $\lambda x. \alpha$  of type  $\langle \sigma, \tau \rangle$ . This is an operation that is often used in semantics, typically (though not exclusively) in order to deal with quantification. What semantic value should we assign to  $\lambda x. \alpha$ ? We cannot apply the standard abstraction rule, which would identify  $\llbracket \lambda x. \alpha \rrbracket_g$  with the function mapping every  $x \in D_\sigma$  to  $\llbracket \alpha \rrbracket_{g[x/x]}$ . For, that would be a function from  $D_\sigma$  to subsets of  $D_\tau$ . But what we need for  $\llbracket \lambda x. \alpha \rrbracket_g$  is a different object, namely, a *set of functions* from  $D_\sigma$  to  $D_\tau$ , since we want that  $\llbracket \lambda x. \alpha \rrbracket_g \subseteq D_{\langle \sigma, \tau \rangle}$ . Thus, standard abstraction cannot be applied in alternative semantics.

Is there an alternative-friendly version of the abstraction rule? In other words, is there a satisfactory way to define which functions should belong to the set  $\llbracket \lambda x. \alpha \rrbracket_g$ ? A natural candidate is the following, proposed by Kratzer and Shimoyama (2002):

$$(5) \quad \llbracket \lambda x. \alpha \rrbracket_g := \{f : D_\sigma \rightarrow D_\tau \mid \text{for any } x \in D_\sigma, f(x) \in \llbracket \alpha \rrbracket_{g[x/x]}\}$$

However, Shan (2004) has pointed out that this proposal, combined with the standard techniques for quantification, leads to problematic empirical predictions. He furthermore argued that it is impossible to obtain the right set of functions in a principled way, and that an alternative-based notion of meaning therefore calls for a variable-free approach to meaning composition (Szabolcsi 1989; Jacobson 1999), which does entirely without abstraction. Novel and Romero (2010) argue that the cases which Shan deemed problematic could in fact be dealt with by enriching the underlying type theory with a new basic type for assignments, following Poesio (1996), and making certain assumptions about the meaning of *wh*-indefinites. Charlow (2014), however, points out that this remedy still fails for cases where the abstraction operator binds into an indefinite in its scope.

We will not make a direct contribution to this debate. Instead, we will take a more conservative approach, and ask whether it is at all necessary to depart from the standard abstraction mechanism.



## 2.2. Composing alternatives using standard composition rules

In our view, the feature of alternative semantics that is responsible for its empirical success is the fact that sentences are taken to express *sets of propositions*, rather than single propositions. This yields a notion of sentence meaning that is more structured than the standard, truth-conditional notion, and this extra structure seems to play a key role in a range of linguistic phenomena.

However, alternative semantics does not just assume that sentences express sets of propositions: it goes on to assume that *every expression* denotes a set of objects in the corresponding domain. As we have seen, this stronger assumption forces us to depart from the standard composition rules.

There does not seem to be any particular conceptual motivation for the assumption that every expression denotes a set of objects. Moreover, in linguistic applications of the framework the assumption does not seem essential, as we will show in a moment for some concrete cases. Most importantly, if we discharge this stronger assumption, then it becomes apparent that the remaining, more fundamental assumption, i.e., that sentences express sets of propositions, is perfectly compatible with the standard type-theoretic operations of meaning composition. We will demonstrate this by sketching a framework that is based on the following three assumptions:

1. the semantic value of a complete sentence is a set of propositions;
2. the semantic value of an expression of type  $\tau$  is a single object in  $D_\tau$ ;
3. the fundamental composition rules are the standard type-theoretic ones.

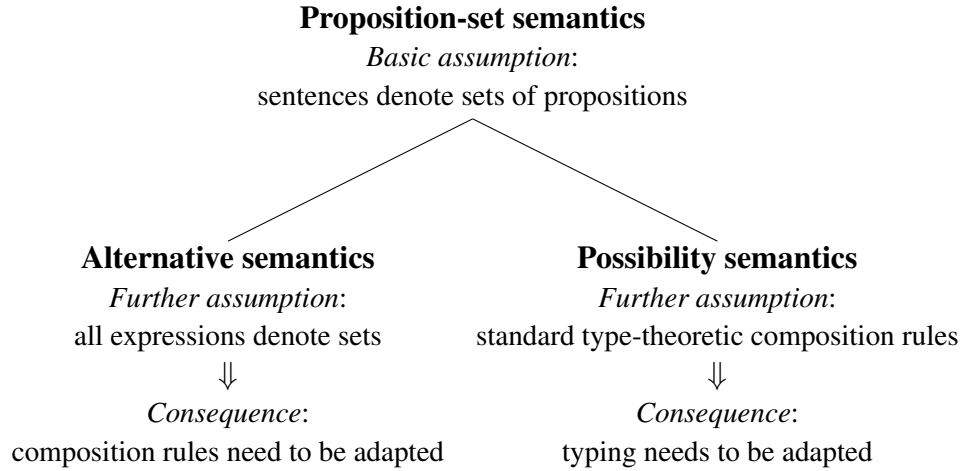
In this framework, which we will refer to as *possibility semantics*, it is not the compositional machinery, but rather the *typing of expressions* that needs to be adjusted. For instance, consider a complete sentence  $\alpha$ . By assumption (1), its semantic value  $\llbracket \alpha \rrbracket_g$  should be a set of propositions. Moreover, by assumption (2),  $\llbracket \alpha \rrbracket_g$  will be an object in the domain  $D_\tau$  of the corresponding type. Thus, we must take sentences to be of a type  $\tau$  such that the objects in  $D_\tau$  are sets of propositions: this is the type  $\langle \langle s, t \rangle, t \rangle$ , which we will abbreviate for convenience as  $T$ .

Assuming standard syntactic structures for sentences, we can then use assumption (3) to reverse engineer the types that should be assigned to various sorts of sub-sentential expressions. For instance, the following types suggest themselves for verbs, sentential operators, and quantifiers.

- |   |  |  |
|---|--|--|
| (6) a. <b>walks</b> : $\langle e, T \rangle$                | c. <b>not</b> : $\langle T, T \rangle$                   | e. <b>everyone</b> : $\langle \langle e, T \rangle, T \rangle$ |
| b. <b>likes</b> : $\langle e, \langle e, T \rangle \rangle$ | d. <b>or</b> : $\langle T, \langle T, T \rangle \rangle$ | f. <b>who</b> : $\langle \langle e, T \rangle, T \rangle$      |

Thus, the relation between alternative semantics and possibility semantics may be represented succinctly as follows.

(7)



Now let us consider the actual meanings that should be assigned to expressions in possibility semantics. In alternative semantics, a basic sentence like **John walks** is taken to express the singleton set  $\{|Wj|\}$ , which has as its unique element the proposition that John walks, i.e., the set  $|Wj| = \{w \mid j \text{ walks in } w\}$ . This treatment may be adopted in possibility semantics as well. Then, using assumption (3) again, we can work backwards to infer what meanings should be assigned to sub-sentential constituents. For instance, this procedure suggests the following entry for **walks**:

$$(8) \quad \llbracket \text{walks} \rrbracket = \lambda x. \{|Wx|\} = \lambda x. \{\{w \mid x \text{ walks in } w\}\}$$

Suitable meanings for other sub-sentential constituents may be inferred similarly starting from the desired sentential meanings.

Let us now show by means of two examples how theories formulated in alternative semantics may be reproduced in possibility semantics. First, consider disjunction. The treatment advocated by Simons (2005), Alonso-Ovalle (2006), and Aloni (2007), which has it that  $\llbracket \alpha \text{ or } \beta \rrbracket = \llbracket \alpha \rrbracket \cup \llbracket \beta \rrbracket$ , makes disjunction an alternative-generating operation. E.g., for **John sings or Mary dances** we get two separate alternatives, one for each disjunct, rather than just one disjunctive alternative.

$$(9) \quad \llbracket \text{John sings or Mary dances} \rrbracket = \llbracket \text{J sings} \rrbracket \cup \llbracket \text{M dances} \rrbracket = \{|Sj|\} \cup \{|Dm|\} = \{|Sj|, |Dm|\}$$

This may be reproduced *categorically* in possibility semantics simply by associating sentential disjunction with its familiar meaning:  $\llbracket \text{or} \rrbracket = \lambda \mathcal{P}_T. \lambda \mathcal{Q}_T. \mathcal{P} \cup \mathcal{Q}$ .

Since we dropped the assumption that all expressions denote sets, one may wonder how disjunctions of sub-sentential constituents can be handled in possibility semantics. To see this, consider the sentence **John sings or dances**. In alternative semantics, for the disjunctive VP we have:

$$(10) \quad \llbracket \text{sing or dance} \rrbracket = \llbracket \text{sing} \rrbracket \cup \llbracket \text{dance} \rrbracket = \{\lambda x. |Sx|\} \cup \{\lambda x. |Dx|\} = \{\lambda x. |Sx|, \lambda x. |Dx|\}$$

This set of properties then combines pointwise with  $\llbracket \mathbf{John} \rrbracket = j$ , yielding  $\{|Sj|, |Dj|\}$ . Notice that the disjunctive verb phrase expresses a *set* of properties here. Thus, the alternatives that eventually emerge at the sentential level are already clearly visible at the verb phrase level.

In possibility semantics, the final result is the same, but it is obtained in a different way. We simply assume that disjunction is given its standard cross-categorical meaning:  $\llbracket \mathbf{or} \rrbracket = \lambda \mathcal{P}_\tau. \lambda \mathcal{Q}_\tau. \mathcal{P} \cup \mathcal{Q}$  for any conjoinable type  $\tau$ .<sup>6</sup> The verb phrase is then interpreted as follows:<sup>7</sup>

$$\begin{aligned}
 (11) \quad \llbracket \mathbf{sing or dance} \rrbracket &= \llbracket \mathbf{sing} \rrbracket \cup \llbracket \mathbf{dance} \rrbracket = \lambda x. \{|Sx|\} \cup \lambda x. \{|Dx|\} \\
 &= \{\langle x, p \rangle \mid p = |Sx|\} \cup \{\langle x, p \rangle \mid p = |Dx|\} \\
 &= \{\langle x, p \rangle \mid p = |Sx| \text{ or } p = |Dx|\} \\
 &= \lambda x. \{|Sx|, |Dx|\}
 \end{aligned}$$

This function then combines by means of standard function application with  $\llbracket \mathbf{John} \rrbracket = j$ , yielding  $\{|Sj|, |Dj|\}$ . Notice that in this case, the verb phrase does not express a set of properties, i.e., a set of functions from individuals to propositions, but rather a single function from individuals to sets of propositions. These sets of propositions only fully emerge at the sentential level. However, at the VP level they are already latently present, so to speak: the VP expresses an alternative-generating function, i.e., a function that, for any given input, produces a set of alternative propositions. Precisely because of this shift in perspective, there is no need for pointwise function application.

As a second example, consider Hamblin (1973)'s account of wh-questions, for which alternative semantics was originally developed. Hamblin assumes that **who** is of type  $e$ , but rather than denoting a single individual, it denotes the whole set of (human) individuals in the domain. By combining this denotation pointwise with, e.g. the meaning of **sing**,  $\lambda x. \{|Sx|\}$ , Hamblin obtains the meaning of **who sings**, namely,  $\{|Sx| \mid x \in D_e\}$ . The same result may be obtained in possibility semantics without assuming that all expressions denote sets. However, **who** cannot be taken to have type  $e$  in this setting, because that would mean that its semantic value is a specific individual. Instead, it has to be treated as a generalized quantifier, with type  $\langle \langle e, T \rangle, T \rangle$ :

$$(12) \quad \llbracket \mathbf{who} \rrbracket = \lambda P_{\langle e, T \rangle}. \bigcup_{x \in D_e} P(x)$$

In words, the function denoted by **who** takes a function  $P$  from individuals to sets of propositions, and returns the set consisting of all propositions which belong to the output of  $P$  for some input individual  $x$ . It is easy to see that applying this function to the meaning of **sing**, or to anything of the same semantic type, results precisely in the meaning that Hamblin obtained by pointwise

<sup>6</sup>The set of conjoinable types is defined by the following two clauses: (i)  $t$  is a conjoinable type; (ii) if  $\beta$  is a conjoinable type, then  $\langle \alpha, \beta \rangle$  is a conjoinable type. Essentially, conjoinable types are types whose objects may be identified with sets of some kind. See, e.g., Partee and Rooth (1983) for more details.

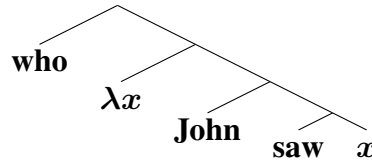
<sup>7</sup>As customary in type-theory, we identify a set with the corresponding characteristic function. Thus, an object of type  $\langle \sigma, \langle \tau, t \rangle \rangle$  may be equivalently regarded as a function from  $D_\sigma$  to sets of objects in  $D_\tau$ , or as a set of pairs in  $D_\sigma \times D_\tau$ . In particular, a function from individuals to sets of propositions may be identified with a set of individual-proposition pairs. Such functions may thus be combined by union, intersection, and other set-theoretic operations.

function application.

Finally, let us verify that the compositionality issues that we discussed above for alternative semantics no longer arise for possibility semantics. First, since meanings are composed by means of standard function application, rather than pointwise function application, in possibility semantics there is nothing that prevents a categorematic treatment of operators that need access to the whole set of alternatives generated by their argument. After all, the input to the functor is now the entire set of alternatives, rather than each alternative in isolation. To illustrate this, consider again negation. Sentential negation now has type  $\langle T, T \rangle$ , that is, it expresses a function that takes a set of propositions into a new set of propositions. We obtain the desired result simply by defining  $\llbracket \text{not} \rrbracket = \lambda \mathcal{P}_T. \{ \overline{\bigcup \mathcal{P}} \}$ , and letting negation combine directly with its argument by standard function application. Thus, the problem with pointwise function application no longer arises.

Moreover, in possibility semantics there is no need to devise a special abstraction rule: the standard rule works fine. To see this, consider the following syntactic tree for **who did John see**:

(13)



Assume that  $\llbracket \text{John} \rrbracket_g = j$ ,  $\llbracket \text{saw} \rrbracket_g = \lambda x. \lambda y. \{ |S y x| \}$ , and  $\llbracket x \rrbracket_g = g(x)$ . By function application we get that  $\llbracket \text{John saw } x \rrbracket_g = \{ |S j g(x)| \}$ , a set containing a single proposition. Now,  $\lambda x$  is interpreted by means of the standard abstraction rule, which yields  $\llbracket \lambda x \text{ John saw } x \rrbracket_g = \lambda x. \{ |S j x| \}$ . This constituent is of type  $\langle e, T \rangle$ , i.e., it expresses a function from individuals to sets of propositions. Applying the above entry for  $\llbracket \text{who} \rrbracket_g$  to this function yields the set of propositions  $\{ |S j x| \mid x \in D_e \}$ , as desired. Abstraction is unproblematic here, because it needs to deliver a single function from individuals to sets of propositions, rather than a set of functions from individuals to propositions.

Although we only gave a very minimal sketch of a full-fledged Montagovian fragment, we hope it suffices to illustrate that theories which have been formulated in alternative semantics may generally be reproduced straightforwardly in possibility semantics.<sup>8</sup> This allows us to handle the same phenomena in a mathematically more well-behaved setting, and frees us from the problems de-

<sup>8</sup>An exception is the use of alternatives as a device for scope-taking (Shimoyama 2001), which derives the exceptional scoping ability of Japanese indeterminate pronouns as a consequence of pointwise function application. However, as Charlow (2014, p.149-150) points out, this strategy does not provide us with a general account of exceptional scope. For instance, it cannot deal with cases where multiple disjunctions/indefinites appear together in the same environment and only one of them takes exceptional wide scope (e.g., *Bill denied the rumor that a friend of his speaks a Bantu language*). A full-fledged alternative for Shimoyama's account of Japanese indeterminate pronouns, and exceptional scope-taking more generally, is beyond the scope of the present paper, but various options would be compatible with our general framework.

scribed above: first, since function application is no longer pointwise, operations that need access to the whole set of alternatives generated by their argument can be given a categorematic treatment; and second, we no longer need to look for a clever alternative-friendly abstraction rule.

### 3. Entailment

Type theory does not only come with the operations of function application and abstraction which are used to compose meanings; it also comes with a notion of entailment which is used to *compare* meanings. This notion amounts to set-theoretic inclusion, and it applies cross-categorically to expressions of any conjoinable type. This general notion of entailment also gives rise to a principled cross-categorial treatment of conjunction and disjunction. Namely, if  $\alpha$  and  $\beta$  are expressions of any conjoinable type, then their conjunction  $\alpha$  **and**  $\beta$  may be taken to denote the *meet*, i.e., the *greatest lower bound*, of  $\llbracket \alpha \rrbracket$  and  $\llbracket \beta \rrbracket$  with respect to entailment. Dually, the disjunction  $\alpha$  **or**  $\beta$  may be taken to denote the *join*, i.e., the *least upper bound*, of  $\llbracket \alpha \rrbracket$  and  $\llbracket \beta \rrbracket$  with respect to entailment.<sup>9</sup> It is easy to see that, for any two expressions  $\alpha$  and  $\beta$  of a conjoinable type, the meet of  $\llbracket \alpha \rrbracket$  and  $\llbracket \beta \rrbracket$  with respect to  $\subseteq$  always exists, and amounts simply to the intersection  $\llbracket \alpha \rrbracket \cap \llbracket \beta \rrbracket$ ; and similarly, the join of  $\llbracket \alpha \rrbracket$  and  $\llbracket \beta \rrbracket$  exists and amounts to the union  $\llbracket \alpha \rrbracket \cup \llbracket \beta \rrbracket$ .

Just like the composition rules of function application and abstraction, the cross-categorial treatment of entailment, as well as the cross-categorial treatment of conjunction and disjunction as meet and join operations that it gives rise to, are crucial features of the type-theoretic framework, which should not be lost in the process of moving to a more fine-grained notion of meaning.

Unfortunately, in both alternative semantics and possibility semantics, the standard notion of entailment as set inclusion no longer gives sensible results. To see this, consider two basic sentences such as **John walks** and **John moves**: intuitively, the first sentence entails the second. In a classical semantic framework, this is captured by the type-theoretic notion of entailment:  $\llbracket \text{John walks} \rrbracket$  is the set  $|Wj|$  of worlds where John walks, and  $\llbracket \text{John moves} \rrbracket$  is the set  $|Mj|$  of worlds where John moves; since every world in which John walks is also a world in which John moves, we have  $|Wj| \subseteq |Mj|$ , and the entailment is predicted. However, in both alternative semantics and possibility semantics we have  $\llbracket \text{John walks} \rrbracket = \{|Wj|\}$  and  $\llbracket \text{John moves} \rrbracket = \{|Mj|\}$ ; since  $\{|Wj|\} \not\subseteq \{|Mj|\}$ , the entailment is not predicted.<sup>10</sup>

The general type-theoretic treatment of conjunction as intersection no longer gives desirable results in alternative/possibility semantics either. For instance, we would expect the conjunction **John sings and Mary dances** to express the singleton  $\{|Sj \wedge Dm|\}$ , which has as its unique alternative the proposition that John sings and Mary dances. However, treating conjunction as inter-

<sup>9</sup>Formally, the meet of  $a$  and  $b$  with respect to a partial order  $\leq$  is an element  $c$  such that (i)  $c \leq a$ ,  $c \leq b$  and (ii) for any  $d$  such that  $d \leq a$  and  $d \leq b$  it holds that  $d \leq c$ . Similarly for join. See, e.g., Keenan and Faltz (1985); Winter (2001); Roelofsen (2013a) for more background on these algebraic notions and their linguistic relevance.

<sup>10</sup>This problem was first pointed out by Groenendijk and Stokhof (1984), who gave it as an argument against Hamblin's theory of questions. But as argued here, the problem in fact concerns alternative semantics more generally.

section yields an absurd meaning:

$$(14) \llbracket \text{John sings and Mary dances} \rrbracket = \{|Sj|\} \cap \{|Dm|\} = \emptyset$$

Just like for the compositionality problem, there are two ways to react to this problem: we may try to replace the standard type-theoretic notions of entailment and conjunction with pointwise counterparts which make suitable predictions in the alternative/possibility semantics framework; or, alternatively, we may reconsider some assumptions of our setup so that the standard type-theoretic notions may be recovered. We will first consider the first option, i.e., to define *pointwise* notions of entailment and conjunction. We will find, however, that this is still problematic, and then turn to the second approach.

### 3.1. Pointwise entailment and conjunction

**Pointwise entailment.** Let us consider again the example illustrating the failure of standard entailment in alternative/possibility semantics: the problem is that the set of alternatives expressed by **John walks** is not a subset of the set of alternatives expressed by **John moves**; however, notice that the unique alternative for **John walks** is a subset of the unique alternative for **John moves**. This suggests that, instead of comparing the whole *set* of alternatives, in alternative/possibility semantics we should really be comparing the individual alternatives in the sets. More precisely, we may define entailment as pointwise inclusion:  $\alpha$  entails  $\beta$  in case every alternative for  $\alpha$  is included in some alternative for  $\beta$ :

$$(15) \alpha \models \beta \stackrel{def}{\iff} \forall p \in \llbracket \alpha \rrbracket \exists q \in \llbracket \beta \rrbracket \text{ such that } p \subseteq q$$

This notion of entailment would indeed make the right predictions for basic cases: for instance, since the unique alternative for **John walks**,  $|Wj|$ , is included in the unique alternative for **John moves**,  $|Mj|$ , we would now correctly predict that **John walks**  $\models$  **John moves**.

However, as discussed in Roelofsen (2013a), there is a fundamental problem with this notion. Namely, entailment defined in this way does not amount to a *partial order* on the space of meanings. In particular, it is not *anti-symmetric*, which means that two expressions  $\alpha$  and  $\beta$  may be logically equivalent—that is, entail each other—and yet have different meanings. To see this, consider the following two sentences:<sup>11</sup>

$$(16) \llbracket \text{John moves} \rrbracket = \{|Mj|\}$$

$$(17) \llbracket \text{John moves or walks} \rrbracket = \{|Mj|, |Wj|\}$$

Since the proposition  $|Wj|$  that John walks is contained in the proposition  $|Mj|$  that John moves, every alternative for **John moves or walks** is contained in an alternative for **John moves**. Vice

<sup>11</sup>For concreteness, we assume in our examples that disjunction has the alternative-generating behavior argued for by Simons (2005), Alonso-Ovalle (2006), and Aloni (2007). Nothing hinges on this assumption, though, and the reader should feel free to replace disjunction with her favorite alternative-generating item.

versa, the unique alternative for **John moves** is clearly contained in one of the alternatives for **John moves or walks**. Thus, the two sentences entail each other, but they have different meanings.

It seems to us essential for the notion of logical equivalence that it *does* imply synonymy, i.e., identity of meaning. If a certain equivalence relation does not guarantee that, we would just not call it *logical equivalence*. As a consequence, the relation  $\models$  defined above does not really qualify as a satisfactory notion of *entailment* in the alternative semantics framework.

This conceptual problem also has practical repercussions. For instance, if entailment is not a partial order on the space of meanings, conjunction and disjunction can no longer be treated as meet and join operations with respect to entailment. Consider for instance conjunction: we would like to define  $\llbracket \alpha \text{ and } \beta \rrbracket$  as the meet of  $\llbracket \alpha \rrbracket$  and  $\llbracket \beta \rrbracket$ , i.e., as the weakest meaning entailing both  $\llbracket \alpha \rrbracket$  and  $\llbracket \beta \rrbracket$ . However, since pointwise entailment is not anti-symmetric, there is not a *unique* such meaning, but rather a whole *cluster* of them, and we have no principled way to single out one particular element from this cluster. This means that we lost our principled account of conjunction and disjunction in terms of cross-categorical *meet* and *join* operations.

Thus, for both conceptual and practical reasons, redefining entailment as pointwise inclusion is unsatisfactory.

**Pointwise conjunction.** Setting the general problem with entailment aside, we may still try to devise an alternative-friendly notion of conjunction that avoids the problematic predictions which result from treating conjunction as intersection. Recall our example: we have  $\llbracket \text{John sings} \rrbracket = \{|Sj|\}$ ,  $\llbracket \text{Mary dances} \rrbracket = \{|Dm|\}$ , and we want  $\llbracket \text{John sings and Mary dances} \rrbracket = \{|Sj \wedge Dm|\} = \{|Sj| \cap |Dm|\}$ . This suggests that, rather than intersecting two meanings directly, conjunction should be intersecting the individual alternatives within these meanings. More precisely, it suggests the following treatment of conjunction as pointwise intersection:

$$(18) \quad \llbracket \text{and} \rrbracket = \lambda P. \lambda Q. \{p \cap q \mid p \in P \text{ and } q \in Q\}$$

Again, for the most basic cases, this treatment makes the right predictions. For instance, we do indeed get that  $\llbracket \text{John sings and Mary dances} \rrbracket = \{|Sj| \cap |Dm|\} = \{|Sj \wedge Dm|\}$ ; and this extends more generally to all cases where both conjuncts have singleton meanings. However, with non-singleton conjuncts, pointwise intersection often yields spurious alternatives. For instance, we expect that conjoining a sentence with itself will make no difference to its meaning. But that is not generally the case. Consider a sentence with two alternatives, such as  $\alpha = \text{John sang or danced}$ . Besides the two expected alternatives  $|Sj|$  and  $|Dj|$ , the conjunction  $\alpha \wedge \alpha$  also generates a third alternative, namely the proposition  $|Sj \wedge Dj|$  that John sang and danced.

$$(19) \quad \llbracket \text{John sang or danced and John sang or danced} \rrbracket = \{|Sj|, |Dj|, |Sj \wedge Dj|\}$$

We see no reason why conjunction should give rise to this extra alternative, and we doubt that empirical support for this prediction may be found. Thus, even if the general problem concerning entailment and the usual characterization of conjunction as a meet operator is set aside, it is difficult, if not impossible, to devise a satisfactory alternative-friendly treatment of conjunction.<sup>12</sup>

### 3.2. Recovering standard entailment and conjunction

Given that adapting the notions of entailment and conjunction to alternative/possibility semantics is not a trivial affair, to say the least, it is worth considering once more the strategy we adopted in Section 2 to deal with the compositionality problem: identify exactly which features of the framework are responsible for the problem, and ask whether it is possible to modify these features so that the problem is avoided, while the desirable features of the framework are retained.

In order to do this, let us look once more at the example illustrating the problem with entailment. Why is it that  $\llbracket \text{John walks} \rrbracket$  is not a subset of  $\llbracket \text{John moves} \rrbracket$  in alternative/possibility semantics? Well, because both meanings are singleton sets, consisting of the unique alternative for the sentence. The assumption that a basic sentence  $\alpha$  denotes the singleton  $\{|\alpha|\}$ , shared by alternative and possibility semantics, may seem quite innocent: after all, the standard meaning of a sentence  $\alpha$  is a single proposition,  $|\alpha|$ , and if we want to represent this meaning as a *set* of propositions, what better candidate than the singleton set containing just  $|\alpha|$ ? However, the problems with entailment and conjunction indicate that identifying classical propositions with the corresponding singleton sets may not be the best way of embedding classical semantics into alternative semantics after all.

It is certainly natural to regard a basic sentence like **John walks** as having a unique alternative, namely, the proposition  $|Wj|$ . But it does not follow from this that we have to construe the meaning of **John walks** in alternative/possibility semantics as the singleton set  $\{|Wj|\}$ . To enjoy the benefits of having alternatives in our semantics, it is not necessary to assume that the meaning of a sentence is *identical* with the set of alternatives that the sentence introduces; it is sufficient to assume that the meaning of a sentence *determines* the set of alternatives that it introduces.

What, then, should we take the meaning of a basic sentence like **John walks** to be? Let us examine carefully what the desiderata are. Suppose  $\alpha$  and  $\beta$  are two basic sentences, that is, two sentences having as their unique alternative the proposition that they classically express. For such sentences, we want the standard, truth-conditional notion of entailment to be preserved. That is,  $\alpha \models \beta$  should hold just in case  $|\alpha| \subseteq |\beta|$ . Moreover, we want to preserve the standard type-theoretic conception of entailment as meaning inclusion, so  $\alpha \models \beta$  should amount to  $\llbracket \alpha \rrbracket \subseteq \llbracket \beta \rrbracket$ . To satisfy these two desiderata, we need to make sure that  $\llbracket \alpha \rrbracket$  and  $\llbracket \beta \rrbracket$  are construed in such a way that:

$$(20) \quad |\alpha| \subseteq |\beta| \iff \llbracket \alpha \rrbracket \subseteq \llbracket \beta \rrbracket$$

<sup>12</sup>A similar issue arises for universal quantification: if we take a universal quantifier to perform pointwise intersection, even a vacuous universal quantifier may introduce spurious alternatives.



This result is naturally obtained if we do not construe  $\llbracket \alpha \rrbracket$  and  $\llbracket \beta \rrbracket$  as the *singleton* sets  $\{|\alpha|\}$  and  $\{|\beta|\}$ , respectively, but rather as the *powersets*  $\wp(|\alpha|)$  and  $\wp(|\beta|)$ , i.e., the set of all subsets of  $|\alpha|$  and  $|\beta|$ , respectively. Clearly, if  $|\alpha| \subseteq |\beta|$ , then any subset of  $|\alpha|$  is also a subset of  $|\beta|$ . And conversely, if any subset of  $|\alpha|$  is a subset of  $|\beta|$ , then it follows that  $|\alpha| \subseteq |\beta|$ . Intuitively, we take the meaning of **John walks** to be the set of all propositions that contain *enough* information to establish that John walks, i.e., all propositions  $p$  such that John walks in every world in  $p$ , rather than just the proposition that contains *precisely* the information that John walks, i.e., the proposition consisting of *all* worlds in which John walks.

This does not mean that we give up the idea that **John walks** has a unique alternative: for, we can recover the unique alternative for **John walks** as the *maximal element* of its meaning. This is precisely the set of *all* worlds where John walks. Thus, by carefully distinguishing the meaning of a sentence from the alternatives it introduces, we can simultaneously retain the usual alternatives for the sentence on the one hand, and the standard type-theoretic notion of entailment on the other.

The reasoning just outlined for basic sentences with a single alternative can be generalized to sentences with multiple alternatives as well. In the spirit of Hamblin (1973) as well as more recent work on *inquisitive semantics* (see, e.g., Ciardelli et al. 2012, 2013) such sentences can be thought of as raising an *issue* as to which of the alternatives contains the actual world. Crucially, while Hamblin originally identified the meaning of a sentence with the alternatives it introduces, inquisitive semantics dissociates the two notions in precisely the way discussed above for basic sentences. That is, the meaning of a sentence in inquisitive semantics consists of all propositions that contain *enough* information to resolve the issue that the sentence raises. As a consequence, sentential meanings in inquisitive semantics are not unconstrained sets of propositions, as in alternative/possibility semantics, but rather sets of propositions that are *downward closed*: if  $\llbracket \alpha \rrbracket$  contains a proposition  $p$  then it also includes every stronger proposition  $q \subseteq p$ . After all, if  $p$  contains enough information to resolve the issue that  $\alpha$  raises, then any  $q \subseteq p$  will also contain enough information to do so.

We will refer to downward closed sets of propositions as *inquisitive meanings*. Given the inquisitive meaning  $\llbracket \alpha \rrbracket$  of a sentence  $\alpha$ , the *alternatives* that  $\alpha$  introduces can still be recovered as the *maximal elements* of  $\llbracket \alpha \rrbracket$ . Intuitively, these are propositions that contain enough information to resolve the issue raised by  $\alpha$ , and *not more information than necessary* to do so.<sup>13</sup>

$$(21) \quad \text{ALT}(\alpha) = \{p \in \llbracket \alpha \rrbracket \mid \text{there is no } q \in \llbracket \alpha \rrbracket \text{ such that } p \subset q\}$$

<sup>13</sup>Interestingly, this approach imposes some constraints on the kinds of alternative sets that may be associated with a sentence. In particular, if  $p$  and  $q$  are two alternatives associated with a sentence  $\alpha$ , we must have that  $p \not\subseteq q$  and  $q \not\subseteq p$ , neither one can be nested in the other. This has consequences, e.g., for the analysis of sentences like **Frege lived in Göttingen or in Germany** (cf., Hurford 1974; Chierchia et al. 2009). Appendix A of the handout version of this paper, available via [www.illc.uva.nl/inquisitivesemantics](http://www.illc.uva.nl/inquisitivesemantics), provides some preliminary remarks on this issue, suggesting that the more constrained notion of alternatives is in fact advantageous, but a comprehensive discussion must be left for another occasion. Due to space limitations, the appendix could not be included in the present paper.

It is easy to see how the compositional fragment outlined above for possibility semantics may be adjusted to yield downward closed sentential meanings. For instance, since we now want that  $\llbracket \text{John walks} \rrbracket = \wp(|Wj|)$ , we will let **walk** denote the function that maps any individual  $x$  to the set of propositions which contain enough information to establish that  $x$  walks.

$$(22) \quad \llbracket \text{walks} \rrbracket = \lambda x. \wp(|Wx|) = \lambda x. \{p \mid x \text{ walks in every } w \in p\}$$

For a detailed exposition of a compositional inquisitive semantics for an elementary fragment of English we refer to Theiler (2014) and Roelofsen et al. (2014).<sup>14</sup> Here, we will focus on showing how the problems with entailment and conjunction discussed above evaporate when meanings are taken to be downward-closed.

First, as we have already seen, the standard type-theoretic notion of entailment as inclusion now *does* make the right predictions for basic sentences. For instance:

$$(23) \quad \llbracket \text{John walks} \rrbracket = \wp(|Wj|) \subseteq \wp(|Mj|) = \llbracket \text{John moves} \rrbracket$$

Moreover, unlike the pointwise notion of entailment considered above, entailment as inclusion constitutes a partial order on the space of inquisitive meanings. In particular, it is anti-symmetric, which means that any two expressions that are logically equivalent express the same meaning. Furthermore, as shown in Roelofsen (2013a), the space of inquisitive meanings ordered by entailment forms a complete Heyting algebra, just like the space of classical propositions ordered by entailment. This means in particular that two inquisitive meanings  $\mathcal{P}$  and  $\mathcal{Q}$  always have (i) a *meet*, i.e., a unique greatest lower bound w.r.t. entailment, given by  $\mathcal{P} \cap \mathcal{Q}$ , and (ii) a *join*, i.e., a unique least upper bound w.r.t. entailment, given by  $\mathcal{P} \cup \mathcal{Q}$ . This means that we can restore the standard treatment of conjunction and disjunction as meet and join operations; moreover, these operations still amount to intersection and union, just as in the classical Montagovian setup.

$$(24) \quad \begin{array}{ll} \text{a. } \llbracket \text{and} \rrbracket &= \lambda \mathcal{P}. \lambda \mathcal{Q}. \mathcal{P} \cap \mathcal{Q} \\ \text{b. } \llbracket \text{or} \rrbracket &= \lambda \mathcal{P}. \lambda \mathcal{Q}. \mathcal{P} \cup \mathcal{Q} \end{array}$$

This result generalizes to arbitrary conjoinable types, yielding a cross-categorical account of conjunction and disjunction. For instance, for the  $\langle e, T \rangle$ -type disjunction **sing or dance** we get:

$$(25) \quad \begin{aligned} \llbracket \text{sing or dance} \rrbracket &= \llbracket \text{sing} \rrbracket \cup \llbracket \text{dance} \rrbracket = \lambda x. \wp(|Sx|) \cup \lambda x. \wp(|Dx|) \\ &= \{ \langle x, p \rangle \mid p \subseteq |Sx| \} \cup \{ \langle x, p \rangle \mid p \subseteq |Dx| \} \\ &= \{ \langle x, p \rangle \mid p \subseteq |Sx| \text{ or } p \subseteq |Dx| \} \\ &= \lambda x. (\wp(|Sx|) \cup \wp(|Dx|)) \end{aligned}$$

As in alternative semantics, disjunction typically generates alternatives. For instance:

<sup>14</sup>See also Appendix B of the handout version of this paper, available via [www.ilic.uva.nl/inquisitivesemantics](http://www.ilic.uva.nl/inquisitivesemantics).

$$(26) \quad \llbracket \text{John sings or Mary dances} \rrbracket = \llbracket \text{John sings} \rrbracket \cup \llbracket \text{Mary dances} \rrbracket = \wp(|Sj|) \cup \wp(|Dm|)$$

This meaning has two maximal elements, namely, the proposition that John sings, and the proposition that Mary dances:

$$(27) \quad \text{ALT}(\text{John sings or Mary dances}) = \{|Sj|, |Dm|\}$$

Thus, we recover the alternative-generating treatment of disjunction that was argued for on an empirical basis by Simons (2005), Alonso-Ovalle (2006) and Aloni (2007). However, now this behavior is not merely stipulated, but follows from a principled treatment of disjunction as a join operation in the given semantic framework (cf. Roelofsen 2013b).

Indefinites and *wh*-phrases could also be treated as join operators, which would give them the potential to generate alternatives as well.<sup>15</sup>

- (28) a. **someone, who** :  $\langle \langle e, T \rangle, T \rangle$   
 b.  $\llbracket \text{someone} \rrbracket = \llbracket \text{who} \rrbracket = \lambda P. \bigcup_{x \in D_e} P(x)$   
 c.  $\llbracket \text{someone walks} \rrbracket = \llbracket \text{who walks} \rrbracket = \bigcup_{x \in D_e} \wp(|Wx|)$   
 d.  $\text{ALT}(\text{someone walks}) = \text{ALT}(\text{who walks}) = \{|Wx| \mid x \in D_e\}$

Let us now consider conjunction. We have restored the standard treatment of conjunction as a meet operator. This does not only re-establish the link between entailment and conjunction, but also resolves the empirical problems pointed out above. First, performing intersection now yields the right results for the cases that were problematic in alternative and possibility semantics.

$$(29) \quad \begin{aligned} \llbracket \text{John sings and Mary dances} \rrbracket &= \llbracket \text{John sings} \rrbracket \cap \llbracket \text{Mary dances} \rrbracket \\ &= \wp(|Sj|) \cap \wp(|Dm|) \\ &= \wp(|Sj| \cap |Dm|) = \wp(|Sj \wedge Dm|) \end{aligned}$$

As desired, **John sings and Mary dances** is predicted to have a unique alternative, namely, the proposition that John sings and Mary dances. Moreover, unlike the pointwise conjunction operation that we considered above, intersection is obviously *idempotent*, which means that the problem with spurious alternatives no longer arises:

$$(30) \quad \text{ALT}(\text{John sings or dances and John sings or dances}) = \{|Sj|, |Dj|\}$$

More generally, since conjunction is treated again as performing the *meet* operation with respect to entailment, it regains its familiar, well-understood logical features.

<sup>15</sup>On this view, **someone** and **who** generate the same set of alternatives, as in, e.g., Kratzer and Shimoyama (2002). The difference between the two could be captured by means of constraints on what happens with these alternatives in the further derivation. Of course, different choices for these items are also compatible with the framework we propose.

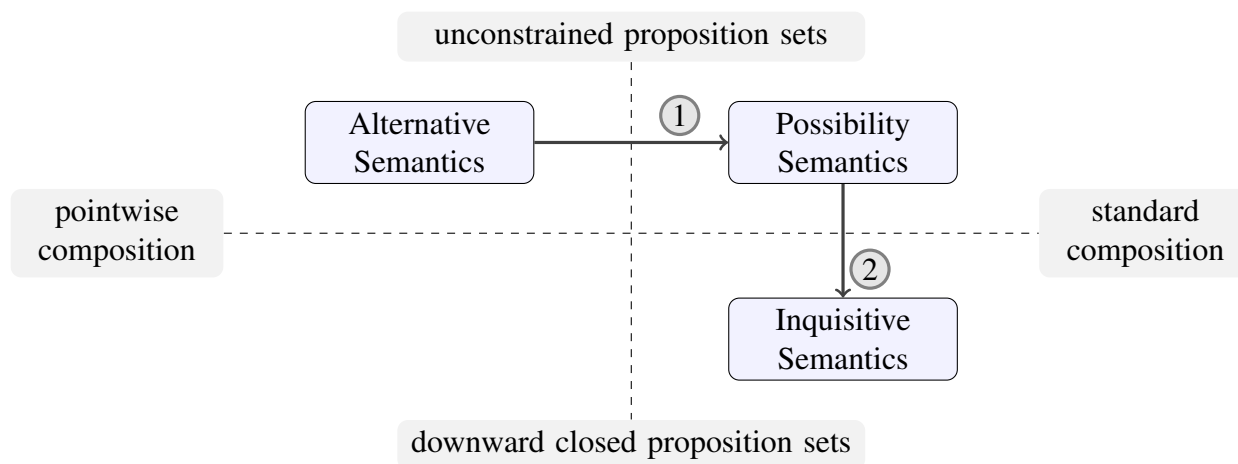


Figure 1: The proposal at a glance.

Summing up, we have shown that the issues with entailment and coordination that arise in alternative semantics may be avoided by carefully reconsidering one of the basic features of the framework, namely, the identification of the *meaning* of a sentence with the set of *alternatives* that it introduces. By teasing the two notions apart, construing the meaning of a sentence as a *downward closed* set of propositions, and viewing the maximal elements of this set as the alternatives that the sentence introduces, we obtain a semantic framework which allows us to retain on the one hand an alternative-inducing notion of meaning, and on the other hand, the principled type-theoretic account of generalized entailment and coordination that is characteristic of Montague grammar.

#### 4. Conclusion

While it clearly seems that alternatives have an important role to play in semantics, the specific architecture of Hamblin-style alternative semantics forces us to give up two crucial features of the standard Montagovian framework, namely, (i) the type-theoretic composition operations of function application and abstraction and (ii) the type-theoretic treatment of cross-categorical entailment and coordination. This leads to a number of problems, both empirical and theoretical.

We have tried to identify precisely which features of alternative semantics are responsible for these issues, and how they could be modified in order to avoid the resulting problems. Our proposal is summarized in Figure 1. First, we argued that the compositionality issue stems from the assumption that *all* expressions denote sets of objects of the corresponding type. This assumption does not seem to have strong conceptual or empirical motivation, and dropping it does not seem to undermine the general spirit of the framework, nor the empirical coverage of the theories that are formulated within it. This step, marked ① in Figure 1, led us to the framework of *possibility semantics*, where sentences still denote unconstrained sets of propositions, but meanings are composed by means of the standard type-theoretic operations.

However, like alternative semantics, possibility semantics still faces the entailment issue, which also leads to problems in the treatment of conjunction. We argued that this issue stems from the assumption that the meaning of a sentence is *identical with* the set of alternatives that it introduces. Once again, this assumption does not seem strictly necessary, neither from a conceptual point of view nor from an empirical one. Conceptually, there is another natural perspective on sentential meanings, motivated in recent work on inquisitive semantics, under which they are construed as sets of propositions that are *downward closed*. Empirically, all that is required for applications is that the meaning of a sentence *determine* a set of alternatives. If the meaning of a sentence is a downward closed set of propositions, the maximal elements of this set are naturally viewed as the alternatives that it introduces. This step, marked ② in Figure 1, resolves the entailment issue: the general type-theoretic notion of entailment is recovered, and conjunction and disjunction can again be treated as *meet* and *join* operations w.r.t. entailment. Notice that the two proposed steps are independent, that is, one of them could in principle be adopted without the other.

The resulting framework retains a fine-grained notion of meaning, which associates with every sentence a set of alternatives, but has a much more solid type-theoretic foundation than Hamblin-style alternative semantics: as in the usual Montagovian framework, meanings are composed by means of the standard type-theoretic composition rules, and compared by means of the standard notion of entailment as meaning inclusion. In this way, the empirical coverage of the analyses formulated in alternative semantics is preserved, while the problematic predictions stemming from the observed framework issues are avoided.

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# Completely Bare Swedish Superlatives

Elizabeth Coppock — University of Gothenburg & Swedish Collegium for Advanced Study

Christian Josefson — University of Gothenburg

**Abstract.** This paper shows that Swedish differs from both German and English with respect to the distribution and interpretation of definiteness-marking on superlatives: Bare degree and amount superlatives unambiguously receive a relative interpretation, definite-marked amount superlatives are unambiguously ‘proportional’ (although they do not always carry a ‘more than half’ interpretation), and definite-marked degree superlatives can have an absolute or a relative reading. We show that an analysis based on movement of the superlative morpheme accounts well for the Swedish pattern but does not provide the tools for a cross-linguistically valid framework, failing in particular to account well for relative readings in conjunction with definiteness-marking. We therefore propose an alternative, non-movement approach building on a very recent treatment of the superlative morpheme, giving it access to a contrast set and an association relation. The crucial difference between Swedish on the one hand and English and German on the other hand is proposed to lie in whether the association relation is saturated through semantic composition or by context.

**Keywords:** superlatives, relative vs. absolute and proportional readings, definiteness, Swedish

## 1. Introduction

As the reader may recall, there are seven continents in the world (North America, South America, Europe, Africa, Asia, Australia, and Antarctica). Imagine that our friend Gloria has visited three of them, namely North America, Africa, and Europe, and that everyone else in the room has visited only North America and Europe. In this situation, (1) is true.

- (1) Gloria has visited the most continents.

This is a *relative reading*. In contrast, (2) strikes many native English speakers (the first author included) as false in this scenario.

- (2) Gloria has visited most continents.

If the sentence is false, it is because Gloria has not visited the majority of the continents; here we have a *proportional reading*. Bare *most* can have relative readings as well, as Szabolcsi (2012) documents, despite assumptions to the contrary in foregoing literature. So in English, the variant with definiteness marking (*the most*) has a relative reading and no proportional reading, and the bare variant (*most*) has a proportional reading as well as a relative reading, the former possibly being the more dominant of the two.

German works differently, and in Swedish, it’s roughly the opposite: the definite-marked variant (3) has only a proportional reading, and the bare variant (4) has only a relative reading.

- (3) Gloria har besökt de flest-a kontinent-er-na.  
Gloria has visited the.PL many.est-W continent-PL-DEF  
→ Gloria has visited more than half of the continents.

- (4) Gloria har besökt flest kontinent-er.  
 Gloria has visited many.est continent-PL  
 → Gloria has visited more continents than anyone else.

This contrast is the starting point for the present investigation: How can the same basic ingredients give rise to such widely differing patterns of interpretation?

## 2. Background: English and German

Let us begin with some brief background on relative readings in general, and how they interact with definiteness in English and German. Relative readings generally require some sort of licenser. This is typically focus, as in (5) and (6). In (5), the focussed element Jean is being compared to the other elements of what we will call the *contrast set* (the sisters). Jean is associated with the highest value, compared to her sisters, and they are measured in terms of the expensiveness of the books that they bought. Example (6), where Tuesday is being compared in the same way to other days, shows that relative readings do not require the licenser to be in subject position.

- (5) Of her 3 sisters, [Jean]<sub>F</sub> bought the most expensive book.  
 (6) There was the least snow on [Tuesday]<sub>F</sub>.

*Wh*- constructions can also license relative readings, both questions as in (7) and relative clauses as in (8):

- (7) Who received the fewest letters?  
 (8) The one who receives the most votes wins.

And as Heim (1999) pointed out, even PRO can license relative readings:

- (9) A: How do you win this contest?  
 B: By [ PRO putting the tallest plant on the table ].

But there is a limit: some constructions contain no licenser. As Hackl (2009) points out, presentational constructions where the superlative DP is in the coda position are one. Here, *the most* cannot appear, because *the most* only has relative readings, and in this configuration there's no licenser for the relative reading. Here are two examples, one with a count noun and one with a mass noun:

- (10) There are people living on (\*the) most continents.  
 (11) There is contamination in (\*the) most oil.

Since *least* and *fewest* have no proportional reading, neither *least* or *the least* or *fewest* or *the fewest* is viable in this configuration.

- (12) \*There are people living on (the) fewest continents.  
 (13) \*There is contamination in (the) least oil.

With degree superlatives, the definite form is ambiguous between an absolute and a relative reading, and a bare form is not an option.



(14) Gloria climbed the highest mountain.

a. ‘Gloria climbed Mt. Everest.’ [absolute]

b. ‘Gloria climbed a higher mountain than anybody else.’ [relative]

German has only the definite variant for both degree and amount superlatives; the bare variant in (15) is ungrammatical. As one might then expect, definite amount superlatives have both a relative and a proportional reading.<sup>1</sup>

(15) Hans hat \*(die) meisten Bücher gelesen.

a. ‘John read more books than anybody else.’ [relative]

b. ‘John read more than half of the books.’ [proportional]

Likewise, there is no bare variant for negative amount superlatives, as shown in (16).

(16) Hans hat \*(die) wenigsten Bücher gelesen.

a. ‘John read fewer books than anybody else.’ [relative]

b. ‘John read less than half of the books.’ [proportional]

So we see that there is some variation within the Germanic family as to how definiteness interacts with the relative vs. non-relative distinction. What we will see in the next section is that the variation is much greater than that, as already hinted in the introduction. In Section 4 we will see that Hackl’s (2009) analysis works strikingly well for Swedish. But we argue that it cannot be generalized to account for English and therefore offer an alternative based on Coppock & Beaver’s (2014) analysis of the superlative morpheme in Section 5.

### 3. Swedish

Let us first establish some background on the inventory of Swedish amount comparatives and superlatives (see Table 3). English makes a distinction between count and non-count for negative comparatives and superlatives (*less/least* vs. *fewer/fewest*) which is not present in German (which uses *weniger/wenigste* for both). Swedish makes a corresponding distinction in the positive paradigm, with the comparative and superlative of ‘many’ being *fler* and *flest*, and the comparative and superlative of ‘much’ being *mer* and *mest*. Swedish also makes a *less/least* vs. *fewer/fewest* distinction: The negative comparative for ‘much’ is *mindre*; for ‘many’ it is *färre* (or more colloquially, *mindre*). (There is a puzzling gap in the cell corresponding to the negative superlative for ‘many’: the negative superlative for ‘much’ is straightforwardly *mindre*, but *färst* sounds odd or

<sup>1</sup>Based on what we have just seen about English, we might expect that (16) would only have a relative reading. However, we do see a kind of proportional reading sometimes attested with *die wenigsten*; consider the following quotation (attributed to Hugo von Hofmannsthal), although this example has been reported to sound ‘archaic’ (Sven Lauer, p.c.): “Die wenigsten Leute haben auch nur einen Augenblick ihres Lebens wirklich gewollt, ebensowenig als geliebt.” Translation: ‘A minority of people have even for one moment in their lives really wanted, much less loved.’ A word-for-word translation of this example does not work in English, with or without definiteness marking: \*“{Fewest, The fewest} people have even for one moment in their lives really wanted, much less loved.” So there is no corresponding proportional reading for *fewest* in English. This is a curious little difference between English and German which we will not aim to account for here.

	ENGLISH	GERMAN	SWEDISH
MANY + ER	more	mehr	fler
MANY + EST	most	meisten	flest
MUCH + ER	more	mehr	mer
MUCH + EST	most	meisten	mest
LITTLE + MANY + ER	fewer	weniger	färre
LITTLE + MANY + EST	fewest	wenigste	??färst/?minst
LITTLE + MUCH + ER	less	weniger	mindre
LITTLE + MUCH + EST	least	wenigste	minst

Table 1: The inventory of amount comparatives and superlatives in English, German and Swedish

archaic and *minst* sounds incorrect in combination with plurals, e.g. ??*färst/minst böcker* ‘fewest books’.)

Now for the interaction with definiteness. As mentioned above in connection with examples (3) and (4), repeated here as (17) and (18), definite-marked amount superlatives in Swedish receive a proportional reading, while bare ones receive a relative reading.

- (17) Gloria har besökt de flest-a kontinent-er-na.  
 Glora has visited the.PL many.est-W continent-PL-DEF  
 → Gloria has visited more than half of the continents.
- (18) Gloria har besökt flest kontinent-er.  
 Gloria has visited many.est continent-PL  
 → Gloria has visited more continents than anyone else.

In (17) we have definiteness-marking both with the plural definite article *de* and with the suffix *-na*; the *-a* ending on *flest* is a so-called ‘weak’ ending, which occurs when the noun phrase is definite or plural (or both, as in this case); this sentence implies that Gloria has visited more than half of the continents (a proportional reading). In (18), we have no definiteness-marking anywhere, and the sentence means that Gloria has visited a greater number of continents than anyone else (a relative reading). So in a scenario like the one described above, where Gloria has visited three continents and everyone else has visited just two, (17) is false and (18) is true.

Here are some corpus examples with *flest* and *de flesta*.

- (19) De med *flest stalkers* kommer vinna.  
 ‘Those with (the) *most stalkers* are going to win.’
- (20) Till slut var det faktiskt myrorna som vann kampen om *flest döingar*.  
 ‘At the end it was in fact the ants who won the competition for (the) *most dead ones*.’
- (21) Han har tittat på *de flesta matcherna*.  
 ‘He has watched *most of the matches*.’

- (22) I själva verket kan *de flesta varor och tjänster* produceras regionalt.  
 ‘In fact *most goods and services* can be produced regionally.’

All of these would sound odd or have a different meaning with a change in definiteness marking.

As one would expect given the foregoing, the bare variant is not acceptable when there is no relative reading licensor. This is shown for *flest* in (23) and *mest* in (24).

- (23) Det finns flygplatser vid  $\left\{ \begin{array}{l} *flest \text{ städer.} \\ \text{de flesta större städer(na).} \end{array} \right\}$   
 ‘There are airports in (the) most large cities.’
- (24) Det finns kolhydrater i  $\left\{ \begin{array}{l} *mest \text{ mat.} \\ \text{den mesta maten.} \end{array} \right\}$   
 ‘There are carbohydrates in (the) most food.’

As in English, neither definite nor bare negative amount superlatives are acceptable in this construction, whether the noun is plural or mass:

- (25) Det bor folk på  $\left\{ \begin{array}{l} *färst/minst \text{ kontinenter.} \\ *de första/minsta kontinenterna. \end{array} \right\}$   
 ‘There are people living on (the) most continents.’
- (26) Det är kontaminanter i  $\left\{ \begin{array}{l} *minst \text{ olja.} \\ *den minsta oljan. \end{array} \right\}$   
 ‘There are contaminants in (the) most oil.’

Interestingly, this pattern is reflected in degree superlatives as well. In English we saw a split between amount and degree superlatives, but in Swedish the distinction goes all the way to degree superlatives. The degree superlative with definiteness marking in (27) has an absolute reading, referring to the pine tree that is taller than all other pine trees. In contrast, (28) doesn’t mean that Gloria sold the ice cream that was more delicious than any other ice cream; it means that Gloria sold more delicious ice cream than all of her competitors.

- (27) Den stör-st-a tall-en blev ner-skuren.  
 the big-est-W pine-DEF became down-cut
- (28) Gloria sålde god-ast glass.  
 Gloria sold good-est ice.cream

According to the Swedish Academy Grammar (Teleman et al. 1999), example (27) involves “direct selection”, where “the member of the group that has the given property to a greater degree than the others” is distinguished (Vol. II §45-46); example (28) involves what they call “indirect selection”, presumably because Gloria is compared with other ice cream sellers indirectly, through the tastiness of their ice cream.

However, degree superlatives accompanied by definiteness-marking can have a relative reading in some cases; according to Teleman et al. (1999, II, p. 79), “indirect selection can also be expressed with the same type of noun phrase as direct selection”, and (29) is an example of that; it can mean either that Fredrik bought the wine that is more expensive than all other wine or that Fredrik bought more expensive wine than anyone else.

## AMOUNT SUPERLATIVES

	[+DEF]	[-DEF]
English	relative	proportional/?relative
German	proportional/relative	*
Swedish	proportional	relative

## DEGREE SUPERLATIVES

	[+DEF]	[-DEF]
English	absolute/relative	*
German	absolute/relative	*
Swedish	absolute/relative	relative

Table 2: Interaction between definiteness and relative vs. absolute/proportional readings of superlatives in English, German, and Swedish

- (29) Fredrik köp-te det dyr-ast-e vin-et.  
 Fredrik buy-PAST the.SG expensive-est-W wine-DEF  
 (ambiguous between relative and absolute)

The current picture is summarized in Table 3, which shows that there are three distinct patterns, and that English and Swedish are in a way opposites, at least when it comes to amount superlatives. While in English, the definite variant has a relative reading and the bare variant has (primarily) a proportional reading, the opposite holds in Swedish: The definite-marked variant has a proportional reading and the bare variant has a relative reading. And in Swedish, this correlation is reflected in the realm of degree superlatives as well.

Before moving on, we should note that we are dealing with a more radical absence of definiteness-marking with superlatives than what has been discussed in previous literature. Borthen (2007) for example discusses the possibility of article drop in cases like (30).

- (30) Gloria ritade (den) rolig-ast-e bild-en. [relative, absolute]  
 Gloria drew the funny-SUP-W picture-DEF  
 ‘Gloria drew the funniest picture.’

But an absolute reading is available here regardless of whether the article is present. This kind of article drop is interesting, but it does not interact with the relative vs. absolute distinction. *Completely* bare superlatives have only a relative reading, and no absolute or proportional reading.

#### 4. Movement analysis

As the reader may know, there are several different approaches to relative readings in the literature. According to the *movement* approach (Szabolcsi 1986, Heim 1999, Hackl 2009), the superlative morpheme *-est* takes scope outside of the object DP on a relative reading but is interpreted inside the DP on a proportional or absolute reading. Under another approach (Farkas & É. Kiss 2000,

Sharvit & Stateva 2002, Teodorescu 2009), the superlative morpheme is always interpreted inside the DP. On the latter kind of analysis, the natural move to make is to say that the appearance of relative ‘readings’ is due to variation in the contents of the comparison class.

In this section, we will show that the movement approach works uncannily well for Swedish. Under a set of assumptions that have been suggested independently in previous literature, the DP-internal structure requires a definite article and yields only a non-relative reading, as in (31), whereas the DP-external structure may not be definite and yields only a relative reading as in (32).

(31) Gloria har besökt de flesta kontinenterna. [*\*relative*, proportional]

(32) Gloria har besökt flest kontinenter. [relative, *\*proportional*]

As an aid to distinguish between the readings we will enlist the three following scenarios:

(33) a. **3-2-1 Scenario**

Gloria - North America, Africa, Europe  
Fred - North America, South America  
Sue - Europe

b. **2-2-1 Scenario**

Gloria - North America, South America  
Fred - North America, South America  
Sue - Europe

c. **5-2-1 Scenario**

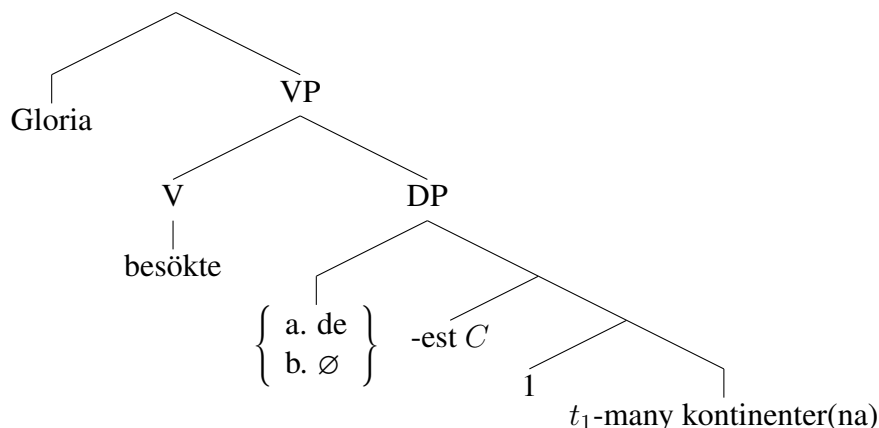
Gloria - North America, South America, Europe, Asia, Africa  
Fred - North America, South America  
Sue - Europe

The dash signifies the ‘visit’ relation, so under the 3-2-1 scenario, Gloria visited North America, Africa and Europe, etc. In the 3-2-1 scenario, Gloria visited more continents than any of her friends, so the relative reading is true. The proportional reading is false because Gloria didn’t visit more than half of the continents. In the 2-2-1 scenario, Gloria and Fred both visited the same two continents (North America and South America), and the relative and the proportional readings are both false, because Gloria didn’t visit more than any of her friends nor did she visit more than half. In the 5-2-1 scenario, both readings are true. A given theory of superlatives and definiteness makes the right predictions for Swedish if (31) is predicted true in those scenarios where the proportional reading is true, and (32) is predicted to be true in those scenarios where the relative reading is true.

#### 4.1. DP-internal

The hallmark of the movement analysis is the case where the superlative morpheme has moved outside of the DP, but let us first consider the DP-internal structure. According to the movement analysis literature, the DP-internal structure actually does involve movement of the superlative morpheme, but here the movement is limited to within the DP.

(34)



Even though the superlative morpheme present in (34) has undergone movement, it is still inside the DP. However, it is no longer a sister to the cardinality predicate *-many*. We will consider two variants of the structure, the definite as in (34a) and the bare as in (34b). We will begin with the latter, as it is a somewhat simpler case.

Using the principle of Maximize Presupposition (Heim 1991, Schlenker 2011, Percus 2006), we can derive the result that the DP-internal structure requires a definite article, so the bare variant (34b) is ungrammatical. Since the description that the definite article would combine with is inherently unique but not necessarily instantiated (as there may be a tie for first place, so to speak), it is useful to assume that the definite article presupposes uniqueness but not existence, as under the analysis proposed by Coppock & Beaver (2015). We adopt Coppock & Beaver’s (2015) lexical entry for *the* and for definiteness-marking in Swedish (encoded both by the article and by the suffix), shown in (35).

- (35) **Lexical entry:** *the*  
 $the \rightsquigarrow \lambda P \lambda x . [\partial[|P| \leq 1] \wedge P(x)]$

This formula uses Beaver & Krahmer’s (2001)  $\partial$  (read ‘partial’) operator, which marks the formula within its scope (e.g. the uniqueness part of (35)) as presupposed. The input is a predicate and the output is the same predicate as long as there is no more than one satisfier of the predicate; otherwise the output is a constant function to the ‘undefined’ truth value. So, in essence, using Coppock & Beaver’s (2015) analysis of *the* ensures that whatever description *the* is given is unique, but does nothing else.

We also assume that the bare, unmarked (morphologically empty) form is a competitor to the definite form, so that they are competitors for the purposes of Maximize Presupposition. Maximize Presupposition is articulated in (37), which depends on the notion of Presuppositional Domination, defined in (36). (See Coppock & Beaver 2015 for more detail.)

- (36) **Presuppositional Domination**

Expression  $\alpha$  *presuppositionally dominates* expression  $\beta$  just in case  $\alpha$  and  $\beta$  are classically equivalent, and  $\alpha$  has presuppositions at least as strong as  $\beta$  but not *vice versa*.

(37) **Principle: Maximize Presupposition**

In a context  $C$ , lexical item  $\alpha$  blocks  $\beta$  in a derivation iff (i)  $\alpha$  and  $\beta$  are competitors, (ii)  $\alpha$  presuppositionally dominates  $\beta$ , and (iii) replacing  $\alpha$  by  $\beta$  does not affect how  $C$  would be updated.

The update of a context  $C$  (a set of worlds) with a sentential meaning  $p$  is defined iff  $p$  is defined at every world in  $C$ . In that case the updated context is just the subset of worlds in  $C$  where  $p$  is true.

With these assumptions, we can derive that the definite form *has* to be chosen when the structure is DP-internal. The description that the article would combine with is [-est  $C$   $t$ -many kontinenter]. It is unique, because it characterises the largest continent-plurality in  $C$  and only one plurality can be bigger than all others in  $C$ . So the presuppositions of definiteness marking are always satisfied. Because a speaker then has to choose definite over bare, the bare form is ungrammatical.<sup>2</sup>

Let us now focus on the DP-internal structure with definiteness marking, and consider under what conditions it would turn out to be true. Since the denotation of the definite description (definiteness marking + superlative description) is a predicate (type  $\langle e, t \rangle$ ) under Coppock & Beaver's (2015) analysis, and this is not the right type to occupy an argument position, it must undergo a type-shift in order to function as an argument. Following Coppock & Beaver (2015), we assume that a definite description can be interpreted either with an iota shift (denoting the unique individual satisfying the description), or with an existential shift (as an existential quantifier).

(38) **Meaning shift: IOTA**

$$\text{IOTA} \equiv \lambda P \iota x . P(x)$$

(39) **Meaning shift: EX**

$$\text{EX} \equiv \lambda P \lambda Q . \exists x [P(x) \wedge Q(x)]$$

In order to evaluate the truth conditions after these two shifts, we need an analysis of the superlative morpheme. A standard analysis will suffice for the present discussion. The superlative morpheme takes a gradable predicate  $G$  (relating an individual with a degree, like the meaning of *tall* or the cardinality predicate *-many*) and an individual  $x$ , presupposes that  $x$  is in some contextually given comparison class  $C$ , and says that  $x$  bears  $G$  to a greater degree than any other element in  $C$ .

$$(40) \quad \text{-est} \rightsquigarrow \lambda G_{\langle d, et \rangle} \lambda x . [\partial[x \in C] \wedge \forall x' \in C [x \neq x' \rightarrow \exists d [G(x, d) \wedge \neg G(x', d)]]]$$

Applying the iota shift results in the truth conditions shown in (41) and applying the existential shift results in the truth conditions shown in (42).

(41) **DP-internal/IOTA**

$$\text{VISIT}(G, \iota x [\forall x' \in C [x' \neq x \rightarrow \exists d [* \text{CONT}(x) \wedge \text{MANY}(x, d)] \wedge \neg [* \text{CONT}(x') \wedge \text{MANY}(x', d)]]])$$

'Gloria visited that continent-plurality that is more numerous than all other continent-pluralities in  $C$ '

<sup>2</sup>This conclusion would not follow as straightforwardly under a Fregean analysis of the definite article, where it presupposes uniqueness and existence, because uniqueness is not guaranteed. If there are two entities that are tied for most numerous then there is no entity that is more numerous than all others. Nothing we have said so far rules out that possibility.

## (42) DP-internal/EX

$$\exists x[\text{VISIT}(G, x) \wedge \forall x' \in C[x' \neq x \rightarrow \exists d[*\text{CONT}(x) \wedge \text{MANY}(x, d)] \wedge \neg[*\text{CONT}(x') \wedge \text{MANY}(x', d)]]]$$

‘Gloria visited some continent-plurality that is more numerous than all other continent-pluralities in  $C$ ’

These two both give a proportional reading under certain assumptions, as we will show shortly. Let us concentrate on (41) to begin with. In order to decide when this is true, we have to look at what  $C$  contains. There seem to be two rational strategies for constructing  $C$ : a *pointwise* strategy, where for each visitor, the plurality of continents visited by that visitor is a member of  $C$ ; and a *partition* strategy, dividing the set of continents in two, those that Gloria has visited, and those that she has not visited. These strategies yield the following values for  $C$  in the given scenarios:

(43) a. **Pointwise strategy:** for each visitor, the continents visited

$$3\text{-}2\text{-}1 \ C = \{\underline{\text{NA+SA+E}}, \text{NA+SA}, \text{E}\}$$

$$2\text{-}2\text{-}1 \ C = \{\underline{\text{NA+SA}}, \text{E}\}$$

$$5\text{-}2\text{-}1 \ C = \{\underline{\text{NA+SA+E+As+Af}}, \text{NA+SA}, \text{E}\}$$

b. **Partition strategy:** continents Gloria {did, did not} visit

$$3\text{-}2\text{-}1 \ C = \{\text{NA+SA+E}, \underline{\text{As+Af+Ant+Aus}}\}$$

$$2\text{-}2\text{-}1 \ C = \{\text{NA+SA}, \underline{\text{E+As+Af+Ant+Aus}}\}$$

$$5\text{-}2\text{-}1 \ C = \{\underline{\text{NA+SA+E+As+Af}}, \text{Ant+Aus}\}$$

In each set, we have underlined the continent-plurality that is largest, in order to make it easy to calculate whether the sentence is predicted to be true. If Gloria visited the underlined plurality, then the sentence is true in the scenario; otherwise it is false. So the pointwise strategy yields true in all scenarios, and the partition strategy yields true only in the 5-2-1 scenario. The partition strategy (under a DP-internal analysis, regardless of if we choose an iota or existential shift) thus delivers the right pattern of truth values for a proportional reading.

The pointwise strategy comes closer to the relative reading, but misses in the 2-2-1 scenario. Note that there are only two elements in  $C$  under the pointwise strategy for the 2-2-1 scenario, since Gloria and Fred visited the same two continents. Since this is the largest continent-plurality in  $C$ , and Gloria visited it, the sentence is predicted to come out as true in this scenario. But neither the proportional reading nor the relative reading is true in this scenario, because Gloria visited neither more continents than anybody else nor more than half of the continents. So the pointwise strategy does not deliver either the proportional or the relative reading.

If we had a way of enforcing the partition strategy and ruling out the pointwise strategy, then the DP-internal analysis would always get an proportional reading. One way to do this is to adopt Hackl’s (2009) assumption that  $C$  cannot contain overlapping pluralities. The pointwise strategy will in general produce overlapping pluralities, particularly when what is at issue is what continents various people have visited; two people may have visited overlapping sets of continents. We speculate that it is for this reason that the pointwise strategy cannot be used in an example like this, and the partition strategy has to be used.



By this reasoning, the pointwise strategy might be ‘safe’, so to speak, in other domains. Consider voting, for example. Each vote goes to exactly one party, so for every party, the votes they received are non-overlapping. Suppose that the pointwise strategy is allowed in such a circumstance. In a parliamentary system, there may be more than two parties, and it is not uncommon that none of them gets more than half of the votes, but we expect a sentence with definiteness marking nevertheless to be true. This prediction is borne out for the definite-marked amount superlative in Swedish:

- (44) Centerpartiet fick *de flesta rösterna* (24,4%), men vann inte flera mandat än de två regeringspartierna SDP (21,5%) och samlingspartiet (20,2%)...  
 ‘The Center Party got *the most votes* (24%), but did not win more mandates than the two government parties SDP (21.5%) and the coalition party (20.2%)...’

In this sentence it is clear that the Center Party did not get more than half of the votes (only 24.4%), and yet there is a definite-marked amount superlative in it. Native Swedish speakers agree that this case is much better than the example with the continents. Note that example (44) cannot be translated into English using *most of the*.

- (45) #The Center Party got most of the votes (24.4%).

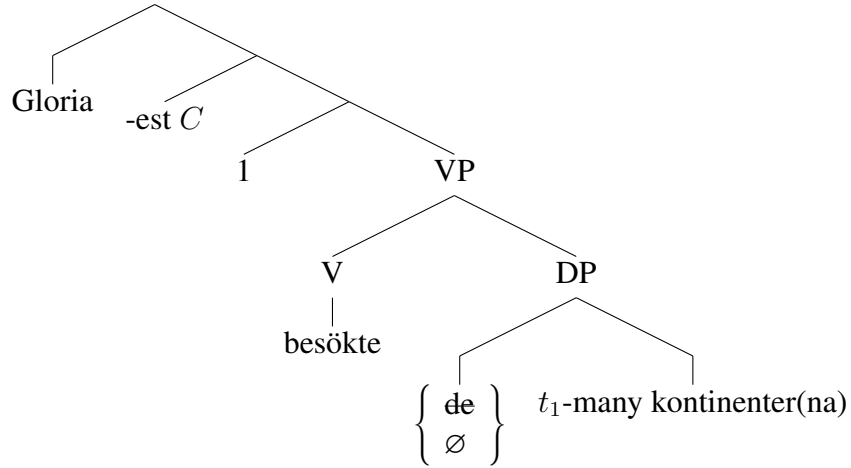
So *most (of the)*, in contrast to Swedish *de flesta*, appears to be genuinely proportional. But it may not be quite right to say that definite amount superlatives in Swedish always have ‘proportional’ readings, if ‘proportional’ implies ‘more than half’; they have readings with non-overlapping comparison classes.

The No Overlapping Pluralities principle thus appears to guide the choice of strategies at a domain level: If the domain is such that there is a risk of overlapping pluralities, then the pointwise strategy is not allowed and the partition strategy is required, leading to a ‘more than half’ interpretation. It is not entirely clear to us how to formalize this. But given a formulation of the No Overlapping Pluralities principle with this property, we will correctly obtain a proportional(-like) interpretation for definite-marked amount superlatives in Swedish, and also make the more subtle prediction that a ‘more than half’ interpretation will not arise in certain domains. Since we have already established that the definite article is necessary in DP-internal structures, we now have part of the correlation between definite marking and proportional readings in Swedish.

#### 4.2. DP-external

In the DP-external structure, the superlative morpheme has moved all the way up beyond the VP node, and it combines with a more complex and abstract gradable property formed by abstraction over its degree trace, a relation between individuals and the number of continents they visited.

(46)



It is a common assumption, frequently invoked in the literature associated with the movement analysis, that definite noun phrases are islands for movement. Let us adopt that assumption here as well. This means that the variant of (46) with definiteness marking is ungrammatical.

So, let us concentrate on the variant of (46) without definiteness marking. We assume that the bare noun phrase is associated with an existential quantifier. The truth conditions that emerge from this analysis are then as follows:

(47) DP-external/EX

$$\forall x' \in C [x' \neq G \rightarrow \exists d [\exists y [*CONT(y) \wedge MANY(y, d) \wedge VISIT(G)(y)]] \wedge \neg [\exists y [*CONT(y) \wedge MANY(y, d) \wedge VISIT(x')(y)]]]$$

‘The number of continents that Gloria visited is greater than the number of continents that anybody else in  $C$  visited’

Now  $C$  consists of potential continent-visitors (people) rather than continents. (Since  $C$  now consists of continent-visitors, the question of overlappingness does not arise.) As discussed above, this is true when Gloria climbed more mountains than anyone else, so it delivers the right truth conditions for the relative reading.

Let us summarize the assumptions we have made in Section 4: (i) The superlative morpheme can be interpreted DP-internally or DP-externally; (ii) definiteness-marking is analyzed using Coppock & Beaver’s (2015) lexical entry for *the*, which presupposes uniqueness but not existence; (iii) after the definite article combines with its sister (the DP), either an iota shift or an existential shift is utilized, and the resulting formulae both yield proportional readings for the DP-internal structure; (iv) Maximize Presupposition; (v) the bare form is a competitor to the definite article, so the definite article is chosen over the bare form whenever its presuppositions are satisfied (given Maximize Presupposition); (vi) the choice of strategy for constructing  $C$  is constrained by the principle of No Overlapping Pluralities, so the pointwise strategy may not be used in a given domain unless it is guaranteed not to produce overlapping pluralities.

None of these assumptions is entirely new, so this is a relatively straightforward application of the movement analysis. Taken together, they imply that there are two possibilities: a DP-internal

structure, which comes with definiteness-marking and yields a proportional (or proportional-like) reading, an a DP-external structure in which the DP is not definite, yielding a relative reading.

Note that we have assumed here that definiteness-marking actually signals definiteness, in contrast to applications of the movement analysis to English, where the definite article is an expletive. This assumption receives cross-linguistic support from work on superlatives in Slavic languages. Based on what they call ‘DP-internal relative readings’, Pancheva & Tomaszewicz (2012) conclude that *-est* can move only in the absence of an overt definite determiner in Slavic. They argue furthermore that even in English, an overt definite determiner blocks *-est* movement.

## 5. Back to English

In English, the very same morphological pieces lead to the opposite pattern of interpretations:

(48) Gloria has visited the most continents. [relative,\*proportional]

(49) Gloria has visited most continents. [%relative, proportional]

How can this be? In this section we will argue that the movement analysis cannot easily be generalized to account for English, and will propose an alternative analysis for both languages building on a new treatment of the superlative (retaining some of the progress we made in the previous section).

Above, we concluded that a proportional reading, along with definiteness marking, always arises under the DP-internal structure, and that a relative reading, and no definiteness marking, arises under the DP-external structure. This does not leave room for definiteness-marking in conjunction with a relative reading, but we see this for both degree and amount superlatives in English and German, and even Swedish degree superlatives appear to have a relative interpretation, as we noted above in connection with example (29). What kind of system would allow for relative readings of definite-marked superlatives?

In the literature associated with the movement analysis, the following possibility is suggested: The definite article that appears with superlatives on a relative interpretation is not actually a marker of definiteness. At LF, the definite marker is deleted if the superlative has moved to a DP-external position. So the determiner is just an expletive in such cases. It is not made clear in this literature under what circumstances the definite article may be interpreted as indefinite. Another question that arises is why an indefinite article couldn’t be used instead, as Coppock & Beaver (2014) point out:

(50) Gloria climbed the/?a highest mountain.

Another possibility is to loosen the assumptions that give rise to the proportional reading when the superlative is DP-internal. One crucial assumption that we made use of above was the No Overlapping Pluralities principle. If we postulated that this did not apply in English, so that the ‘pointwise’ strategy could apply in English, could we account for the English pattern? The answer turns out to be no. The pointwise strategy does yield something like relative readings, but it would falsely predict “Gloria visited the most continents” to be true in the 2-2-1 scenario, where Gloria

and Fred visited the same two continents, and Sue visited only one. The two mountains climbed by Gloria and Fred being the largest plurality in the comparison class, the sentence is predicted to be true, and this prediction is incorrect. In general, the partition strategy falsely predicts that sentences with relative readings are true in a case where two members of the contrast set are associated with the same plurality via the relevant association relation, and this plurality is largest in the comparison class.<sup>3</sup> Call this the *first-place tie problem*.

Precisely in order to avoid this problem, Coppock & Beaver (2014) propose another way of analyzing the superlative morpheme. The solution relies on letting the superlative morpheme have direct access to the contrast set and the association relation, rather than taking the range of the association relation as the comparison class (as under the pointwise strategy). For a given member of the contrast set (e.g. Gloria), let us call the entities that this individual stands in the relevant relation to (e.g. visited) with its *associates* (e.g. the pluralities of continents visited by Gloria). On a relative reading, the members of the contrast set are indirectly compared through the measure of their associates. A superlative description holds of an entity if it is the associate of some member of the contrast set and it is greater according to the given measure (e.g. quantity, height, etc.) than all associates of all other members of the contrast set.

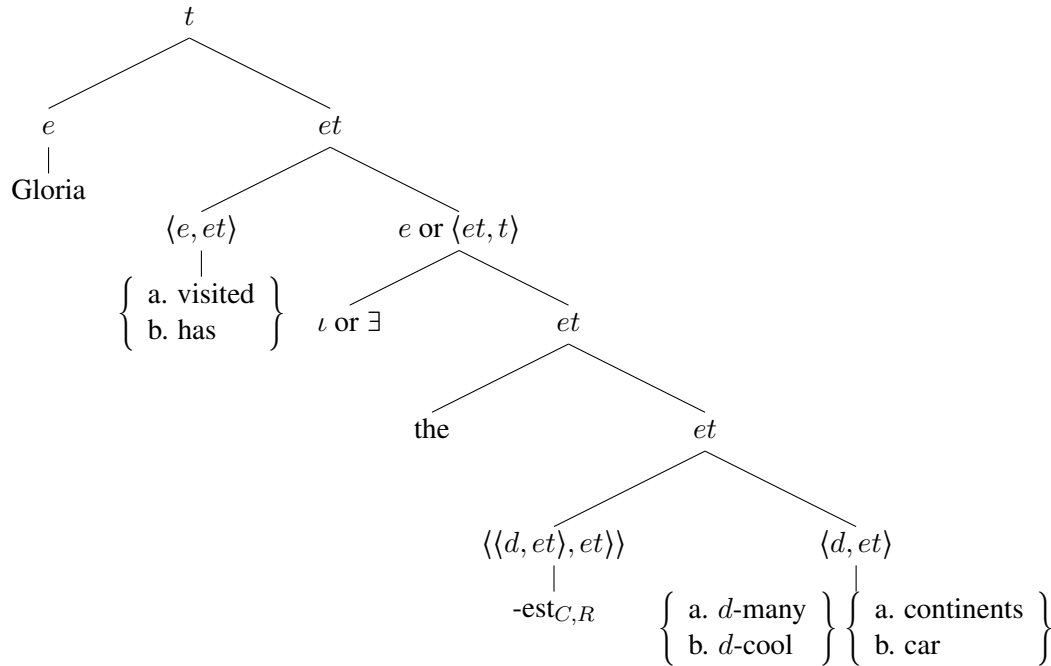
$$(51) \quad -est \rightsquigarrow \lambda C_{\langle e,t \rangle} \lambda R_{\langle e, \{e,t\} \rangle} \lambda G_{\langle d, et \rangle} \lambda x. \exists y [\partial [R(y, x) \wedge C(y)] \wedge \exists d [G(x, d) \wedge \forall y' \forall x' [[R(y', x') \wedge C(y') \wedge y \neq y'] \rightarrow \neg G(x', d)]]]$$

So a superlative morpheme denotes a function which takes four arguments: a contrast set  $C$ , an association relation  $R$ , a gradable predicate  $G$ , and a subject  $x$ . The subject  $x$  is presupposed to be an associate of some member of the contrast set. The superlative description holds of  $x$  if it is  $G$  to a degree  $d$  that is greater than the  $G$ -ness of any associate of any distinct member of the contrast set. If Gloria and Fred visited the same two continents, then this continent plurality will not satisfy the superlative description, because for any member of the contrast set  $y$  who visited it (Gloria or Fred), there will always be another member of the contrast set (Fred or Gloria, respectively) who visited an equally numerous one (namely that very continent plurality).

When the contrast set  $C$  and association relation  $R$  are saturated by context (pragmatically), the result is a uniquely characterizing predicate of type  $\langle e, t \rangle$ , which the definite article can combine with. This is shown simultaneously for the amount superlative *Gloria visited the most continents* and the degree superlative *Gloria has the coolest car*.

<sup>3</sup>This problem motivates Krasikova (2012) to use intensions rather than extensions in the comparison class, but this solution presents certain technical difficulties (Dylan Bumford, p.c.).

(52)



The definite description may then in principle undergo either an iota or an existential shift, although as Coppock & Beaver discuss, various pieces of evidence suggest that it undergoes an existential shift in the case of relative readings.

The association relation is assumed to be trivial in case of a proportional or absolute (non-relative) reading, so the entry is flexible enough to handle both types of readings. If  $R$  is a non-trivial relation such as ‘visit’ or ‘have’, then a relative reading emerges. If  $R$  is identity, then a non-relative (proportional or absolute) reading emerges. The result is equivalent to the more standard analysis of *-est*, as we can see from the following equivalence, where  $R$  is instantiated as identity:

$$\begin{aligned}
 (53) \quad &= \lambda G_{\langle d, et \rangle} \lambda x. \exists y [\partial[y = x \wedge C(y)] \wedge \exists d [G(x, d) \wedge \forall y' \forall x' [[y' = x' \wedge C(y') \wedge y \neq y'] \rightarrow \neg G(x', d)]]] \\
 &= \lambda G_{\langle d, et \rangle} \lambda x. [\partial[C(x)] \wedge \exists d [G(x, d) \wedge \forall x' [[C(x') \wedge x \neq x'] \rightarrow \neg G(x', d)]]]
 \end{aligned}$$

Since the superlative is always interpreted DP-internally under the present view, and we end up with an equivalent analysis of the superlative morpheme itself, the result is equivalent to the DP-internal structure under the analysis from the previous section. Thus if we make the further assumption that the contrast set  $C$  is subject to the No Overlapping Pluralities principle, then we predict proportional(-like) readings in case the association relation is identity, for the reasons outlined above. (When the association relation is trivial, the *contrast set* in the present analysis takes on the role of the *comparison class* in the more standard analysis.) In particular, we derive the result that a ‘more than half’ implication emerges in a domain like continent-visiting, but not in a domain like vote-receiving.

Whether  $R$  is non-trivial or identity, definiteness marking is predicted to appear when it is pragmatically saturated, because the superlative description is inherently unique. So the basic system

works well for German: definiteness-marking is always present, and compatible with both proportional and relative readings.

English and Swedish deviate from the German pattern in their own ways: In English, definite amount superlatives have no proportional interpretation, and in Swedish, definite amount superlatives have no relative interpretation. For English, we assume that the proportional reading of a definite amount superlative is blocked by bare *most*, which we take to be a separate lexical item, not generated compositionally via the superlative morpheme.

For Swedish, let us suppose that the association relation *R* cannot be saturated by context, and has to be filled in compositionally. For example, if the superlative expression is the object of a transitive verb, then the transitive verb is taken as an argument by the object. This process is incompatible with the presence of a definite article. If the definite article is present, then the association relation must already have been saturated, because the definite article expects an argument of type  $\langle e, t \rangle$ . The superlative description therefore must be bare if it is to combine compositionally with an association relation represented by a constituent of the sentence. This yields bare superlative descriptions with relative readings.

As pointed out by the Swedish Academy Grammar (Teleman et al. 1999, Vol. II, pp. 78-9), bare Swedish superlatives tend to occur where bare arguments are allowed more generally. Mass nouns and plurals in Swedish, as in English, don't require an article. Singular count nouns typically do, but there are some exceptions, and this correlates with the acceptability of superlatives.

- (54) a. \*Lindberg skrev bäst bok.  
'Lindberg wrote the best book.'
- b. \*Lindberg skrev bra bok.  
'Lindberg wrote (a) good book.'
- (55) a. Johan hade rödast näsa.  
'Johan had the reddest nose.'
- b. Johan hade röd näsa.  
'Johan has (a) red nose.'

This suggests that compositional saturation is limited to cases where bare arguments are independently licenced by the grammar.

Now, what about non-relative readings? Suppose that Swedish also has at its disposal a type-shifting operation that fills in the association relation as identity. If this applies, then the superlative description ends up as a uniquely characterizing predicate, and the definite article would then be required. As in English and German, a non-relative reading emerges, given an appropriately characterized No Overlapping Pluralities principle.

This system predicts only absolute readings (with a trivial association relation) for definite degree superlatives as in (29) (*Fredrik köpte det dyraste vinet* 'Fredrik bought the most expensive wine'). However, it is not entirely clear to us how one could distinguish between a genuinely relative reading and one in which the association relation is identity and the contrast set consists of wines

bought by Fredrik et al. So it is not clear what concrete facts, if any, the analysis gets wrong, given that the difference between a relative reading and an absolute reading is very subtle in the realm of degree superlatives.<sup>4</sup>

## 6. Summary

In Section 4, we argued that the movement analysis, in conjunction with a set of general assumptions (Maximize Presupposition, a ‘weak uniqueness’ analysis of the definite article, the bare form as a competitor to the definite form, and No Overlapping Pluralities), derives the Swedish pattern. The DP-internal structure yields definiteness-marking in conjunction with a proportional reading for amount superlatives, or an absolute reading for degree superlatives, and the DP-external structure yields a relative reading and no definiteness-marking. But as we argue in Section 5, the movement analysis does not account well for languages in which relative readings come with definiteness. Assuming that the definite article is vacuous is problematic, and merely loosening the No Overlapping Pluralities assumption leads to what we called the ‘first-place tie problem’.

Under the alternative view we presented in Section 5, the superlative morpheme is always interpreted DP-internally. Following Coppock & Beaver (2014), *-est* takes a contrast set and an association relation. When the association relation is identity, the result is equivalent to a standard analysis of *-est*, and a non-relative reading emerges. For amount superlatives, the result is a proportional(-like) reading, assuming No Overlapping Pluralities. When the association relation is non-trivial, we get a relative reading. If the association relation argument is saturated pragmatically (filled in by context), then the superlative description is a uniquely characterizing predicate, and hence definiteness-marking emerges (via Maximize Presupposition). This is what happens in English and German (except that English has bare *most*, which blocks a proportional reading for amount superlatives). Swedish only allows compositional saturation. This yields relative readings if the superlative morpheme combines with a non-trivial association relation, and then there can be no definiteness marking for type reasons. If a type-shift applies, saturating the association relation with identity, then a non-relative reading emerges along with definiteness-marking. Assuming that the contrast set is subject to No Overlapping Pluralities, we get a ‘more than half’ interpretation in those domains for which the pointwise strategy for determining the contrast set is not safe. (In the case of degree superlatives it is difficult to distinguish relative from non-relative readings, hence the appearance of relative readings with degree superlatives.)

What is common to all three languages is the analysis of definiteness, the superlative morpheme, the No Overlapping Pluralities principle, and Maximize Presupposition. The points on which the languages differ are: whether or not the language has a proportional determiner (English: yes, German and Swedish: no), and whether compositional saturation is used (English and German: no, Swedish: yes). Remaining puzzle: why bare *most* can have relative readings in English.

<sup>4</sup>We considered the possibility that the association relation can be saturated pragmatically if the compositional option isn’t allowed due to grammatical constraints on where bare nouns may appear. This would predict that relative readings would tend to arise in conjunction with definiteness marking in just those places where bare nouns are dispreferred. This prediction is not borne out, because we find “relative” readings to the same extent with plural and mass degree superlatives, and there bare arguments are allowed.

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# Use-conditional meaning and the semantics of pragmaticalization

Christopher Davis — University of the Ryukyus

Daniel Gutzmann — University of Frankfurt

**Abstract.** Pragmaticalization is the diachronic process by which propositional, truth-conditional semantic content develops into expressive, use-conditional content. Against the background of a multidimensional hybrid semantics, which employs both truth- and use-conditions to capture the entire conventional meaning of natural language expressions, this change can be understood as a diachronic type shift from truth-conditional to use-conditional meaning. We suggest that in general such shifts do not happen directly, but via an intermediate stage in which a 2-dimensional expression with mixed content is formed, which in a final stage may develop into pure use-conditional content. These concepts are applied to two cases of pragmaticalization: the antihonorific aspectual marker *shimau* in Japanese, and the expressive negation marker *neenu* in Miyara Yaeyaman, a related language of the Southern Ryukyus. As the second case study shows, pragmaticalization may also involve a process which we call pragmatic fission, in which a mixed expression splits into two separate items, leading to a lexical ambiguity between a plain truth-conditional expression and a purely use-conditional item.

**Keywords:** semantic change, pragmaticalization, expressives, use-conditional meaning, multidimensional semantics, expressive negation, Japanese, Ryukyuan, Miyara Yaeyaman

## 1. Grammaticalization and pragmaticalization

Grammaticalization, the development of grammatical categories out of lexical material, is one of the best-studied factors of syntactic and semantic change (see, amongst many others, (Diewald and Wischer 2002; Hopper and Traugott 2003; Lehmann 1995; Narrog and Heine 2011; Traugott and Heine 1991)). Diachronic studies in the last four decades have documented many examples of grammaticalization, and detected various common traits and paths along which expressions may be grammaticalized. Focusing just on the semantic aspects of grammaticalization, we can say that when an element grammaticalizes, its use is less and less determined by semantic factors, and more and more by the grammatical features of its linguistic context. A non-grammaticalized lexical expression is chosen purely on the basis of whether the denotation of that expression fits what the speaker wants to say, and in this sense, its use is entirely optional. In contrast, the use of a fully grammaticalized expression is completely determined by its syntactic context.

For instance, consider the difference between the lexical transitive verb *have* and the grammaticalized auxiliary verb *have*. Whether the speaker uses lexical *have* depends purely on what she intends to communicate and whether the semantics of *have* fit that intent. So, in addition to *have*, there are many possible items that could fill the gap in the following sentence:

- (1) I \_\_\_\_ a book on the history of Ryukyuan. *have, had, own, want, discovered, bought, ...*

The appearance of the auxiliary *have*, in contrast, is determined by the construction in which it is used. That is, while there are many possibilities for the gap in (1), *have* is the only one possible in the following example:

- (2) For a year, I \_\_\_\_ been searching for a book on the history of Ryukyuan.  
*have, had, \*own, \*am, \*will, ...*

In this respect we can say that, in general, grammaticalization semantically proceeds from semantics to grammar/syntax.

- (3) *Semantic change in grammaticalization*: propositional > grammatical meaning

The purpose of this rather lengthy introduction to the kind of semantic change that occurs with grammaticalization is to demonstrate how it differs from another kind of semantic change, which is referred to as *subjectification* (Traugott 1995) or *pragmaticalization* (Auer and Günthner 2005; Diewald 2011); in what follows we use the latter term.<sup>1</sup> According to Traugott, subjectification/pragmaticalization is characterized by “the development of a grammatically identifiable expression of speaker belief or speaker attitude to what is said.” (Traugott 1995, 32) We take a broader view that is not necessarily tied to beliefs or attitudes, and think of pragmaticalization as the diachronic process by which truth-conditional expressions develop into non-truth-conditional ones, like, for instance, expressives (see Auer and Günthner 2005). Expressions at the end of a pragmaticalization path lose their original truth-conditional meanings. Nevertheless, they continue to express conventional semantic content, which can be called *use-conditional* content, following Recanati (2004, 447). The main difference between the semantic change induced by grammaticalization and the one observable in pragmaticalization is thus that the former goes from the propositional “down” to the grammatical level, while the latter goes from the propositional “up” into expressive, use-conditional meaning (Traugott 2003, 633).

- (4) *Semantic change in pragmaticalization*: propositional > expressive meaning

There are many examples of expressions whose meanings have become pragmaticalized in the sense described above, although they are not always as systematically discussed under the umbrella of pragmaticalization as cases of grammaticalization are. As one of the most straightforward cases, consider the development of expressives (in the narrow sense) out of descriptive expressions. Cases of pejoration are among the best-known examples in this category.

- (5) descriptive nouns > expressives  
 a. *boor* ‘countryman, farmer’ > ‘crude person’ (Engl.)  
 b. *wīp* ‘woman’ > *weib* ‘woman.PEJ’ (Germ.)

<sup>1</sup>Note that these two concepts are not necessarily synonymous or even overlapping, depending on one’s definition. In addition, there is also some dispute about whether subjectification and pragmaticalization are at odds with grammaticalization or if they are subtypes of grammaticalization. See (Diewald 2011) for an explicit discussion, as well as the references therein.

Similar cases can be seen in the development of originally descriptive items, like *shit* or *damn*, into interjections or expressive adjectives without any descriptive meaning at all. In (6a) and (7a), both expressions, while arguably already having an expressive component (conventionalized or not), clearly contribute to truth-conditional content as well. In (6b) and (7b), these expressions have lost this descriptive component, and contribute only expressive, use-conditional meaning.<sup>2</sup>

- (6) a. Take care; there is a lot of dog **shit** on the street here.  
 b. **Shit**, I forgot my keys!
- (7) a. You are **damned** if you do, damned if you don't.  
 b. The **damn** car is not starting.

There are also cases of pragmaticalization that do not result in expressives in the narrow sense. For instance, modal particles in German, which encode non-truth-conditional, discourse oriented meaning, developed historically out of truth-conditional adjectives or adverbs (Abraham 1991; Autenrieth 2002, 2005; Diewald 2011; Hentschel 1986; Wegener 2002).

- (8) adverbs/adjectives > modal particles (Germ.)  
 a. *eben* 'flat' > 'just, exactly'  
 b. *schon* 'already' > 'somewhat'

Another category of expressions that often result from pragmaticalization is the broad category of discourse markers; sources for them lie in many different parts of speech, including adverbs, conjunction particles, or even entire matrix clauses (Gohl and Günthner 1999; Auer and Günthner 2005).

- (9) X > discourse markers (Germ.)  
 a. adverb > DM: *jedenfalls* 'anyway'  
 b. conjunction > DM: *und* 'and, so'  
 c. subjunction > DM: *weil, obwohl* 'although'  
 d. matrix clause > DM: *Ich mein* 'I mean'

The goal of this paper is to analyze pragmaticalization from a formal semantic point of view. In order to do so, we connect the phenomenon of pragmaticalization to recent developments in the analysis of expressive content using multidimensional semantics (Potts 2005; McCready 2010; Gutzmann 2011, 2015; a.o). We model the change from truth-conditional to non-truth-conditional meaning, as illustrated in (4) and instantiated by the examples above, in a type-based, hybrid semantic framework. The basic idea is that the observed shifts find a natural formalization in terms of a diachronic semantic type shift. That is, an original expression that is typed truth-conditionally comes to have, via pragmaticalization, a use-conditional type. This not only captures the semantic change during pragmaticalization, but predicts many of the special properties of the resulting pragmaticalized elements, like their often peripheral position, their scope, and their resistance to

<sup>2</sup>Here, and throughout the paper, we use **boldface** to highlight relevant aspects of example sentences.

being targeted by negation. We further argue that the path from truth-conditional to use-conditional meaning does not generally happen directly, but proceeds through an intermediate stage in which the item functions as a *mixed expression*, contributing both truth-conditional and use-conditional meaning simultaneously. This intermediate stage in the pragmaticalization path relies on and provides indirect support for the existence of mixed use-conditional items (Gutzmann 2011; McCready 2010; *pace* (Potts 2005)).

In the [next section](#) we briefly sketch the formal ideas that our analysis of pragmaticalization relies on, without going into the technical details of multidimensional semantics.<sup>3</sup> With the formal framework in place, we suggest in Section 3 how pragmaticalization may be construed as a diachronic type shift involving a mixed use-conditional item as an intermediate stage. We then present two case studies of pragmaticalization in Section 4 and Section 5. First, we look at the development of the “anti-honorific” *shimau* construction in Japanese, which we argue exemplifies the second stage of pragmaticalization discussed above, in which an original truth-conditional expression becomes a mixed expression, contributing both its original truth-conditional meaning and a pragmaticalized use-conditional meaning simultaneously. We then discuss the case of *expressive negation* in Miyara Yaeyaman, which instantiates a pragmaticalization path that we label *pragmatic fission*: instead of developing into a purely expressive item, the intermediate mixed expression splits into two separate items, one truth-conditional and the other use-conditional, thereby leading to a case of lexical ambiguity. We then show that pragmaticalization and pragmatic fission can target just one part of an expression’s truth-conditional content, leading to a mixed expression rather than a pure expressive at the end of the pragmaticalization path.

## 2. Hybrid semantics

The core ideas of the multidimensional semantic framework we employ rest on Kaplan’s (1999) influential underground manuscript on the meaning of *ouch* and *oops*: “For certain expressions of natural language, a correct Semantic Theory would state *rules of use* rather than something like a concept expressed.” (Kaplan 1999, 6, our emphasis). However, in contrast to more radical theories under the umbrella slogan of “meaning as use”, his idea is to use a use-conditional perspective to *supplement* truth-conditional semantics – not to replace it entirely – in order to extend formal semantic methods to expressions and meaning aspects that, from a purely truth-conditional perspective, are considered to fall outside the scope of formal semantics. For illustration of the kind of meaning aspects that can be studied within such an extended semantic theory, consider the following minimal pair (Frege 1979, 140).

- (10)    a.    This **dog** howled the whole night.  
           b.    This **cur** howled the whole night.

From a purely truth-conditional perspective, (10a) and (10b) have the same semantic content, as both are true in just the same situations. However, (10b) expresses a certain kind of disdain, which

<sup>3</sup>For a recent in-depth discussion of multidimensional semantics, see Gutzmann (2015).

is absent from (10a) and which is not captured by simply stating the sentence's truth-conditions. However — and this an important motivation for Kaplan's suggestions — the negative attitude in (10b) is associated with the expression *cur* by *linguistic convention*, and hence should be regarded as a *semantic* aspect of meaning instead of a pragmatic one. In order to capture such aspects of meaning, we enhance the truth-conditional perspective by adding an additional layer of use-conditions to the semantics. In order to capture the entire conventional (that is, semantic) meaning of (10b), we need to state both its truth- and use-conditions.

- (11) a. “The cur howled” is **true** if the dog howled.  
 b. “The cur howled” is **feliculously used** if the speaker feels negatively about the dog.

We call expressions like *cur* that contribute simultaneously to both meaning dimensions *hybrid* expressions. Besides lexically hybrid expressions like *cur*, a complex expression may be compositionally hybrid, as shown in the following variant of (10b), in which the negative attitude is conveyed by the expressive adjective *damn* instead of by *cur*.

- (12) This **damn** dog howled the whole night.

Hybrid semantic expressions like those described above require a semantic framework that employs both use- and truth-conditions, a semantics that we accordingly call hybrid semantics. Within such a semantics, natural language sentences do not just receive a truth-value (true or false, 1 or 0), but also a use-value (*felicitous* or *infelicitous*, for which we use the check mark ✓ and the lightning bolt ⚡, respectively).

- (13) Hybrid semantics:  $\langle 1, \checkmark \rangle$   $\langle 1, \text{⚡} \rangle$   $\langle 0, \checkmark \rangle$   $\langle 0, \text{⚡} \rangle$

Now, while introducing these new use-values is itself only a superficial formal device, it allows us to use the standard tools of formal semantics to give proper denotations for use-conditional content in a manner parallel to that of truth-conditional content. To see how, consider a standard truth-conditional clause alongside its use-conditional analog:

- |   |  |
|---|--|
| <p>(T) <i>Truth-conditions</i></p> <p><sub>1</sub> “Snow is white”</p> <p><sub>2</sub> is <b>true</b>,</p> <p><sub>3</sub> iff snow is white.</p> | <p>(U) <i>Use-conditions</i></p> <p><sub>1</sub> “Oops!”</p> <p><sub>2</sub> is <b>feliculously used</b>,</p> <p><sub>3</sub> iff the speaker observed a minor mishap.</p> |
|---|--|

In both conditions, a natural language expression, in the first line, is connected with a condition in the third line, which is supposed to capture its meaning. What differs is the kind of connection — the “mode of expression”, as Kaplan calls it. In (T), the connection is established by the notion of truth, while in (U) it is felicitous use that connects the expression and the condition. The conditions in both (T) and (U) can either be the case or not, which enables us to extend the standard formal tools developed for the evaluation of truth-conditional content (T) to the evaluation of use-conditional content (U). That is, just as (T) leads us to think of the proposition expressed by “Snow is white” as the set of *worlds* in which that sentence true, we can construe the use-conditional proposition expressed by “Oops!” as the set of *contexts* in which the speaker observed a minor

mishap (Kaplan 1999, 17). Using superscripts  $t$  and  $u$  to distinguish truth-conditional (tc) from use-conditional (uc) content, we can state the semantics to which (T) and (U) above lead us more precisely as follows:

- (14) *tc-content: set of worlds*
- a.  $\llbracket \text{Snow is white} \rrbracket^t = \{w: \text{snow is white in } w\}$
  - b.  $\llbracket \text{Snow is white} \rrbracket^t = 1$ , if  $w_{@} \in \{w: \text{snow is white in } w\}$
- (15) *uc-content: set of contexts*
- a.  $\llbracket \text{Oops} \rrbracket^u = \{c: c_S \text{ observed a minor mishap in } c_w\}$
  - b.  $\llbracket \text{Oops} \rrbracket^u = \checkmark$ , if  $c_{@} \in \{c: c_S \text{ observed a minor mishap in } c_w\}$

These basic ideas of hybrid semantics are rather independent of the particular formalization used, and can be implemented in a variety of frameworks. A very influential approach is the type-driven system  $\mathcal{L}_{CI}$  developed by Potts (2005), which however has been argued to be too restrictive to handle certain varieties of use-conditional content. Most importantly, it does not allow for *mixed* use-conditional items (UCIs), expressions that lexically encode both truth- and use-conditional meaning, as seen with the word *cur* in (10b). Such mixed UCIs are captured by other systems that extend the original  $\mathcal{L}_{CI}$  system (Gutzmann 2011; McCready 2010). As we argue below, such mixed UCIs seem to play an important role in pragmaticalization, as they provide an intermediate stage of semantic change between purely truth-conditional and a purely use-conditional items. Although for our purposes a system like that of McCready (2010) or Gutzmann (2011) will suffice, these extended systems still have problems regarding quantificational constructions and constructions invoking abstraction, which however can be overcome by more radical modifications (Gutzmann 2015). We leave aside these formal details, as we do not dive too deeply into question about the actual semantic composition of use-conditional content. We argue only that we need a system that allows for mixed UCI content, and propose lexical entries with mixed content; the formal details of the proposal can be modified to suit the particular formal system that one is working with.

In all systems in the  $\mathcal{L}_{CI}$ -tradition, the distinction between truth- and use-conditional content is implemented by a distinction in semantic types. The core idea is to have one additional basic type which denotes use-conditions, analogous to the truth-conditional type  $t$  (or, more precisely, type  $\langle s, t \rangle$ , the type of propositions). We use type  $u$  as the type for use-conditional content. From this basic type, we can build complex use-conditional types in the usual recursive manner, the important restriction being that use-conditional types can only be in the output of a complex type. The only other device we need for the purposes of this paper is the diamond operator, which is used to build mixed UCIs. For instance, we can translate *cur* as follows, where **bad** denotes a negative speaker attitude.

- (16)  $\llbracket cur \rrbracket = \mathbf{dog} : \langle e, t \rangle \blacklozenge \mathbf{bad} : \langle e, u \rangle$

Even though there is much more to be said about how the compositional system, we will leave it with these short remarks. Our concern in this paper is with the lexical semantics of certain



expressions and how their semantics change over time. For this purpose, it is sufficient that lexically hybrid expressions are translated into diamond-objects like (16). For an overview of Potts's (2005)  $\mathcal{L}_{CI}$  and its extensions, see Chapter 3 of Gutzmann 2015.

### 3. Pragmaticalization in hybrid semantics

Connecting the considerations from the previous section back to the phenomenon of pragmaticalization, our thesis is that, from the point of view of semantic change, pragmaticalization can be understood as a diachronic type-shift from truth-conditional to use-conditional content. Consider again the case of the English pejorative *boor*, which developed from a truth-conditional expression denoting farmers to a use-conditional pejorative expressing a negative evaluation of the person in question as being a crude person. We argue that the original expression had a simple truth-conditional type, which then shifted to a use-conditional type in the pragmaticalized version, basically by switching the output type  $t$  to  $u$ .

(17) *Pejoration as a semantic typeshift*

$$\mathbf{boor} : \langle e, t \rangle > \mathbf{boor}_{ex} : \langle e, u \rangle$$

We use  $\mathbf{boor}_{ex}$  here as a substitute for the pragmaticalized content, i.e. the negative attitude. The pragmaticalization path in (17), going from a truth- to a use-conditional predicate, is an instantiation of what we think is the most simple kind of type shift to be found in pragmaticalization, namely those type shifts in which the output type changes from  $t$  to  $u$ , the rest of the type remaining unaffected.

(18) *Most simple pragmaticalization pattern*

$$A : \langle \sigma, t \rangle > A_{ex} : \langle \sigma, u \rangle$$

However, contrary to what such a schematization may suggest, such diachronic type shifts do not happen suddenly. Instead, they evolve through complex processes and in specific contexts that support such changes (Traugott 2003). Typically, the pejorative character of expressions like that in (17) starts out as a conversational implicature that is derived in specific contexts and is mostly likely driven by extra-linguistic factors. For example, in a social context in which farmers were considered to be “uncivilized”, referring to someone as a *boor* would invite the inference that that person is also crude. Given a sufficiently high frequency, these inferences may be conventionalized and become part of an expression's lexical content, so that they do not need to be derived on conversational grounds anymore. That is, a conversational implicature that is generated with great enough regularity can become conventionalized, giving rise to a conventional implicature. The original 1-dimensional expression generating a conversational implicature gets conventionalized into a 2-dimensional, mixed UCI, with the conventionalized implicature encoded as use-conditional content. At an optional final stage, the original meaning may then be bleached, so that only the negative use-conditional component remains from the originally descriptive predicate, and we end up with what can be called an expletive UCI (Gutzmann 2013). In the case of *boor*, the second stage would be an expression that continues to truth-conditionally denote farmers, while simultaneously conveying the speaker's negative attitude, while at the third stage it loses its original

connection to farmers completely:

(19) *Two-step pragmaticalization of boor*

$$\mathbf{boor} : \langle e, t \rangle > \mathbf{boor} : \langle e, t \rangle \blacklozenge \mathbf{boor}_{ex} : \langle e, u \rangle > \mathbf{boor}_{ex} : \langle e, u \rangle$$

From this simple example, we extract the following schematic pattern that characterizes in formal terms the semantic change that happens during pragmaticalization, where  $A$  is some truth-conditional content and  $A_{ex}$  is the derived use-conditional content.

(20)  $A > A \blacklozenge A_{ex} > A_{ex}$

Unsurprisingly, this two-step pragmaticalization pattern is just a specific instance of the so-called “overlap model” proposed for grammaticalization (Heine 2003, 590).

(21) *Two-step grammaticalization*

$$A > A, B > B$$

As the case studies in the next section will reveal, there is in addition to the straightforward semantic bleaching process sketched above another possibility for how pragmaticalization may proceed after the second stage of a mixed UCI is reached. Instead of stripping away the truth-conditional content to leave a purely use-conditional expression at stage three, the expression may instead split into two separate expressions. One of these would be the purely use-conditional expletive UCI that the pattern in (20) delivers, whereas the other would be the plain truth-conditional expression that started the entire process. We call this process *pragmatic fission*:

(22) *Pragmatic fission*

$$A > A \blacklozenge A_{ex} > \begin{cases} A \\ A_{ex} \end{cases}$$

Instead of creating a single purely use-conditional item, pragmatic fission leads to a lexical ambiguity that restores the original, truth-conditional component alongside the new, pragmaticalized expression. We will also see that in some cases pragmatic fission targets only one part of the truth-conditional content of the original expression, giving rise to what we call partial pragmatic fission. This may be schematized as follow.

(23) *Partial pragmatic fission*

$$(A \& B) > (A \& B) \blacklozenge B_{ex} > \begin{cases} (A \& B) \\ A \blacklozenge B_{ex} \end{cases}$$

In the following two sections we apply the ideas developed in this and the previous section to two case studies from Japanese and Ryukyuan. In Japanese, the verbal auxiliary *shimau* serves to simultaneously express completive aspectual semantics and a negative evaluative stance on the part of the speaker. This construction, we argue, represents Stage 2 of the pragmaticalization path described above, in which a conversational implicature arising from the construction’s original aspec-



tual meaning has conventionalized, so that *shimau* simultaneously contributes a truth-conditional aspectual meaning and a use-conditional negative evaluative meaning.

The second case study comes from Yaeyama Ryukyuan, where the negative morpheme *neenu* can contribute either logical or pragmatic negation to a verb. We argue that this ambiguity results from pragmatic fission, in which a Stage 2 morpheme splits at Stage 3, giving rise to an ambiguous morpheme expressing *either* truth-conditional content *or* use-conditional content, but not both simultaneously. Like Japanese *shimau*, Ryukyuan *neenu* contributes truth-conditional aspectual content in addition to negativity; pragmatic negation in Ryukyuan is thus also a case of mixed content.

#### 4. Case Study 1: Japanese *shimau* / *chimau*

We first look at the Japanese completive aspect construction *V-te shimau*, in which the infinitival *te* form of the verb combines with the aspectual auxiliary *shimau*. As discussed extensively by [Strauss \(2003\)](#), this construction encodes both completive aspect and an evaluative stance on the part of the speaker, a dual semantic contribution it shares with similar constructions in other languages like Korean. The *V-te shimau* construction can undergo one of at least two phonological reductions, resulting in the forms *V-chau* or *V-chimau*. The latter is analyzed by [Potts and Kawahara \(2004\)](#) as an “anti-honorific” expressive morpheme, as exemplified in the following example:

- (24) Example of “anti-honorific” *chimau*: (Potts and Kawahara, 2004, 254)  
 John-wa [Mary-ga nesugoshi-**chim**at-ta] -koto-o shitteiru.  
*John-TOP Mary-NOM oversleep-antihon-PAST -fact-ACC know*  
 a. ‘John knows that Mary overslept.’  
 b. ‘It sucks that Mary overslept.’ [antihonorification]

[Potts and Kawahara \(2004, 258\)](#) give the following disjunctive characterization of *chimau*’s meaning:

- (25) *Two meaning aspects of chimau*:  
*chimau* attaches to a verb stem, and  
 a. emphasizes the completion of the action, or  
 b. expresses the speaker’s displeasure with the action.

The first of these meanings expresses a kind of completive aspect, while the second expresses something about the speaker’s evaluative stance. According to [Potts and Kawahara \(2004\)](#), the second of these meanings is *expressive*, or use-conditional in our terms. This is supported by examples like (24), where the evaluative meaning contributed by *chimau* is interpreted relative to the speaker, despite being embedded under ‘John knows’. The antihonorific version of *chimau*, according to Potts and Kawahara, leaves the truth-conditional content of the resulting sentence unchanged, as illustrated by the following examples and their English translations ([Potts and Kawahara, 2004, 258](#)):

- (26) a. nesugoshi-ta ⇒ nesugoshi-**chimat**-ta  
           oversleep-PAST   oversleep-**antihon**-PAST  
           ‘I overslept’       ‘I overslept, which sucks.’  
       b. mi-rare-ta       ⇒ mi-rare-**chimat**-ta  
           see-PASS-PAST   see-PASS-**antihon**-PAST  
           ‘I was seen’       ‘I was seen.’ (‘I wasn’t supposed to be seen.’)

Although we follow Potts and Kawahara in treating the evaluative meaning component of *shimau* / *chimau* as expressive/use-conditional, we argue that it simultaneously contributes truth-conditional aspectual meaning. The disjunctive characterization of *chimau*’s semantics in (25) is forced by the fact that Potts and Kawahara analyze the morpheme using the expressive logic of Potts (2005), which as described above is designed in such a way that mixed content is not allowed. Thus, a morpheme like *chimau* can *either* contribute truth-conditional aspectual meaning (25a) *or* expressive meaning (25b), but not both simultaneously. We think, however, that this is incorrect, and that in fact *chimau* and its unreduced counterpart *shimau* can be seen to contribute to both meaning dimensions simultaneously.

Strauss cites Soga (1983) in labeling *shimau* as a marker of “emotive terminative aspect”, an evocative label that simultaneously references the construction’s contribution to aspectual and expressive meaning dimensions. This double contribution of *shimau* is illustrated by the following example, from Makino and Tsutsui (1986) as cited by Strauss (2003, 661) (transcription and gloss modified from the original):

- (27) koko-ni oiteoku-to jimu-ga tabe-te shimau yo.  
       here-LOC put-if Jim-NOM eat-TE SHIMAU PRT  
       ‘If you leave it here, Jim will eat it (up).’

Describing the dual semantic contribution of *shimau* in the above sentence, Strauss says that it “expresses the idea that if the food item in question is left unattended, Jim will eat it all and nothing will be left of it — an outcome that would likely engender regret, disappointment, or even relief, depending upon the context” (Strauss, 2003, 661). In this example, then, it seems like *shimau* contributes both a completive aspect and an expressive meaning simultaneously. Strauss’s description also suggests that it is the underlying completive aspect meaning (expressing a finished action that cannot be undone) that leads to an implicature about the speaker’s evaluative stance toward the situation (regret, disappointment, etc). Following this intuition, we argue that the basic meaning of *shimau* is historically aspectual; this basic aspectual meaning generates an implicature about the speaker’s evaluative stance. Over time, this implicature has become conventionalized, giving rise to an expression that simultaneously contributes a truth-conditional aspectual meaning (corresponding to the meaning in (25a)) and a use-conditional evaluative/expressive meaning (corresponding to the meaning in (25b)).

While *shimau/chimau* expresses negative speaker evaluation, it continues to express completive aspect as well. It is thus a hybrid expression, representing Stage 2 of the pragmaticalization process:

- (28) **Stage 1:**  $\llbracket \text{shimau}_1 \rrbracket = \lambda p \lambda e. p(e) \ \& \ \mathbf{CMPL}(e) : \langle \langle s, t \rangle, \langle s, t \rangle \rangle$   
**Stage 2:**  $\llbracket \text{shimau}_2 \rrbracket = \lambda p \lambda e. p(e) \ \& \ \mathbf{CMPL}(e) : \langle \langle s, t \rangle, \langle s, t \rangle \rangle \ \blacklozenge \ \lambda p. \mathbf{EVAL}(p) : \langle \langle s, t \rangle, u \rangle$

Stage 2 represents a situation where a pervasive conversational implicature (here, negative speaker sentiment) generated by the truth-conditional meaning of the Stage 1 morpheme has become conventionalized, but has not replaced the original truth-conditional content of the expression.<sup>4</sup> In the next case study, we discuss a construction in Yaeyama Ryukyuan, a sister language of Japanese, in which a similarly mixed-content item has undergone what we call *pragmatic fission*, leading to an ambiguity between a truth-conditional and use-conditional meaning.

## 5. Case Study 2: Pragmatic Negation *neenu* in Yaeyama Ryukyuan

The Ryukyuan languages (ShimojiPellard:2010) exhibit a diachronic process whereby a morpheme originally encoding *logical* negation has come to be used in a particular construction to express instead a kind of *pragmatic* negation. The data in this paper are based on original fieldwork on the Miyara dialect of Yaeyaman (henceforth Miyaran), a Southern Ryukyuan language spoken on the island of Ishigaki in Okinawa Prefecture, Japan (English-language descriptive overviews of Miyaran can be found in Izuyama 2003 and Davis and Lau 2015).

In Miyaran, the negative morpheme *neenu* has a basic function as the negative form of the inanimate existential verb *aru*. It is also used as a marker of logical negation in certain constructions, for example when added to an adjectival predicate:

- (29) bada=du      ncc-i-ru,      jaa-ha-**neenu**      =saa.  
*stomach*=FOC *fill*-PROG-PRS *hungry*-ADJ-NEG =SFP  
 ‘My stomach’s full, I’m not hungry.’

In these environments, *neenu* is used to signal logical, truth-conditional negation. But in the construction illustrated by the sentence below, the logical negation associated with the morpheme can be semantically bleached, in which case it instead indicates a negative attitude or assessment on the part of the speaker toward the situation being described:

- (30) iz-i      neenu.  
*say*-INF NEG  
 a. ‘(I) haven’t said anything.’  
 b. ‘(I) went and said something (which I shouldn’t have).’

In the construction illustrated above, *neenu* appears after the infinitival form of the verb stem, resulting in the verbal complex *V-i neenu*. The resulting predicate is ambiguous: It can indicate logical negation, i.e. ‘has not V-ed’, or it can indicate a negative attitude about something that has happened, i.e. ‘has V-ed (which sucks)’. The two meanings of *neenu* can be disambiguated with

<sup>4</sup>In fact, Strauss discusses cases where the evaluative contribution of *shimau* is not negative, but positive, suggesting that, as in the case of other well-studied expressives like English *damn*, the valency or polarity of the use-conditional is highly context-dependent.

polarity sensitive particles:

- (31) a. meeda iz-i neenu.  
           yet say-INF NEG  
           ‘(I) haven’t said (anything) yet.’  
       b. kisa iz-i neenu.  
           just.now say-INF NEG  
           ‘(I) went and said it just now.’

NPIs like *meeda* ‘yet’ disambiguate toward the logical negation meaning (31a), while PPIs like *kisa* ‘just now’ disambiguate toward the pragmatic negation meaning (31b).

The ambiguity of *neenu* can be captured by positing two homophonous lexical entries, truth-conditional *neenu*<sub>log</sub> and use-conditional *neenu*<sub>exp</sub>. *neenu*<sub>log</sub> encodes logical negation, targeting the truth-conditional content of the utterance, while *neenu*<sub>exp</sub> has no effect on the truth conditions of the utterance. Instead, *neenu*<sub>exp</sub> expresses a sense of regret, consternation, or some other negative emotion on the part of the speaker toward the proposition being expressed, very similar to the use-conditional contribution of Japanese *shimau/chimau*. In fact, when Yaeyaman speakers are asked to translate constructions with *neenu*<sub>exp</sub> into Japanese, they often use *shimau*, and vice versa when translating sentences with *shimau* into Yaeyaman. As a first pass approximation, then, we can assume that the use-conditional content of *neenu*<sub>exp</sub> is the same as that of *shimau*. Unlike *shimau*, however, the truth-conditional and use-conditional meaning dimensions are not expressed simultaneously.

- (32) a.  $\llbracket neenu_{log} \rrbracket = \lambda p. \mathbf{NEG}(p) : \langle \langle s, t \rangle, \langle s, t \rangle \rangle$   
       b.  $\llbracket neenu_{exp} \rrbracket = \lambda p. \mathbf{PRAGNEG}(p) : \langle \langle s, t \rangle, u \rangle$

*neenu*<sub>log</sub> is of type  $\langle \langle s, t \rangle, \langle s, t \rangle \rangle$ , while *neenu*<sub>exp</sub> is of type  $\langle \langle s, t \rangle, u \rangle$ . We argue that the expressive negation marker *neenu*<sub>exp</sub> derives historically from the logical negation marker *neenu*<sub>log</sub>, exemplifying the pragmaticalization pattern in which a truth-conditional expression diachronically shifts to a use-conditional expression. More specifically, a function from truth-conditions into truth-conditions shifts into a function from truth- into use-conditions.

- (33)  $neenu_{log} > neenu_{exp}$

This pragmaticalization pattern makes logical negation *neenu*<sub>log</sub> the basic and historically older interpretation. Evidence for this comes from the fact that *neenu*<sub>log</sub> has a broad distribution in Miyara Yaeyaman, outside the construction discussed here. In all other contexts where it appears, *neenu* consistently negates the truth-conditional content of the sentence without contributing any conventionalized negative attitude toward the proposition, i.e. it is interpreted similarly to *neenu*<sub>log</sub>. The original meaning (logical negation) is preserved in all contexts, while the pragmaticalized meaning is found in only a subset thereof.

The pragmaticalization exhibited by *neenu* can be attributed to a strong cross-linguistic tendency

for expressions of logical negation to be associated pragmatically with negative attitudes on the part of the speaker, a fact documented in detail by Potts (2011). As Potts documents on the basis of cross-linguistic corpus data, words and morphemes encoding logical negation have usage patterns associated consistently with negative evaluative contexts. We take it that these usage patterns register initially as a kind of conversational implicature, where use of negative morphology tends to trigger an implicature of negative attitude. This implicature can subsequently be conventionalized, for particular morphemes in particular constructions (here, *neenu*), leading to a hybrid expression. Finally, the original truth-conditional content can be bleached, leaving a pure expression of “pragmatic negation” freed from its original logical source.

The pragmaticalization path we posit for *neenu* is one that we label *pragmatic fission*.

(34) Pragmatic Fission of *neenu*

**Stage 1:** Original morpheme with only truth-conditional content.

**Stage 2:** In a particular construction, an implicature is conventionalized, leading to a hybrid expression.

**Stage 3:** The hybrid expression splits into two homophonous expressions, one encoding only the original truth-conditional content, the other encoding only the usage-conditional content.

For *neenu*, the synchronic grammar represents Stage 3, with truth-conditional *neenu*<sub>log</sub> and usage-conditional *neenu*<sub>exp</sub> fissioning from Stage 2 hybrid *neenu*<sub>2</sub>.

(35) **Stage 1:**  $\llbracket neenu_1 \rrbracket = \lambda p. \mathbf{NEG}(p) : \langle \langle s, t \rangle, \langle s, t \rangle \rangle$

**Stage 2:**  $\llbracket neenu_2 \rrbracket = \lambda p. \mathbf{NEG}(p) : \langle \langle s, t \rangle, \langle s, t \rangle \rangle \blacklozenge \lambda p. \mathbf{PRAGNEG}(p) : \langle \langle s, t \rangle, u \rangle$

**Stage 3:**  $\llbracket neenu_{log} \rrbracket = \lambda p. \mathbf{NEG}(p) : \langle \langle s, t \rangle, \langle s, t \rangle \rangle$

$\llbracket neenu_{exp} \rrbracket = \lambda p. \mathbf{PRAGNEG}(p) : \langle \langle s, t \rangle, u \rangle$

In the discussion of *neenu* presented thus far, we have ignored the fact that in addition to negation (logical or pragmatic), the morpheme also encodes a kind of aspectual semantics, similar to that seen with *shimau*. The verbal construction *V neenu* is the negative form of a construction encoding a kind of resultative or stative aspectual semantics, saying that some current state holds that results from an earlier event described by the verb. Following the analysis in Davis and Lau (2015), we call this the *resultative* verb form. The morpheme encoding this aspectual semantics is *-eeru*:

(36) *izj-eeru*.

*say-RES*

‘(I am) in a **state resulting from** an event of saying (something).’

The semantics of *-eeru* can be approximated as follows, where  $\mathbf{RES}(e, e')$  is true if  $e$  is an eventuality resulting from eventuality  $e'$ :

$$(37) \quad \llbracket eeru \rrbracket = \lambda p. \lambda e. \exists e' [p(e') \ \& \ \mathbf{RES}(e, e')]$$

We propose that  $neenu_{\log}$  is the negative counterpart of the resultative aspect marker *-eeru*. That is, it encodes both the resultative semantics of *-eeru* as well as logical negation (which scopes over this aspectual semantics). The use of  $neenu_{\log}$  contributes the same aspectual semantics as *-eeru*, and then negates the resulting proposition:

$$(38) \quad \begin{array}{l} \text{izi } neenu. \\ \text{say RES.NEG} \\ \text{'(I am) not in a state resulting from an event of saying (something).'} \end{array}$$

The semantics of  $neenu_{\log}$  incorporating both aspect and negation can be approximated as follows:

$$(39) \quad \llbracket neenu_{\log} \rrbracket = \lambda p \lambda e. \mathbf{NEG}(\exists e' [p(e') \ \& \ \mathbf{RES}(e, e')])$$

The pragmaticalized  $neenu_{\exp}$  loses the truth-conditional negative meaning component, but we propose that it contributes the same resultative aspectual semantics as both  $neenu_{\log}$  and *-eeru*:

$$(40) \quad \begin{array}{l} \text{izi } neenu. \\ \text{say RES.NEG} \\ \text{'(I am) in a state resulting from an event of saying (something) (which sucks).'} \end{array}$$

This can be modeled by a denotation with both truth-conditional aspectual semantics and use-conditional negative semantics:

$$(41) \quad \llbracket neenu_{\exp} \rrbracket = \lambda p. \lambda e. \exists e' [p(e') \ \& \ \mathbf{RES}(e, e')] \ \blacklozenge \ \lambda p. \mathbf{PRAGNEG}(p)$$

There are thus actually *two* components to the meaning of  $neenu_{\log}$ : resultative aspect (**RES**) and negation (**NEG**). In the pragmaticalized  $neenu_{\exp}$ , truth-conditional **NEG** has shifted to use-conditional **PRAGNEG**, leaving the resultative aspectual semantics **RES** behind in the truth-conditional dimension.  $neenu_{\exp}$  is thus a hybrid expression, resulting from a partial pragmaticalization of *neenu*. The synchronic grammar represents Stage 3 of the following pragmaticalization path:

$$(42) \quad \begin{array}{ll} \text{Stage 1:} & \llbracket neenu_1 \rrbracket = \lambda p \lambda e. \mathbf{NEG} \exists e' [p(e') \ \& \ \mathbf{RES}(e, e')] \\ \text{Stage 2:} & \llbracket neenu_2 \rrbracket = \lambda p \lambda e. \mathbf{NEG} \exists e' [p(e') \ \& \ \mathbf{RES}(e, e')] \ \blacklozenge \ \lambda p. \mathbf{PRAGNEG}(p) \\ \text{Stage 3:} & \llbracket neenu_{\log} \rrbracket = \lambda p \lambda e. \mathbf{NEG} \exists e' [p(e') \ \& \ \mathbf{RES}(e, e')] \\ & \llbracket neenu_{\exp} \rrbracket = \lambda p \lambda e. \quad \exists e' [p(e') \ \& \ \mathbf{RES}(e, e')] \ \blacklozenge \ \lambda p. \mathbf{PRAGNEG}(p) \end{array}$$

## 6. Conclusion and open questions

In the preceding sections we have argued for a three-stage model of pragmaticalization, in which expressions of mixed truth-conditional and use-conditional types serve as a bridge between original descriptive expressions and their semantically bleached, pragmaticalized counterparts. In Stage 1 of the process, we have an expression with a purely descriptive, truth-conditional semantics

which, for extra-linguistic reasons, tends to trigger a conversational implicature when used. Stage 2 represents a situation where, due to the consistency of this implicature, it is conventionalized, becoming part of the conventional semantic content of the original expression. In effect, the move from Stage 1 to Stage 2 represents a shift from a conversational to a conventional implicature. The possibility of mixed expressions in the lexicon allows for this shift to happen “non-destructively”, leaving the original truth-conditional content of the expression intact.<sup>5</sup>

Once the original pragmatic content has been conventionalized into the use-conditional meaning dimension, the conditions are right for semantic bleaching of the original truth-conditional content to take place, moving us from Stage 2 to Stage 3. Note that by deleting the original truth-conditional content of the utterance, this shift removes the original trigger for the implicature whose conventionalization generated the use-conditional content of the expression in the first place. This stage in effect deletes the source of the implicature, leaving only the implicature behind.

This basic framework helps to make sense of pragmaticalization, and in particular the existence of mixed UCIs provides a bridge between the two ends of the pragmaticalization path. There are of course many questions left to resolve within this general approach. For example, what are the contexts that enable and facilitate such diachronic type shifts? What are (im)possible pragmaticalization paths? How exactly does conventionalization of an implicature happen, and how would we as researchers (and as language learners) be able to tell when conventionalization had occurred? We hope that these and other questions can be fruitfully explored within the basic formal framework developed in this paper.

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<sup>5</sup>Given the fact that this shift represents a move from non-conventional pragmatic content to conventional (and therefore, in our terms semantic) content, the process might better be described as *semanticalization of pragmatic content*, rather than *pragmaticalization*, which would seem to suggest a move *away* from conventional content. However, if one considers the process from stage 1 to stage 3, the term *pragmaticalization* seems adequate again.



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# The polysemy of container pseudo-partitives

Karen Duek — University of California, Santa Cruz

Adrian Brasoveanu — University of California, Santa Cruz<sup>1</sup>

**Abstract.** In a series of experimental studies, we investigate the nature of the meaning multiplicity associated with container pseudo-partitives, e.g., *glass of water* can refer to the container (the glass) or the containee (the portion of water), asking if its distinct interpretations are available simultaneously in copredication environments or if they are in competition. The studies compare the acceptability of container pseudo-partitives to lexical polysemes (*book*) and homonyms (*date*), for which copredication has been claimed to be licit and anomalous respectively, and show that pseudo-partitives behave more like polysemes than homonyms, which is unexpected for current accounts. But we also see that copredication with pseudo-partitives is acceptable to a lesser extent than with polysemes, pointing to the possibility that copredication should be rethought in terms of the gradient costs it imposes, and that the multiple meanings of phrasal polysemous expressions like pseudo-partitives might be asymmetrically available in copredication environments.

**Keywords:** polysemy, pseudo-partitives, copredication / zeugma, experimental semantics

## 1. Introduction

This paper is in broad terms concerned with the different shades of meaning multiplicity found in natural language, in particular in the nominal domain. Though pervasive, nominal meaning multiplicity is not uniform. A basic distinction can be made between two major classes of meaning multiplicity: homonymy and polysemy. Whereas homonyms are single linguistic expressions associated with multiple meaning representations that are clearly distinct and unrelated (i.e., this is an instance of ambiguity in the technical, formal-semantics sense of the term), polysemes are associated with a single, complex meaning representation in which multiple aspects of a concept relate to each other in systematic and productive ways.

This distinction is reflected in the fact that the senses of homonyms stand in competition, while the senses of a polyseme are typically available simultaneously. The zeugma, a.k.a. copredication, test targets precisely this difference. The example in (1-a) illustrates the anomaly that results from trying to force the single instance of the homonym *date* to satisfy the selectional requirements of *moldy*, which selects for the fruit sense of *date*, and *sarcastic*, which selects for its human sense. In (1-b), *enthraling* requires *book* to be interpreted as an abstract, propositional object, while *fall* demands that we conceive of *book* as a physical object. But unlike the *date* example, the result is not zeugmatic.

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- (1) a. #The moldy [*inanimate*] **date** was very sarcastic [*animate*].  
 b. An enthralling [*abstract*] **book** fell [*concrete*] off the table.

The need for a typology of meaning multiplicity for nouns has been long recognized for lexical items, but less is currently known about the possibilities left open for meaning multiplicity at the phrasal level: the possibility of constructing polysemous representations out of syntactically complex expressions has been less systematically explored. This paper will consider the case of container-containee meaning multiplicity exhibited by English pseudo-partitives (*glass of wine*, *box of books*) as a window into this matter. Pseudo-partitives can be interpreted in at least 3 ways:

- (2) a. Marina broke the glass of wine that was on the table. *container*  
 b. Marina drank the glass of wine that was on the table. *containee / concrete portion*  
 c. This recipe calls for a glass of wine. *measure*

In (2-a), *break* requires the pseudo-partitive to be interpreted as a container; we will refer to this interpretation as the container reading. In (2-b), to meet the selectional requirements of *drink*, the same phrase must be interpreted as a containee, i.e., a concrete portion of wine; we will refer to this as the containee, or the concrete portion, reading. Finally, in (2-c), there is no requirement that there be any actual container involved, or any actual containee (concrete portion), only that there is an abstract amount of wine that would be enough to fill a glass (the measure reading).

In this paper, we will be concerned only with the first two readings, leaving aside the measure interpretation. We report two experimental studies whose main goal was to examine the container/containee meaning multiplicity exhibited by pseudo-partitives. The experiments aim to distinguish between two families of accounts that attribute this multiplicity to different sources:

- (3) Two ways to account for the container/containee meaning multiplicity of pseudo-partitives:  
 a. **Pseudo-partitives are ambiguous:** the container noun is basically ambiguous between a lexical head (the container reading) and a functional head (the containee reading) and depending on its lexical vs. functional nature, it occupies different syntactic positions and has distinct denotations (Selkirk 1977, Corver 1998, Grimshaw 2007, Landman 2004, Rothstein 2009, Partee and Borschev 2012).  
 b. **Pseudo-partitives are complex type constructors:** a polysemous denotation is built compositionally (this novel account builds on Pustejovsky 1995 and Asher 2011).

Ambiguity approaches take the phrasal meaning multiplicity of pseudo-partitives to be an instance of homonymy: different meanings are associated with distinct, competing representations, so they should not be simultaneously available. In contrast, a complex-type constructor account assimilates the container/containee multiplicity to polysemy, which predicts that they can be simultaneously

available in the same representation. Thus, the zeugma / copredication test should provide adequate evidence for one or the other type of approaches. Theoretically, what is at stake is whether polysemy is restricted to the lexical domain, or if the grammar offers compositional mechanisms to derive the same sort of meaning flexibility at the phrasal level.

We report here two acceptability-judgment studies in which native English speakers were asked to assess zeugma / copredication sentences with container pseudo-partitives. As baselines for the pseudo-partitive judgments, we asked speakers to also judge zeugmatic sentences that involved lexical homonymy and lexical polysemy. The studies show that container pseudo-partitives are unlike homonyms: copredication with pseudo-partitives does not lead to clear anomaly in the same way that it does with homonyms. The results are compatible with the hypothesis that the output of the semantic composition needed to interpret pseudo-partitives is polysemous in nature. The implication is therefore that complex semantic representations exhibiting meaning multiplicity are not exclusively associated with lexical items, which are inherently conceptually complex, but that particular constructions can manipulate simple nominal meanings to build such complex representations compositionally.

But the studies also show that pseudo-partitives are not exactly like lexical polysemes: we can observe a small effect that distinguishes the clearly acceptable cases of lexical polysemy and the somewhat less acceptable cases of phrasal polysemy. Thus, overall, our results point to the possibility that copredication should be rethought in terms of the gradient costs it imposes.

## 2. Background

Current accounts of the container/containee ambiguity take each reading to correspond to a distinct syntactic and semantic representation, thereby assimilating the meaning multiplicity exhibited by pseudo-partitives to homonymy. Partee and Borschev (2012), for instance, take the container reading to arise as a consequence of the container word being the head of the nominal phrase / projection. The container word has a relational denotation and takes the containee nominal as its complement. When we predicate something of a pseudo-partitive, that predicate is taken to be true of the container (together with the substance that fills it).

In contrast, the concrete portion and measure readings are derived if the containee word is the head of the nominal phrase and the container word combines with a numeral to form a nominal modifier for the containee noun. Partee and Borschev (2012) recognize that their account is incompatible with the possibility of copredication, which nonetheless seems possible and non-zeugmatic at least between the container and containee / concrete portion readings, as in (4). They suggest that if these facts indeed hold, a more appropriate account of this meaning multiplicity should approximate it to the representation of lexical polysemy.

- (4) a. The glass of wine that was a cabernet had a chip on the rim.

- b. The glass of wine that had a chip on the rim was a cabernet.

The possibility of copredication for polysemes has motivated theories that significantly enrich (i) the structure of the lexicon, such as [Pustejovsky \(1995\)](#), or (ii) the system of types and the mechanisms of predication employed in formal semantics ([Asher 2011](#), [Asher and Pustejovsky 2013](#)). For concreteness, we consider the account put forward in [Asher \(2011\)](#) more closely.

Recall that the ability to satisfy multiple, sometimes incompatible, semantic selectional requirements is the most crucial diagnostic tool for nominal polysemy. Likewise, this is often the criterion used to determine the meaning of an ambiguous element, i.e., a homonym, in a particular context. Therefore progress in accounting for homonymy and polysemy is dependent on developing a precise formal notion of what selectional restrictions are and what it means to meet them. In Asher's account, selectional requirements are modeled as presuppositions at the level of types. This is made possible by significantly expanding the system of types to mirror conceptual organization, including subtype relations. For example, a predicate like *drink* specifies that its argument must be not only be an individual, but a liquid, physical entity.

The result is a 'two-tier' model of lexical meaning: lexical meanings are still modeled as lambda terms, the functional 'structure' of which encodes the 'coarse-grained' compositionality-related part of their meaning (just as in Montagovian semantics), but these terms also include fine-grained information about the richly structured types of the  $\lambda$ -bound variables, which is needed to model polysemy, selectional restrictions and related phenomena. An important component of the formalization is a  $\lambda$ -bound variable  $\pi$  of the presuppositional type  $\Pi$  that encodes the typing constraints a predicate places on its arguments. The type of propositions is thus  $\Pi \Rightarrow t$ : a proposition can be evaluated only with respect to a context that satisfies all of its type presuppositions; if they cannot be satisfied via binding or accommodation, the proposition cannot be evaluated.

The crucial part for us is how the type of a polyseme is established in this framework. Since the polyseme can justify multiple, incompatible type presuppositions, its type will have to be more complex. For example, the type of the object 'contributed' by a noun like *book* must be complex enough to satisfy both a physical-object type presupposition and an abstract-object type presupposition. Such complex types enter semantic composition in a specific way: the complex-type variable (or more generally, term) 'introduced' by a noun like *book* is distinct from the variables it contributes as arguments to other predicates in the sentence, even though the former are related to the latter. For example, *book* continues to contribute a variable of a complex, physical-cum-abstract type to the semantic representation, i.e., a variable whose type is the dot-type  $\text{PHYSICAL} \bullet \text{INFO}$ , even after it combines with a predicate like *heavy*, which exclusively selects for a physical-object type. The fact that the dot-type variable continues to be available correctly predicts that a predicate selecting for an abstract-object type can successfully be added to this representation – see, for example, the felicitous example of copredication in (1-b) above.

If container pseudo-partitives behave like lexical polysemes with respect to copredication, it would be desirable to account for this in a similar way. The account could either (i) give a dot-type meaning to the container noun (building on [Partee and Borschev 2012](#) and related accounts), or (ii) give a dot-type meaning to the entire structure, but not to the container.

Two empirical questions thus arise. The first one is whether container pseudo-partitives in English exhibit a similar pattern of copredication acceptability as lexical polysemes. If so, the second question is whether the container noun on its own is polysemous, or only the full construction is (thus making it a genuine example of phrasal polysemy). If the behavior of pseudo-partitives is close to the one exhibited by polysemes but not identical (which is actually what we will see), this can be taken as modest evidence that pseudo-partitives are an example of phrasal polysemy.

### 3. Experiment 1

The main goal of Experiment 1 was to investigate how speakers treat copredications with container pseudo-partitives. In order to do so, we first seek to establish that the copredication test distinguishes between lexical polysemy and homonymy when using coarse-grained, offline ('non-real-time') measures, in particular, acceptability judgments. We are unaware of previous studies assessing the acceptability of copredication directly. The most closely related studies in the literature are the eye-tracking studies reported in [Frazier and Rayner \(1989\)](#), who found that the distinction between homonymy and polysemy is reflected in the fine-grained, real-time behavioral measures that eye-tracking provides. In particular, [Frazier and Rayner \(1989\)](#) found that participants committed to a particular sense in the case of homonyms (even in neutral contexts that did not bias them one way or another), but no such commitment was made in the case of polysemes. Assuming offline acceptability judgments can distinguish between homonyms and polysemes, they will serve as baselines when we evaluate the acceptability of copredication with container pseudo-partitives, enabling us to locate pseudo-partitives on the homonymy-to-polysemy spectrum.

#### 3.1. Design and materials

We tested the acceptability of copredication with homonyms, polysemes and container pseudo-partitives. We manipulated three factors: (i) the senses selected by the first predicate, e.g., for a polyseme like *book*, whether the predicate selects for its concrete or abstract sense; (ii) the senses selected by the second predicate, which were the same as the senses selected by the first predicate; and finally, (iii) the type of meaning multiplicity: homonymy, polysemy, pseudo-partitive with a mass containee (*bottle of water*), or with a count containee (*box of books*). That is, Experiment 1 had a  $2 \times 2 \times 4$  factorial design. There were 16 items for homonyms, 16 for polysemes, 16 for pseudo-partitives with count containees, and 20 items for pseudo-partitives with mass containees, for a total of 68 items. Every item was passed through the corresponding 4 conditions (2 senses for the first predicate  $\times$  2 senses for the second predicate) and 4 lists were generated, each of which included every item exactly once, with the items rotated through the 4 conditions across the 4 lists; the participants were rotated through these 4 lists (Latin square design).



The stimuli for this experiment (and the subsequent one) always involved a restricted relative clause modifying the subject nominal, and the two predicates were provided by the relative clause on one hand, and the matrix VP on the other.<sup>2</sup> The nouns and biasing predicates in the homonymy and polysemy conditions were based on the ones used in Frazier and Rayner (1989) whenever possible; modifications were made whenever translating their items into our copredication frame resulted in an unnatural sentence. Homonyms always alternated between an animate and an inanimate sense (e.g., *date*, *bat*), and polysemes always alternated between a sense involving a concrete, physical-object and a sense involving an abstract object ‘stored’ in the concrete one (*book*, *newspaper*). Example items are provided below.

(5) **Homonymy**

- |    |   |                            |
|----|---|----------------------------|
| a. | The date that <b>tasted</b> bitter was <b>bought</b> just yesterday.  | <i>inanimate-inanimate</i> |
| b. | The date that <b>walked</b> in late was very <b>rude</b> to Jane.     | <i>animate-animate</i>     |
| c. | The date that <b>tasted</b> bitter was very <b>rude</b> to Jane.      | <i>inanimate-animate</i>   |
| d. | The date that <b>walked</b> in late was <b>bought</b> just yesterday. | <i>animate-inanimate</i>   |

(6) **Polysemy**

- |    |   |                          |
|----|---|--------------------------|
| a. | The novel that got some great <b>reviews</b> was a terrifying <b>thriller</b> . | <i>abstract-abstract</i> |
| b. | The novel that got <b>soaked</b> in coffee was <b>found in the sale bin</b> .   | <i>concrete-concrete</i> |
| c. | The novel that got some great <b>reviews</b> was <b>found in the sale bin</b> . | <i>abstract-concrete</i> |
| d. | The novel that got <b>soaked</b> in coffee got some great <b>reviews</b> .      | <i>concrete-abstract</i> |

(7) **Mass containee**

- |    |  |                            |
|----|--|----------------------------|
| a. | The jug of lemonade John <b>broke</b> had lemons <b>painted</b> on it. | <i>container-container</i> |
| b. | The jug of lemonade I <b>drank</b> was too <b>sweet</b> .              | <i>containee-containee</i> |
| c. | The jug of lemonade my grandfather <b>broke</b> was too <b>sweet</b> . | <i>container-containee</i> |
| d. | The jug of lemonade I <b>drank</b> had lemons <b>painted</b> on it.    | <i>containee-container</i> |

(8) **Count containee**

- |    |   |                            |
|----|---|----------------------------|
| a. | The tupperware of cookies made of blue <b>plastic</b> is <b>sealed shut</b> .       | <i>container-container</i> |
| b. | The tupperware of cookies I <b>baked</b> today is all <b>chocolate</b> chip.        | <i>containee-containee</i> |
| c. | The tupperware of cookies made of blue <b>plastic</b> is all <b>chocolate</b> chip. | <i>container-containee</i> |
| d. | The tupperware of cookies I <b>baked</b> today is <b>sealed shut</b> .              | <i>containee-container</i> |

Homonyms are expected to be judged as less acceptable in the 2 mismatching conditions than in the matching ones, while polysemes should be judged as equally acceptable in all conditions. Under the ambiguity approach, pseudo-partitives should display the same behavior as the homonyms.

<sup>2</sup>Other structures could be used in the copredication test, e.g., coordinations, adjectival modification, appositives etc. Empirically investigating if these copredication structures yield roughly similar results is left for a future occasion.

Under the complex type approach, pseudo-partitives should behave like the polysemes. A third possibility is that pseudo-partitives match neither lexical polysemes nor homonyms, maybe because the pattern across the 4 conditions is different, and/or because mass and count containees behave in different ways.

An additional complication specific to pseudo-partitives is that because they are syntactically complex, the restrictive relative clause might attach at the level of the lower, containee noun, or at the level of the higher, container noun. If the relative clause attaches low (targeting the containee noun), the stimulus does not necessarily instantiate a case copredication: the relative clause predicates something of the containee, while the matrix clause predicates something of the container. But when the relative clause attaches high (targeting the container noun), the result is definitely a copredication structure of the requisite kind. In what follows, we will treat all four conditions for pseudo-partitives as copredicational, anticipating one of the results of our Experiment 2 indicating that relative clauses in pseudo-partitives do not seem to exhibit such syntactic freedom. But this additional complication leads us to select the container sense as our reference level when we do the statistical analysis of the Experiment 1 and Experiment 2 data.

### 3.2. Procedure and participants

36 native speakers of English participated in the study. All participants were undergraduate students at UCSC, and completed the study for course credit or extra-credit on a UCSC hosted installation of A. Drummond's IBEX platform (<https://code.google.com/p/webspr/>). They were instructed to rate the sentences presented in isolation on a 5-point Likert scale: -2 (very bad), -1 (fairly bad), 0 (neither good nor bad), 1 (fairly good), 2 (very good). The participants were rotated through the 4 lists of items described above. Each participant rated 138 stimuli (68 items + 70 fillers), the order of which was randomized for each participant.

### 3.3. Results and analysis

Graphical summaries of the data are provided in Figures 1 and 2. Since the response variable is ordered categorical, we used mixed-effects ordinal probit regression models to analyze the data. All models included the full fixed-effect structure (main effects and interactions) unless otherwise specified, and crossed random intercepts for subjects and items.<sup>3</sup>

<sup>3</sup>All the data summaries / plots / analyses in this paper have been generated / completed using R (R Core Team, 2013) and the packages ggplot2 (Wickham, 2009) and Ordinal (Christensen, 2012).



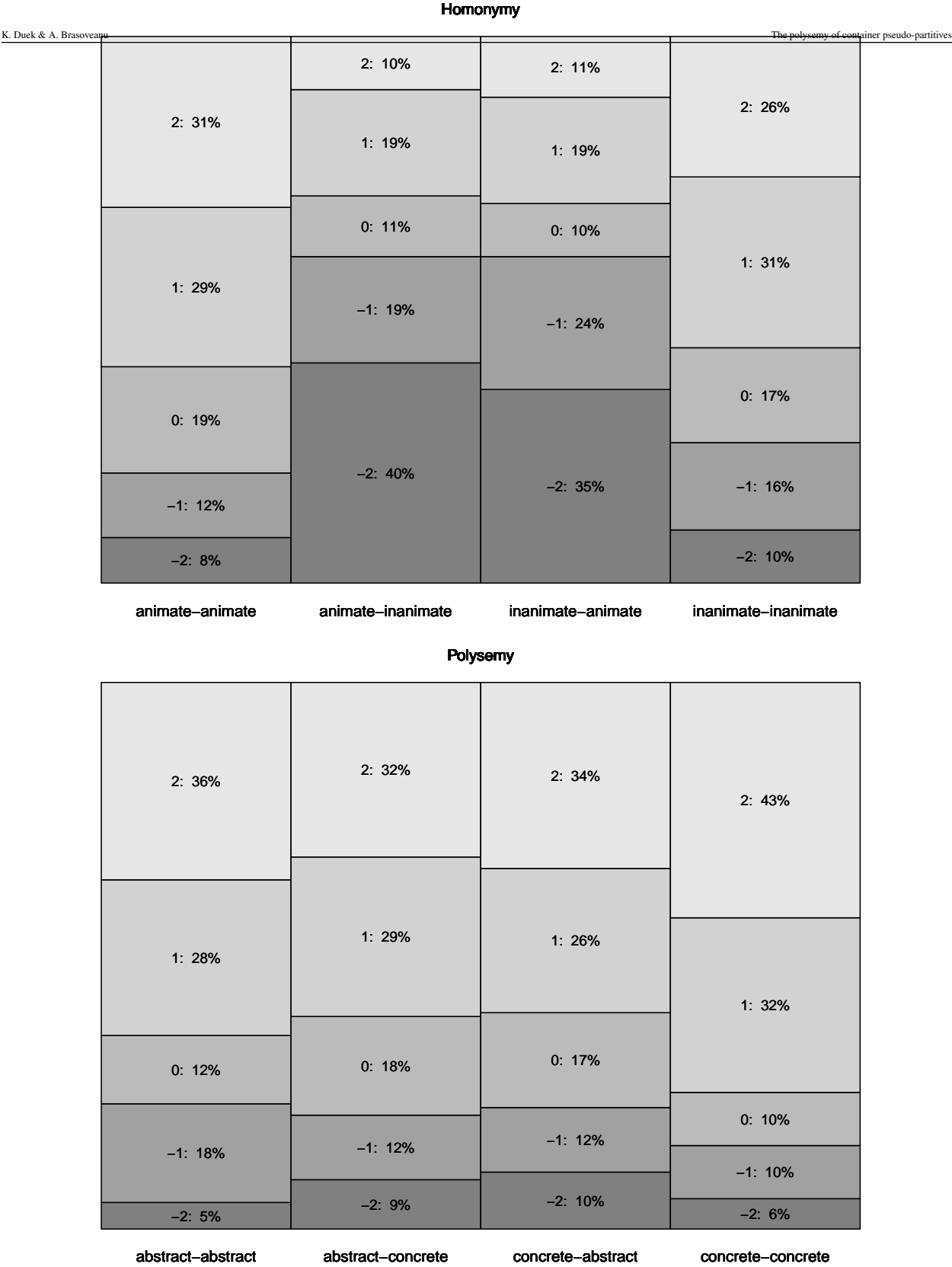


Figure 1: Experiment 1: Data summaries for the homonymy and polysemy conditions.

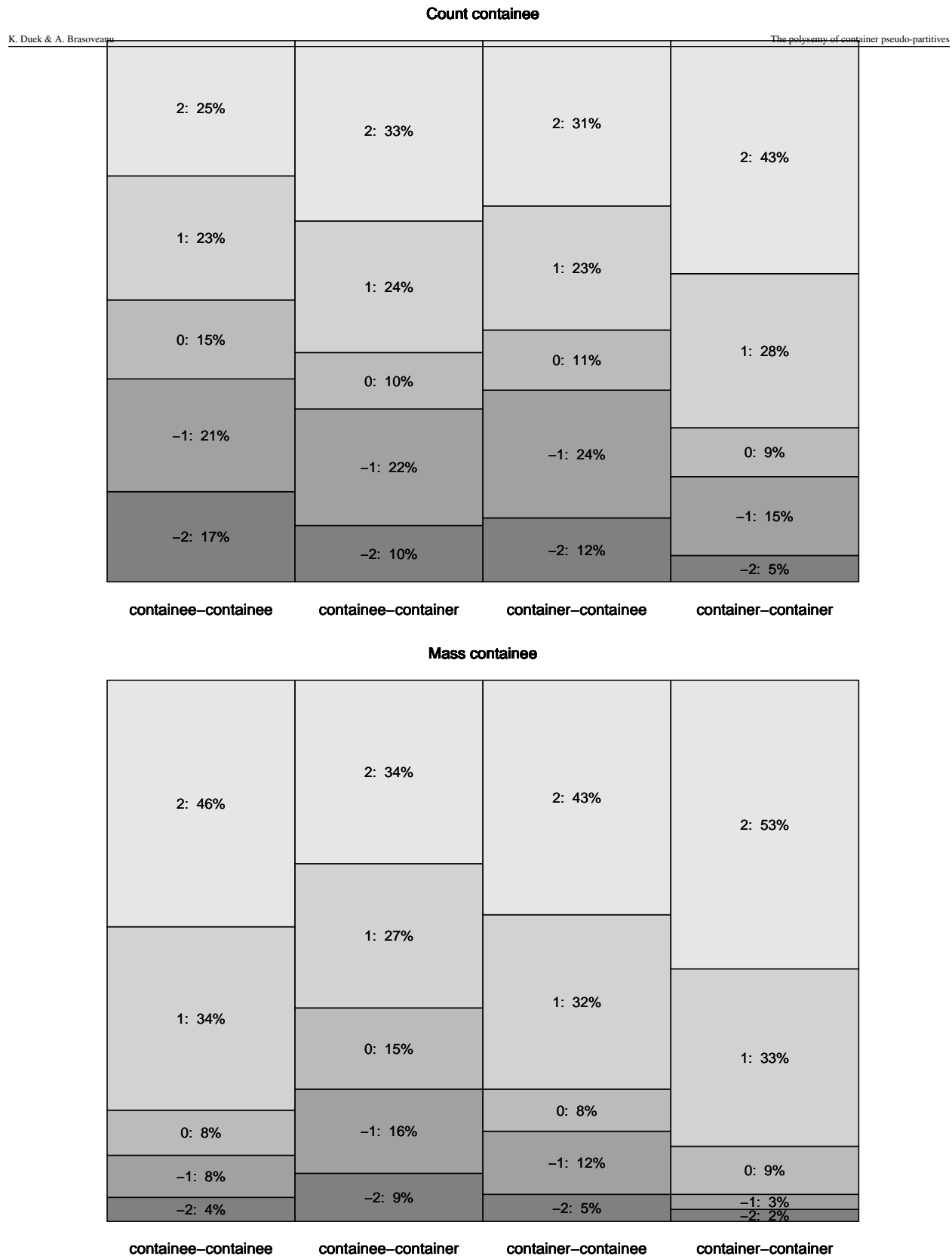


Figure 2: Experiment 1: Data summaries for the count and mass containee conditions.

As expected, homonyms were judged significantly worse in the mismatching conditions than in the matching ones. This can be observed by examining the top panel of Figure 1, e.g., the percentage of unacceptable  $-2$  and  $-1$  ratings given to the mismatching vs. matching conditions. This is confirmed by the statistical analysis of the data. The reference levels for both the first sense (the sense selected by the relative clause) and the second sense (the sense selected by the matrix VP) were set to ANIMATE. There was a main effect of INANIMATE for both the first sense ( $\beta = -1.07, SE = 0.13, p = 0.00$ ) and the second sense ( $\beta = -1.18, SE = 0.14, p = 0.00$ ), and a significant INANIMATE $\times$ INANIMATE interaction ( $\beta = 2.11, SE = 0.19, p = 0.00$ ), which basically reversed the cumulative effect of the two main effects, thereby bringing the acceptability of the inanimate-inanimate condition back to the high level of the reference condition (animate-animate).

For polysemy, we set the reference levels for both the first and the second sense to ABSTRACT. The main effects of switching to CONCRETE were non-significant for both the first sense and the second sense (the estimates were almost identical in the two cases:  $\beta = -0.12, SE = 0.13, p = 0.35$ ). That is, we detected no difference between the abstract-abstract (reference) condition and the mismatching abstract-concrete and concrete-abstract conditions. There was however a significant CONCRETE $\times$ CONCRETE interaction ( $\beta = 0.51, SE = 0.19, p = 0.006$ ). This result, in conjunction with an inspection of the data summaries in Figure 1, indicates that mismatching conditions are slightly worse than matching conditions for polysemes also, but this difference is much smaller than for homonyms – as shown by the much smaller main & interaction effects for polysemy relative to homonymy.

The picture that seems to emerge is that mismatching conditions are worse than matching conditions across the board, but the differences in acceptability between these conditions fall on a gradient spectrum. Homonyms are at the high end of the spectrum, with large – and introspectively available – differences between matching and mismatching conditions. Polysemes are the low end of the spectrum, with small – and introspectively not (or less) available – differences between matching and mismatching conditions.

We can strengthen our confidence in this hypothesis by grouping the matching conditions together, and also the mismatching conditions, pooling the homonymy and polysemy data, and estimating a mixed-effects probit model with two fixed effects: (i) SAME-SENSE (reference level) vs. DIFFERENT-SENSE, and (ii) HOMONYMY (reference level) vs. POLYSEMY. All fixed effects (the main effects and their interaction) are significant in this model. There is a main effect of POLYSEMY ( $\beta = 0.32, SE = 0.13, p = 0.01$ ) indicating that even in the matching conditions (the baseline), polysemes are relatively more acceptable. There is a large negative main effect of DIFFERENT-SENSE ( $\beta = -1.01, SE = 0.10, p = 0.00$ ) indicating that zeugmatic sentences significantly decrease acceptability for homonyms, as expected. Finally, there is a significant positive interaction of POLYSEMY $\times$ DIFFERENT-SENSE ( $\beta = 0.83, SE = 0.13, p = 4 \times 10^{-10}$ ), which almost – but not quite – reverses the negative main effect of DIFFERENT-SENSE observed with homonyms. These results are compatible with the hypothesis outlined above that the differences in acceptability between matching and mismatching conditions fall on a gradient spectrum, with

homonyms at the high end of the spectrum (large differences) and polysemes at the low end of the spectrum (small differences).

For all pseudo-partitives (both those with a count containee and those with a mass containee), we selected CONTAINER as the reference level for both the first predicate (the restrictive relative clause) and the second predicate (the matrix VP).

Mass-containee pseudo-partitives exhibit the same overall pattern as homonyms and polysemes: mismatching conditions are worse than matching conditions. And the difference between these classes of conditions falls roughly in the middle of the spectrum between homonyms and polysemes. This can be observed by comparing the data summaries for mass containees in the lower panel of Figure 2 with the corresponding summaries in Figure 1. The results of the statistical analysis are compatible with this: there is a main effect of CONTAINEE for both the first sense ( $\beta = -0.79, SE = 0.12, p = 1.9 \times 10^{-10}$ ) and the second sense ( $\beta = -0.41, SE = 0.12, p = 0.001$ ), and a significant CONTAINEE $\times$ CONTAINEE interaction ( $\beta = 0.91, SE = 0.17, p = 1.9 \times 10^{-7}$ ). All of these effects have the same direction as the corresponding homonymy and polysemy ones, and their magnitudes are intermediate between the corresponding homonymy and polysemy effects.

Count-containee pseudo-partitives exhibit a slightly different pattern: there is a main effect of CONTAINEE for both the first sense ( $\beta = -0.36, SE = 0.13, p = 0.006$ ) and the second sense ( $\beta = -0.46, SE = 0.13, p = 0.0004$ ), but no significant CONTAINEE $\times$ CONTAINEE interaction ( $\beta = 0.19, SE = 0.18, p = 0.30$ ); see also the top panel of Figure 2. This is compatible with count-containee pseudo-partitives exhibiting a polysemous behavior since zeugma / copredication does not lower acceptability. What we seem to observe is an across-the-board preference for the container sense, which is slightly more pronounced for the second predicate (the matrix VP) than for the first predicate (the restrictive relative clause).

The contrast between count and mass containees is further confirmed when we group the matching conditions together, and also the mismatching ones, pool the count and mass data, and estimate a mixed-effects probit model with two fixed effects: (i) SAME-SENSE (reference level) vs. DIFFERENT-SENSE, and (ii) COUNT (reference level) vs. MASS. We see that there is a positive main effect of MASS ( $\beta = 0.65, SE = 0.13, p = 1.1 \times 10^{-6}$ ), which might be due to independent issues like the pattern of agreement with the matrix verb (see the discussion subsection below). But most importantly, we see that the main effect for DIFFERENT-SENSE ( $\beta = -0.09, SE = 0.09, p = 0.32$ ) is non-significant, indicating that there is no difference between matching and mismatching conditions for count containees, while the interaction MASS $\times$ DIFFERENT-SENSE is significant ( $\beta = -0.32, SE = 0.13, p = 0.009$ ), indicating that there is such a difference for mass containees.

### 3.4. Discussion

Taken together, the results of Experiment 1 confirm the validity of the copredication test in distinguishing homonymy and polysemy. As expected, speakers judge copredication with homonyms

very poorly, and the contrast against matching conditions was quite sharp. Somewhat less expectedly, we still observe some cost of copredication for polysemes, even though the difference between regular predication (the match conditions) and copredication (the mismatch conditions) was much smaller than for homonyms.

The contrast between homonymy and polysemy is large enough to warrant their use as baselines against which to compare the behavior of container pseudo-partitives. However, the fact that copredication was not cost-free for lexical polysemes must qualify our interpretation of the behavior of pseudo-partitives as well. That is, if pseudo-partitives were to behave on a par with polysemes, the expectation should not be that mismatch conditions receive no penalty, but that the size of the effect would be relatively small.

Our results show that overall, container pseudo-partitives pattern more closely with polysemy than homonymy. For count containees, there was no significant interaction effect, i.e., sense matching vs. mismatching does not seem to affect acceptability; there is only an overall preference for the container sense. For mass containees, sense matching vs. mismatching has an effect on acceptability, and this effect seems to be intermediate between the one observed for polysemy and the one observed for homonymy. Generally, this indicates that the relevant readings of the container construction are available simultaneously. It suggests therefore that ambiguity-based accounts that assume distinct syntactic and semantic representations for those readings do not capture the full range of interpretations associated with pseudo-partitives.

However, the patterns of acceptability for pseudo-partitives were more diverse than initially expected. In particular, neither one of the approaches we considered above predicted a sensitivity to whether the containee noun was a mass or bare-plural count noun.

A few potential confounds must be addressed before we can suggest with confidence that the acceptability of copredication for container pseudo-partitives is indeed modulated by the mass/count status of the containee noun. First, while the set of containers used in both conditions overlapped, they were not identical. Second, there was a systematic number mismatch in the count-containee cases: container nouns were always singular and containees were always plural. This meant that the conditions in which the main predicate selected for the plural containee while bearing singular morphology exhibited a somewhat odd number-agreement pattern. For instance, in the sentence *The tupperware of cookies I baked this morning is all chocolate chip*, even though the main predication selects for *cookies*, the copula shows singular agreement morphology with the entire subject. It is possible that the different acceptability pattern exhibited by count-containee pseudo-partitives was a consequence of this confound.

The strength of selectional requirements is a third potentially confounding factor. Many of the predicates did not strongly select for one of the readings, but were more plausibly associated with either the containee or the container reading in the broader context of the sentence in which they appeared. For instance, the item *The pot of curry [that Chris carried] was very fragrant* was de-

signed to be in the condition in which the predicate in the relative clause selected for the container. But while it is clearly pragmatically odd to interpret *carry the pot of curry* as an event of carrying only curry, there is no grammatical clash between the selectional restrictions of *carry* and *curry*.

Finally, to preserve the naturalness of the stimuli, the mismatching conditions (container-containee vs. containee-container) were not mirror images of each other since the predicates were not preserved and simply flipped around. For instance, the reverse mismatching condition for *The pot of curry that Chris carried was very fragrant* was *The pot of curry Mary cooked fell on the floor and broke*. Although both *be fragrant* and *cook* select for the containee reading, it is possible that their selectional ‘strength’ is different, blurring the effect of selection itself.

## 4. Experiment 2

### 4.1. Design and materials

Experiment 2 tested the acceptability of copredications with pseudo-partitives using a different set of items that better controlled for the possible confounds listed above. First, the same container words were used throughout. Second, to avoid the issue of number agreement, containee-selecting predicates were never explicitly number marked (achieved by modalizing the predicate, for example). Third, when sense-biasing predicates were selected, we were more stringent and attempted to select predicates with a much higher bias for one sense or another independently of the particular sentence that the predicate occurred in. Finally, we ensured that for every item, the same predicates were used for the two mismatching conditions container-containee and containee-container, varying only the order in which they occurred. An example item is provided in (9).

- (9)
- a. The container of {gold/diamonds} that was missing a lock has a velvet interior. *container-container*
  - b. The container of {gold/diamonds} that might have been mined in East Africa could be 24 carat. *containee-containee*
  - c. The container of {gold/diamonds} that was missing a lock might have been mined in East Africa. *container-containee*
  - d. The container of {gold/diamonds} that might have been mined in East Africa was missing a lock. *containee-container*

**Procedure and participants.** 42 native speakers of English recruited online participated, without compensation. As in the previous study, they were instructed to rate the sentences on a 5-point scale from -2 (very bad) to 2 (very good). The procedure was the same as in Experiment 1.

## 4.2. Results and analysis

Unlike in Experiment 1, the pattern of acceptability we observe in Experiment 2 is not affected by the count/mass status of the containee noun. In particular, we obtain different results when we group the matching conditions together, and also the mismatching ones, pool the count and mass data, and estimate a mixed-effects probit model with two fixed effects, (i) SAME-SENSE (reference level) vs. DIFFERENT-SENSE and (ii) COUNT (reference level) vs. MASS, just as we did for the Experiment 1 data. We see that the main effect of MASS ( $\beta = 0.03, SE = 0.09, p = 0.73$ ) is non-significant, and so is the interaction MASS $\times$ DIFFERENT-SENSE ( $\beta = 0.08, SE = 0.12, p = 0.50$ ). However, the main effect for DIFFERENT-SENSE ( $\beta = -0.35, SE = 0.08, p = 2.6 \times 10^{-5}$ ) is significant, indicating (in conjunction with the fact that the other effects are non-significant) that there is a difference between matching and mismatching conditions for both mass and count containees.

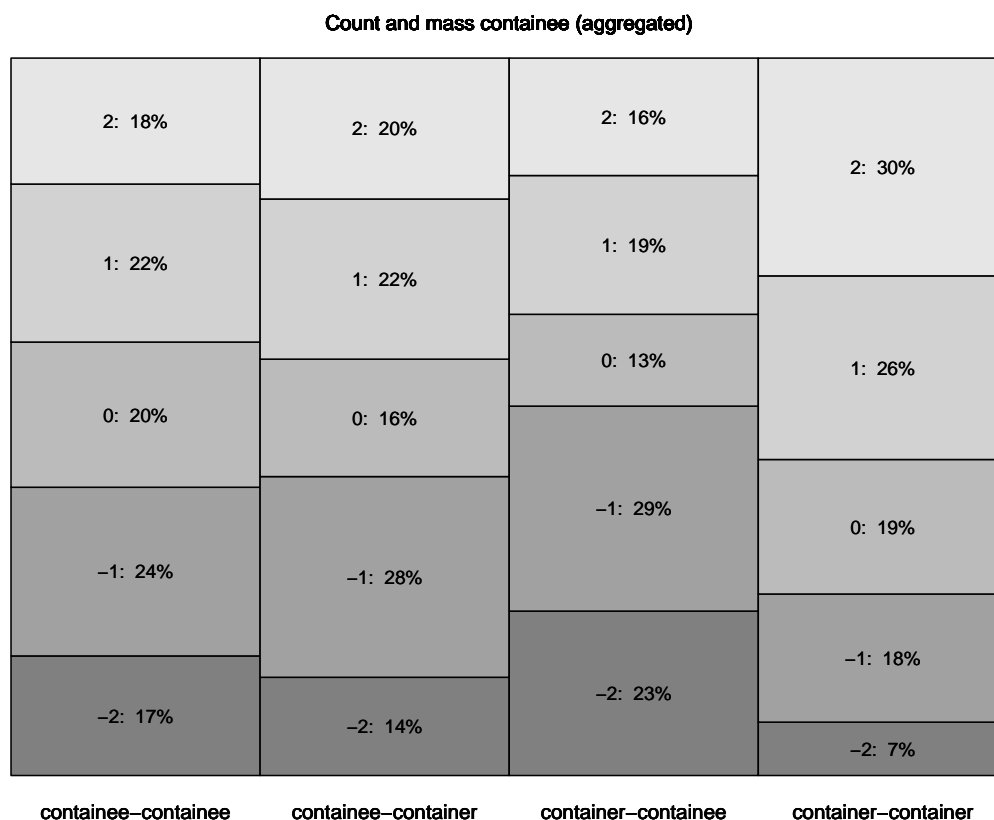


Figure 3: Experiment 2: Summary of the aggregated count and mass containee data.

We therefore aggregated over the count and mass data when we estimated the model examining the four experimental conditions for pseudo-partitives.<sup>4</sup> Just as before, we selected CONTAINER as the reference level for both the first predicate (the restrictive relative clause) and the second predicate

<sup>4</sup>The two models estimated for the count-containee subset only and for the mass-containee subset only yielded very similar results.

(the matrix VP). This time, the pseudo-partitives as a whole, not only the mass-containee ones, exhibited the same overall pattern as homonyms and polysemes, and fell roughly in the middle of the spectrum between them. There was a negative main effect of CONTAINEE for both the first sense ( $\beta = -0.50, SE = 0.09, p = 5 \times 10^{-9}$ ) and the second sense ( $\beta = -0.71, SE = 0.09, p = 0.00$ ), with a more pronounced main effect for the second sense, just as count containees exhibited in Experiment 1. Most importantly, there was a significant CONTAINEE  $\times$  CONTAINEE interaction ( $\beta = 0.64, SE = 0.12, p = 5.3 \times 10^{-8}$ ). All of these effects had the same direction as the corresponding homonymy and polysemy ones, and their magnitudes were intermediate between the corresponding homonymy and polysemy effects.

Importantly, the fact that there is a significant, negative main effect of CONTAINEE for the first sense, i.e., the fact that the container-container condition is significantly better than the containee-container condition, casts some doubt on the hypothesis that the restrictive relative clause (the first predicate) is free to attach itself to either the low (containee) noun or the high (container) noun in the pseudo-partitive. If such syntactic attachment freedom had been available, we would have expected to see no difference between the acceptability of the containee-container condition, where the relative clause would attach low, and the container-container condition, where the relative clause would attach high. Thus, it seems that relative clause attachment is fairly constrained in pseudo-partitives, eliminating one of the possible confounds associated with the fact that pseudo-partitives, unlike homonyms / polysemes, are syntactically complex.

When we compare the summaries in Figure 3 with the corresponding summaries in Figure 1, we see a slight difference in the acceptability profile associated with the four conditions. In particular, the difference between the container-containee and container-container conditions (conditions 3 and 4 in Figure 3) is as expected: the matching condition is significantly better than the mismatching condition (the *post hoc* comparison between these conditions is very highly significant:  $\beta = -0.75, SE = 0.09, p = 0.00$ ). But there is no difference between the containee-containee and containee-container conditions (conditions 1 and 2 in Figure 3; the *post hoc* comparison is non-significant:  $\beta = -0.05, SE = 0.08, p = 0.49$ ). We currently have no explanation for this difference in profile between pseudo-partitives and homonyms / polysemes.

#### 4.3. Discussion

Broadly, the new items employed in Experiment 2 confirm the acceptability of copredication with container pseudo-partitives observed in Experiment 1. The rate of acceptance of copredication still stands somewhere in the middle of a continuum between homonymy and lexical polysemy. Speakers do not find that accessing multiple readings of pseudo-partitives leads to ungrammaticality, but they accept it less than when the same reading is accessed throughout the sentence. Crucially, the contrast between pseudo-partitives, homonyms and polysemes with respect to the acceptability of copredication does not seem to be categorical but a matter of degree.



## 5. General Discussion and Conclusion

The findings reported here, taken together, are quite intricate and complex, but they also point to a clear answer to our main empirical question, namely the acceptability of copredication with container pseudo-partitives. Throughout, pseudo-partitives failed to pattern exactly like homonymy. This is particularly relevant since it is one of the clearest theoretical predictions made by current analyses of container pseudo-partitives. Our results show that the container and containee (concrete portion) readings of the pseudo-partitive construction must be available simultaneously, albeit to a lesser extent than in the case of polysemes. These results lead to two desiderata.

The first is to provide a semantics for container pseudo-partitives that makes copredication licit, thus including it in the ranks of complex / dot-type expressions of the sort proposed by Asher (2011). The idea of constructing complex types outside of the lexicon is not entirely novel. Asher (2011) himself proposes that restricted predication of the sort illustrated in *Louise as a boss is strict* does precisely that. The *as*-phrase constructs the *boss* aspect of the expression in subject position and makes that aspect available for predication by *strict*. The complement of *as* will be a variable that will serve as argument for the main predication, and it will be of a type that can be constructed as an aspect of the term introduced by the subject. In other words, the subject's term is coerced into a complex type, such that one of its constituents is the type specified by the complement of *as*.

Similarly, the pseudo-partitive can be viewed as a complex type constructor, whose constituents are the types of the nominal phrases contained in it. A phrase like *bucket of water*, for instance, will contribute a variable with a complex type, roughly BUCKET • WATER, whose inhabitants are objects that have BUCKET and WATER as aspects associated through a containment relation. To make things concrete, assume a syntactic structure in which the pseudo-partitive contains a functional projection FP taking the container and containee NPs as arguments. The type constructor, contributed by the functional head F (maybe overtly realized as *of*), takes the container and containee NPs as arguments and returns a property of a complex type whose constituent types are contributed by the individual NPs. That is, the functional head F would contribute a function that extracts the most specific typing requirements associated with the properties contributed by the two NPs, and uses them to construct the complex type associated with the entire pseudo-partitive.

Overall, our experimental results indicate that it is worth exploring complex dot-type semantic representations beyond the lexicon. But we should note that the complex type approach (once properly fleshed out) predicts only a subset of our findings, namely that pseudo-partitives do not behave like homonyms. However, this approach in its simplest form cannot capture the fact that pseudo-partitives do not exhibit the exact same behavior as lexical polysemes. The proposal that pseudo-partitives and lexical polysemes make the same sort of complex, dot-type object available for copredication (and semantic composition more generally) fails to predict that in the pseudo-partitive case, the container aspect maintains some primacy. An immediate question is whether the asymmetrical availability of senses / aspects we observe with pseudo-partitives is specific to phrasal polysemy, or can be observed in the lexical domain as well.

Another issue is identifying the conditions under which complex types can be compositionally constructed. In particular, our results naturally lead to the question of whether other binominal structures in English are associated with similar complex-type constructors, and whether they exhibit the same type of (possibly asymmetric) meaning multiplicity. For example, the position occupied by container words can also be filled by group nouns such as *committee* (*of administrators*) or *gang* (*of thieves*), portion nouns such as *pile* (*of garbage/clothes*) and *bunch* (*of crap/roes*), quantity / measure nouns such as *pound* (*of rice/beans*) and *ton* (*of gravel/beach pebbles*), and classifying nouns such as *kind* / *sort* / *species* (*of cheese/squirrels*).

It is known that pseudo-partitives do not exhibit meaning multiplicity only when the first noun is a container. For example, Brasoveanu (2008) and Rett (2014) argue that measure phrases in general are ambiguous: they can denote abstract measures or concrete individuals. The multifaceted nature of group nouns, which seem to allow reference to both an independent entity formed out of the group members and to the members themselves, has also received a great deal of attention in the literature (Barker 1992, Schwarzschild 1996, Winter 2002, Pearson 2011). The question emerging out of the present investigation is whether these senses can be made available simultaneously and if they can, whether there is a preference for one or another.

In sum, this paper has argued that the inventory of nominal meaning multiplicity in natural language is more diverse than that recognized by the current, relatively coarse-grained distinctions. We offer two main contributions. The first, more specific one is that container pseudo-partitives seem to demand a unique, complex representation in order to accommodate the acceptability of copredication. The second, broader contribution is providing experimental evidence in support of the idea that not all polysemy is created equal, and that there is a rich spectrum of polysemy to explore that includes both lexical and phrasal polysemy, and quite possibly distinct sub-varieties in each of these two major types of nominal polysemy.

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## Mandarin utterance-final particle *ba* (吧) in the conversational scoreboard

Allyson Ettinger — University of Maryland

Sophia A. Malamud — Brandeis University

**Abstract.** We explore the meaning of the Mandarin particle *ba* (吧) in interaction with the utterance to which it attaches (the “anchor”) and the context. Previous literature on *ba* contains no unified generalization – effects claimed by various scholars include uncertainty, soliciting agreement/confirmation, or politeness. To arrive at a unified descriptive generalization and clarify the distribution of the particle, we conducted a corpus study of *ba* using Mandarin-language television and film (95 tokens).

We observe that *ba* anchors include assertions, directives, commissives, and sub-sentential tags, and we make the novel descriptive generalization that *ba* creates a confirmation-seeking or softening effect when anchors represent proposals initiated by the speaker, and an effect of uncertainty or reluctant agreement when anchors represent proposals that are already “in play”. We argue that these effects of *ba* can be traced to a single underlying function: *ba* transfers the authority for the conversational move represented by the anchor away from the speaker, making the effects of the anchor contingent on hearer’s approval (cf. Gunlogson, 2008).

To model contingent moves, we propose a conversational scoreboard in which interlocutors’ contributions target the Common Ground, which includes a preference state containing interlocutors’ public discourse commitments (Gunlogson, 2003, 2008), the inquiries that they aim to resolve (Groenendijk and Roelofsen, 2009), and preferences that guide actions (Starr, 2010). Moves often fall short of putting content in the target domain, which must be updated collaboratively. Thus, a move initiating a proposal to update a target domain will fall short until the hearer agrees, and will instead direct its content to the Table component (Farkas and Bruce, 2010, a.o.). The Table determines what is at-issue (Roberts, 1996, a.o.). Departing from prior models, we claim that the objects on the Table are sets of potential updates of the target domain. We articulate the Table into two parts: Table1<sub>choices</sub>, which establishes the conversational goals conceptualized as a choice of one or more updates, and Table2<sub>propose</sub>, which proposes a single move to update the target domain.

*Ba* marks the single update conveyed by the anchor as destined for Table1<sub>choices</sub>, leaving it up to the hearer to advance this content to Table2<sub>propose</sub> or to the target domain. The effects of softening/soliciting confirmation follow from this delegation of authority; the effects of speaker uncertainty/reluctance are derived as implicatures. Our model allows a handle on the meta-linguistic nature of contingent moves, and a unified treatment of assertions, directives, and commissives. We discuss the consequences for the treatment of indirect speech acts, performative modals and verbs, and speech act modifiers in other languages.

**Keywords:** utterance modifier, direct speech act, indirect speech act, Mandarin utterance-final *ba*, conversational scoreboard, discourse commitment, clause types, imperative update, declarative update

## 1. Introduction

The present paper explores the behavior of the Mandarin utterance-final particle *ba* illustrated in (1b), and proposes a theoretical account of its meaning. As the translations in (1) suggest, the particle changes the illocutionary force of the utterance to which it attaches (its “anchor”). *Ba* is unembeddable – it projects through negation, questions, conditionals, and attitudes.

- (1) a. *ni qu*  
       2sg go  
       ‘Go!’
- b. *ni qu ba*  
       2sg go BA  
       ‘(How about you) go.’ or ‘Go (if you must).’

We argue that the meaning of this particle operates at the level of speech acts (discourse moves), interacting with the semantic denotation of the utterances to which *ba* attaches, and modifying the ultimate force of the conversational update effected by these utterances. We build on prior work at the semantics-pragmatics interface, connecting the line of research on models of dialogue (Grosz and Sidner, 1986; Roberts, 1996; Ginzburg, 1996, 2012; Groenendijk and Roelofsen, 2009; Farkas and Bruce, 2010; Malamud and Stephenson, 2014; Murray, 2014) with a compatible approach to the semantics and pragmatics of imperatives (Starr, 2010; Murray, 2014).

We will first provide examples from a corpus study of *ba*, with the aim of providing a more systematic and comprehensive account of the particle’s distribution than has previously been available. The particle can attach to utterances of various clause types, including declarative, imperative, and morphosyntactically unmarked, and to several kinds of sub-clausal utterances. We will argue that all *ba*-modified utterances fall into two basic pragmatic types, roughly comprising assertive and directive/commissive speech acts. We then propose an analysis of the particle’s meaning within a formal discourse model, which builds upon the notions of conditional discourse move (Gunlogson, 2008) and Question Under Discussion (Roberts, 1996). We argue that the effect of *ba* on the force of assertive and requestive utterances calls for a unified model of the pragmatics of these types of discourse moves, with important consequences for the accounts of direct and indirect speech acts and for the semantics-pragmatics interface more generally.

Previous literature on this particle contains no unified descriptive generalization about its meaning. The functions and effects claimed by various scholars range from uncertainty (e.g., Chu, 2009), to soliciting agreement or confirmation (Li and Thompson, 1989), to the effect that Han (1995) terms “disturbing the neustic” – we translate this as “secondary speech act” (Bach, 1999), or “meta-linguistic effect”, or “modifying speaker’s intention” – and politeness (Han, 1995).

This lack of agreement in the literature calls for a careful empirical study of the distribution and meaning of *ba*. In this paper, we first report on such a corpus study, and describe a novel descriptive generalization of this particle's behavior (§2). We then provide a formal model of the pragmatics of speech acts, building on the semantics of clause types in Starr (2010) and on the discourse model in (Farkas and Bruce, 2010) (§3). This model successfully captures the effects of *ba* in interaction with its anchors (§4), and has important consequences for the treatment of (in)directness and performatives (§5).

## 2. The corpus study

We conducted an initial corpus study of over seven hours of Mandarin language television and film. Tokens of the particle *ba*, along with relevant contextual details, were recorded from three hours of the Taiwanese television program *Lanqiu Huo*, “Hotshot”, as well as from the mainland Chinese film, *Yingxiong*, “Hero”, and the Mandarin-language Hong Kong film *Yinghan*, “Underdog Knight”. The majority of tokens – 67 – occurred in the television program, while the films “Hero” and “Underdog Knight” yielded 5 and 23 tokens, respectively, for a total of 95 tokens.

Several informants<sup>1</sup> were consulted regarding grammaticality, felicity, and interpretation of the examples obtained from the corpora. Additional informants later provided further discussion of corpus examples, as well as judgments on fabricated examples.

We refer to the utterance to which the particle *ba* appends as the “anchor”. Anchors for all collected examples were coded for clause type and speech act type. Clause type coding revealed anchors coded as declarative, imperative, sub-sentential, and morphosyntactically unmarked. Speech act coding revealed anchors used to perform assertions, directives, commissives and hortatives.

Analysis of corpus examples and informant responses revealed four primary effects contributed by the particle *ba*. These effects are gradient, and a given instance of the particle may exhibit multiple effects simultaneously (or may be ambiguous between different effects, in the absence of contextual information). We take four strongly representative examples to demonstrate the four effects below.

### 2.1. Confirmation-seeking

In example (2), *ba* appends to a declarative assertion. The speaker of the utterance, a basketball coach, is addressing a player about a difficult move that the player has just performed.

<sup>1</sup>Three informants were consulted. Two informants were university Chinese language instructors who had spoken standard Mandarin since early childhood. One informant was a university linguistics professor and a native speaker of a regional Chinese dialect, who had acquired the standard dialect after entering college.

- (2) *ni        lian        hen    jiu        le    ba*  
 you.sg practice very long time PRT BA  
 ‘You (must have) practiced for a long time, (right?)’

The bare anchor in this case denotes an assertion to the effect of “You practiced a long time”. With the addition of the particle *ba*, we obtain a confirmation-seeking effect, as indicated by the interrogative tag (and epistemic modal) in the English translation.

## 2.2. Softening

In example (3), *ba* appends to an imperative directive (Chen-Main 2005). The speaker of this utterance, a doctor, has just informed a young man that they cannot save his grandmother, who is in the next room. The doctor advises,

- (3) *ni        kuai    jinqu    ba*  
 you.sg fast enter BA  
 ‘Go in quickly.’

The anchor in (3) expresses the directive “Go in quickly”. The effect of the particle in this case (not reflected in the translation) is characterized as one of “softening” or “politeness” – specifically, the particle serves to soften the force of the directive from that of a command to that of a suggestion or request.

## 2.3. Uncertainty

In example (4), the particle appends once again to a declarative assertion. In this case the speaker, who has never played basketball formally, is answering the question of how well he plays the sport:

- (4) *yinggai    bu    cuo    ba*  
 should neg bad BA  
 ‘Should be pretty good, (I’d say).’

The anchor of this utterance denotes the assertion “It should be pretty good.” Informants agree that in this case, addition of the particle *ba* contributes an effect of speaker uncertainty, over and above that contributed by the epistemic modal.

## 2.4. Reluctance

The fourth effect, though attested in the literature and confirmed by informants, did not occur in our original corpus examples. However, it is robustly accepted by speakers and attested in the literature, and as such we provide a fabricated example. The reading given below is appropriate in the following type of scenario: the addressee has been asking permission to go somewhere, and after some resistance, the speaker replies with (5).

- (5) *ni qu ba*  
 2sg go BA  
 ‘Go (if you must).’

The anchor in (5) denotes the directive “Go.” The effect of the particle in this case is agreed to be one of expressing reluctance or hesitation with regard to the acquiescence.

## 2.5. Predictiveness of context

All of the above effects have been observed, in some form or another, by previous researchers of the particle *ba*. What we see, however, through systematic analysis of corpus examples, is that these different effects align with – and thus can be predicted by – the anchor type and discourse context of a given *ba* utterance.

Specifically, we can make the following preliminary generalization:

- (6) The effect of a *ba*-marked utterance is
- a. to solicit hearer agreement/confirmation when the context raises the expectation that the hearer can (and might) provide this, as in examples (2, 3)
  - b. to delay the effect of the anchor if the hearer has already indicated prior agreement/confirmation, e.g., due to politeness or reluctance, example (5)
  - c. to express uncertainty/tentativeness if context indicates that hearer is unable to agree/confirm, e.g., due to lack of knowledge, example (4)

## 2.6. Interrogatives as anchors

Note that no corpus examples were identified for which the anchor could be coded as an interrogative or a question. This is consistent with the general native speaker intuition that the particle *ba* cannot be appended to interrogatives. However, because the literature contains occasional reference to examples of the particle appending grammatically to interrogative anchors (e.g., Chao,



1965), we performed a follow-up corpus study on a larger scale, searching the Mandarin Treebank corpus (230 lines containing the particle *ba*) and the Mandarin CallHome corpus (1640 lines containing the particle *ba*) for any examples of interrogative anchors. No examples of *ba* appending to an interrogative anchor were found. Subsequent construction of examples for consultation with native speakers did reveal, however, that speakers will accept certain interrogative + *ba* utterances, under specific contextual conditions. This suggests that while the construction is exceedingly rare, it can be used both grammatically and felicitously. See §5 for further discussion.

## 2.7. Interim conclusions and desiderata for a model

The effects of modifying an utterance by attaching the particle *ba* not only vary predictably with context, as described in (6), but also are gradient: each example may express, to a larger or smaller degree, some need for confirmation, some uncertainty, some politeness, etc. This pattern leads us to conclude that these ultimate effects are due to pragmatic inference. We propose, informally, that *ba* has a single underlying function: it transfers the authority for the conversational move represented by the anchor away from the speaker. Pragmatic reasoning derives the gradient effects from this underlying meaning and the context.

To capture this underlying speech act modifying function, we need a theory of clause types and their effects. This theory should allow different clause types to have the same type of meaning, which can then be modified by *ba*. In addition, to model the pragmatic reasoning triggered by *ba*, we need a model of conversation. We will next turn to such a unified theory of the semantics of clause types and the pragmatics of speech acts, building on prior work of Farkas and Bruce (2010); Starr (2010).

This model will support *ba*'s effects across anchors, derivable from the unified approach to clause types and a meta-linguistic component to allow speech-act modification (cf. Faller, 2002).

## 3. The semantics of clause types and the pragmatics of speech acts

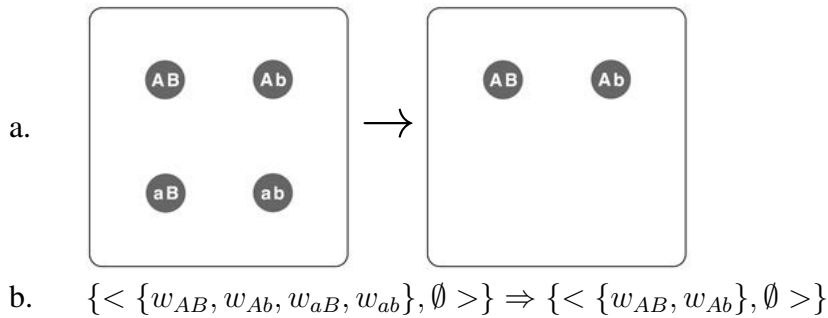
### 3.1. The semantics of clause types (Starr, 2010)

*Ba* modifies clauses of different types; thus any account of *ba* needs to be based on a unified approach to clause types. Independently, a unified semantics of clause types is needed to model sentences connecting different types of clauses (Starr, 2010; Charlow, 2010), as in (7).

- (7) a. If you want to sing, sing!  
       b. If Jo is going, will Mary go?  
       c. Sing and I will dance.

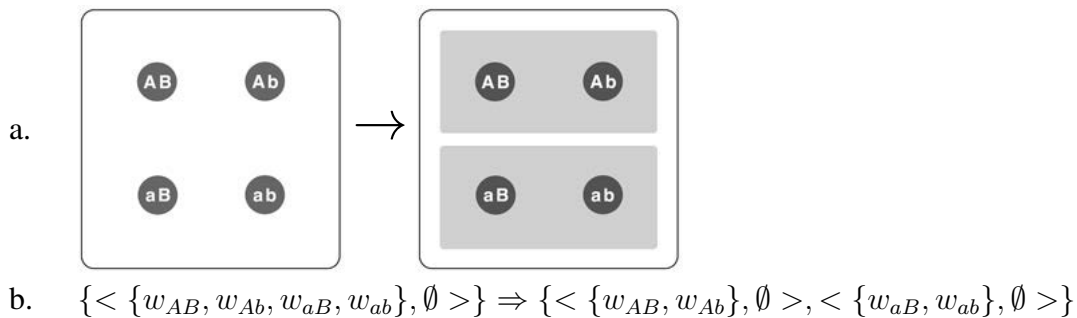
We are going to utilize such a unified semantics proposed by Starr (2010) for declaratives, interrogatives, and imperatives. This is a dynamic semantics which uses a preference state as the Stalnakerian context set. A preference state consists of a set of worlds representing the contextual live possibilities, which are partitioned into alternative propositions, which, in turn, are ranked. On this approach, a declarative sentence denotes a proposition. Its typical effect is to eliminate worlds at which that proposition is not true. A declarative introduces no partitions and no preferences. This is modeled by ranking the single proposition introduced by the declarative as preferred over the empty proposition. Thus, accepting a declarative removes incompatible worlds from the preference state, as in (8).

(8) Starr (2012): Accepting information that  $A$  ( $a$  stands for  $\neg A$ ,  $b$  for  $\neg B$ )



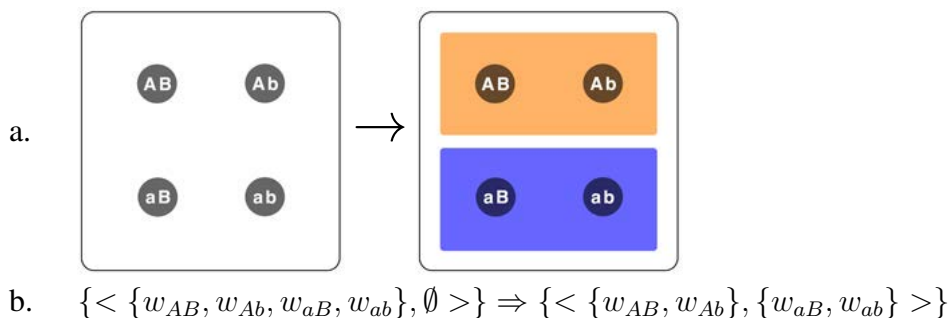
In contrast, the base content of an interrogative sentence is a set of propositions (Groenendijk and Stokhof, 1984; Groenendijk, 2009; Groenendijk and Roelofsen, 2009, among others). Its typical effect is to introduce a partition of the contextual possibilities corresponding to the answer propositions. An interrogative introduces no preferences, which is modeled by ranking each proposition in the partition over the empty proposition. Thus, accepting an interrogative partitions the worlds in the preference state, as in (9).

(9) Starr (2012): Accepting inquiry whether  $A$  ( $a$  stands for  $\neg A$ ,  $b$  for  $\neg B$ )



Finally, the base content of an imperative is a preference relation, ranking alternative propositions. Its typical effect is to introduce a preference corresponding to the ranking in (10).

- (10) Starr (2012): Accepting directive in favor of  $A$  ( $a$  stands for  $\neg A$ ,  $b$  for  $\neg B$ ; warm colors are preferred over cool colors)



If the hearer accepts an imperative directive to perform an action, then for the purposes of the conversation, the hearer now has a preference for those worlds in which the action has been performed. If the hearer adopts this preference for private decision-making, and if this preference is undominated, the requested action becomes optimal for the hearer. A rational hearer will choose to do the action. This will make the preferred proposition come true.

We adopt this semantics of clause types, and claim that while this provides an account of (the dynamics of) content, it is not sufficient as a model of what speakers do with this content (despite appearances to the contrary). For such a model we turn to the pragmatics of conversation.

### 3.2. Speech acts in a conversational scoreboard

To formalize the dynamics of conversation, we adopt a model in which moves such as assertions, directives, and commissives are proposals that address conversational goals of the interlocutors (this was proposed for assertions in Roberts (1996), Farkas and Bruce (2010), among others).

The conversational model consists of several components. The first is the Stalnakerian common ground (CG) (Stalnaker, 1974). Following Gunlogson (2003), we treat the CG not as a primitive, but rather as the intersection of the participants' public discourse commitments (DC). The public discourse commitments and the CG contain propositions – sets of possible worlds; the worlds that are live possibilities for all participants form the context set notated  $\text{info}(\text{CG})$ . The context set is structured as a preference state, so that its worlds are partitioned into issues (live alternatives in CG, notated  $\text{altr}(\text{CG})$ ) and preferences (pairs of alternative propositions, notated  $\text{pref}(\text{CG})$ ) that are jointly accepted by all the interlocutors for the purposes of the conversation.

This preference state constitutes the target domain for conversational moves. Some aspects of a conversational move update this target directly: the words and intonation used, the current speaker (Ginzburg, 1996); and arguably information conveyed by evidentials and appositives (Murray,

2010, 2014, among others). However, at-issue content of a move gets into the target only when all interlocutors agree. This collaborative nature of the target domain update is a key feature of the conversational dynamics (cf. Farkas and Bruce 2010, and proposals such as Groenendijk and Roelofsen (2009); Farkas and Roelofsen (2012) in the Inquisitive Semantics framework). Thus, a move initiating a proposal to update the target domain will typically fall short until the hearer agrees (contra Gunlogson (2003) for  $DC_{\text{hearer}}$  and Portner (2007) for the To-Do-List of the hearer). The hearer's agreement puts the content in the target preference state.

Moves that fall short of the target domain direct their content to the scoreboard component termed the Table (Farkas and Bruce, 2010) instead. We base this scoreboard component on previous models proposing a stack or list containing questions under discussion (QUDs) (Roberts, 1996; Ginzburg, 1996, among others)<sup>2</sup>. We introduce two innovations into the notion of the Table that allow us to model *ba*, and provide a framework for modeling both direct and indirect effects of a variety of speech acts. As a first innovation, we propose that the objects on the Table are not semantic questions (sets of propositions), but rather potential updates of the target domain – that is, preference states updated with the proposed content. This will allow us to model moves that are in some sense meta-linguistic in that they refer to the proposed update of the preference state.

In addition to the updated preference states, the Table will contain a propositional discourse referent identifying at-issue content. This referent is probably recoverable from the preference states on the Table, but it clarifies the exposition to track it separately. This propositional discourse referent provides antecedents for anaphora, such as “yes/no” (Farkas and Bruce, 2010; Murray, 2010, 2014). The proposed update differs in the degree of speaker commitment or preference for the discourse referent proposition.

Our second innovation is to articulate the Table into two distinct parts, which distinguish moves according to the level of conveyed speaker authority and expected addressee engagement. This is modeled as a two-part division of the Table into  $\text{Table1}_{\text{choices}}$  and  $\text{Table2}_{\text{proffer}}$ .

Putting a proposal on  $\text{Table2}_{\text{proffer}}$  is the next best thing to reaching the target domain – it proposes a single move to update that target domain. This is somewhat similar to Beyssade and Marandin (2006)'s “call on the addressee.”  $\text{Table2}_{\text{proffer}}$  cannot contain incompatible proposals. The expected level of hearer's engagement with such a move is minimal – explicit or implicit acceptance of the move will advance the content to the target domain.

Consider a declarative assertion that *A*, as in (8). The initial CG preference state is  $\{< \{w_{AB}, w_{Ab}, w_{aB}, w_{ab}\}, \emptyset >\}$ . After a declarative *A* is uttered, the Table contains, first, the proposed update  $\text{CG}[A] = \{< \{w_{AB}, w_{Ab}\}, \emptyset >\}$ , as in (8b), and second, the propositional discourse referent made salient by this assertion,  $A = \{w_{AB}, w_{Ab}\}$ . The at-issue proposition *A* is proposed to be added to the information of the CG preference state. The inference one can draw from these

<sup>2</sup>Our notion of the Table seems closer to Ginzburg's than to Roberts's QUD, in that it allows preference states that have no live issues, such as proposals to update the context set with an assertion.

Table contents is that the speaker is publicly committed to  $A$ , and that there is a high degree of speaker's authority/commitment to  $A$ . The hearer's expected involvement is just acceptance of this move. These are all the hallmarks of a  $\text{Table2}_{\text{proffer}}$  move.

Turning to another example, consider an imperative directive in favor of  $A$  in the context of the same initial CG,  $\{< \{w_{AB}, w_{Ab}, w_{aB}, w_{ab}\}, \emptyset >\}$ , see (10b). The Table contents after an imperative "Do  $X$ !" is uttered consist of, first, the proposed update:  $\text{CG}[\text{Do } X!] = \{< \{w_{AB}, w_{Ab}\}, \{w_{aB}, w_{ab}\} >\}$ , as in (10b). Second, the Table contains the same discourse referent as with the declarative example above,  $A = \{w_{AB}, w_{Ab}\}$ , where  $A$  = "the hearer will perform action  $X$ ". As noted above, if the hearer agrees,  $A$  will typically enter into the context set  $\text{info}(\text{CG})$ : that is, if the move is accepted and this preference enters the Common Ground, the requested action will typically become optimal and the hearer will choose to perform it, making  $A$  true. The at-issue proposition  $A$  is promoted in the preferences in the CG, which, as with the declarative example, indicates a high degree of speaker's authority/commitment to  $A$ . The hearer's expected involvement in advancing this preference state towards the target domain is just acceptance. Thus, imperative directives are, like declarative assertions,  $\text{Table2}_{\text{proffer}}$  moves.

In sum, in both the declarative and imperative examples above, the Table contains a proposal that the at-issue proposition be used as a single update of  $\text{info}(\text{CG})$  or  $\text{pref}(\text{CG})$ . The Table contains no incompatible proposals. The hearer's expected engagement in advancing the conversation is acceptance. This kind of proposal is the next best thing to reaching the target and updating the CG directly.

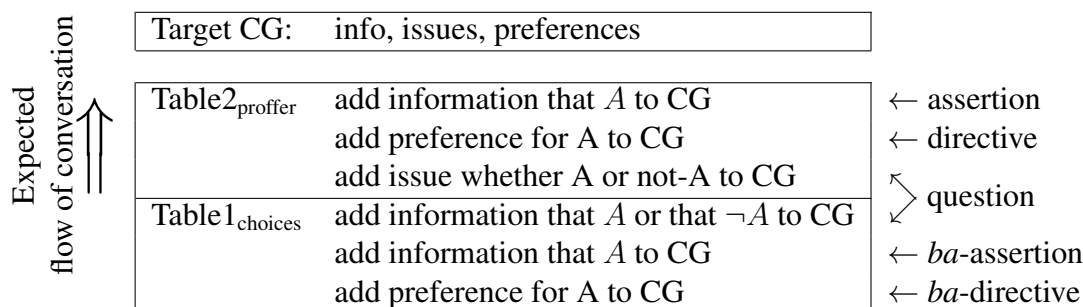
In contrast,  $\text{Table1}_{\text{choices}}$  establishes the conversational goals, conceptualized as a choice of one or more updates. A conversational goal is in 1-to-1 correspondence with a QUD, or an issue in the sense of Farkas and Bruce (2010) – a set containing one or more propositions. When one or more updates are placed on  $\text{Table1}_{\text{choices}}$ , the hearer is expected to make a proposal by advancing a single option to  $\text{Table2}_{\text{proffer}}$  or to the target domain.

For example, consider a polar interrogative question whether  $A$ . The initial CG, as before, will be  $\{< \{w_{AB}, w_{Ab}, w_{aB}, w_{ab}\}, \emptyset >\}$ , see (9b). After an interrogative is uttered, the proposed update on the Table is  $\text{CG}[A?] = \{< \{w_{AB}, w_{Ab}\}, \emptyset >, < \{w_{aB}, w_{ab}\}, \emptyset >\}$ . The discourse referent is, as before,  $A = \{w_{AB}, w_{Ab}\}$ . The proposal is to advance the issue whether  $A$  to the target domain, and this proposal requires only the hearer's acceptance to advance, so it's a  $\text{Table2}_{\text{proffer}}$  move involving an issue. However, there is additionally the proposal to eventually advance one of the answer propositions to the  $\text{info}(\text{CG})$ . The hearer's potential involvement is to determine which proposition should be added to the CG. Note that an interrogative question is not proposing to add the at-issue proposition  $A$  to  $\text{info}(\text{CG})$  – rather, it's proposing to eventually add either  $A$  or  $\neg A$ . This indicates a low degree of speaker's authority/commitment to  $A$ , and a higher degree of hearer's potential involvement in advancing content towards the target domain (in this case, determining the content of the eventual update).

This is indicative of a  $\text{Table1}_{\text{choices}}$  move: putting a proposal on  $\text{Table1}_{\text{choices}}$  establishes the conversational goals without proffering the at-issue proposition as information or preference to be added to the CG. A comparison between questions and assertions brings out the differences between  $\text{Table1}_{\text{choices}}$  and  $\text{Table2}_{\text{proffer}}$  moves. Questions recruit addressee involvement in decisions about potential updates and thus are  $\text{Table1}_{\text{choices}}$  moves. In contrast, assertions proffer a single update directly, and thus are  $\text{Table2}_{\text{proffer}}$  moves.

The conversational model thus consists of the target domain and the two-part Table. The dynamics of conversation includes the interlocutors' expectation that content will progress towards the target domain as part of the normal progress of conversation. The model is summarized in (11) below.

(11)



With all the ingredients for the semantics of clause types and the pragmatics of speech acts in place, we can now turn to *ba*.

## 4. Pragmatic inferencing and the effects of *ba*

### 4.1. The function of *ba*

We proposed, informally in (6), that *ba* transfers the authority for the conversational move represented by the anchor away from the speaker. We can now formalize this proposal: *ba* marks the update conveyed by the anchor as destined for  $\text{Table1}_{\text{choices}}$ . In addition, *ba* presupposes that the update conveyed by the anchor isn't already destined for  $\text{Table1}_{\text{choices}}$ ; that is, the use of *ba* presupposes that it is not redundant.

Within this system, the structure of the update process – and specifically, the shared expectation that content is to advance forward along the Table1-Table2-target path – allows for generation of inferences based on the choices of discourse participants. For instance, in this model we assume that a speaker may direct a discourse move to any stage along the Table1-Table2-target path that s/he is authorized to change.<sup>3</sup> The speaker is expected to advance the content as far as s/he can along this path. As a result of this expectation, if a speaker chooses to place content at an earlier

<sup>3</sup>Note that the update made by an utterance cannot be derived from utterance denotation alone in this system, contra Groenendijk and Roelofsen (2009), among others, cf. non-default initiatives in Farkas and Roelofsen (2012).

stage, this will generate additional inferences (Grice, 1975) – such as reluctance, uncertainty, or deference – the precise nature of which will depend on the discourse context. This process of inferencing, we argue, is the means by which the four observed effects of the particle *ba* are derived from the underlying function that we have proposed.

#### 4.2. Seeking hearer input

Examples (2) and (3), repeated below, exemplify inferences generated by a  $\text{Table1}_{\text{choices}}$  move when the addressee can reasonably be expected to advance the placed content. Recall that in these two examples, the effects of the particle *ba* amount to confirmation-seeking and softening, respectively.

- (2) *ni lian hen jiu le ba*  
 you.sg practice very long time PRT BA  
 ‘You (must have) practiced for a long time, (right?)’

- (3) *ni kuai jinqu ba*  
 you.sg fast enter BA  
 ‘Go in quickly.’

In utterance (2), the speaker moves to place on  $\text{Table1}_{\text{choices}}$  the proposed update  $\text{CG}[A] = \{ \langle \{w_{AB}, w_{Ab}\}, \emptyset \rangle \}$ , and the propositional discourse referent  $A = \{w_{AB}, w_{Ab}\}$ . In utterance (3) the speaker moves to place on  $\text{Table1}_{\text{choices}}$  the proposed update  $\text{CG}[\text{Do } X!] = \{ \langle \{w_{AB}, w_{Ab}\}, \{w_{aB}, w_{ab}\} \rangle \}$  and the discourse referent  $A = \{w_{AB}, w_{Ab}\}$  (where  $A = \text{“the hearer will perform action } X\text{”}$ ). As discussed above, the expectation is that a cooperative hearer will advance content from  $\text{Table1}_{\text{choices}}$  if possible. In both of the above cases, the hearer can reasonably be expected to advance the content (that is, there is no a priori reason in the context to suspect that the hearer cannot or will not advance the content – the addressee of (2) can reasonably be expected to know whether he has practiced for a long time, and similarly, the addressee of (3) can reasonably be expected to comply and go in to see his ailing grandmother). The hearer can infer from the speaker’s choice to place content on  $\text{Table1}_{\text{choices}}$ , rather than  $\text{Table2}_{\text{proffer}}$ , that the speaker is willing to commit to the placed content, but that this willingness is contingent on the hearer’s advancing the content to  $\text{Table2}_{\text{proffer}}$ , or to the target domain. In a context in which this action on the part of the hearer can reasonably be expected, such a move suggests a need for approval/confirmation of the update, perhaps for reasons of uncertainty or polite deference.

#### 4.3. Not seeking hearer input

Examples (4) and (5), repeated below, exemplify inferences generated by a  $\text{Table1}_{\text{choices}}$  move when discourse context alters default expectations about the hearer’s ability or willingness to advance

the placed content. Recall that the particle *ba* in these examples has effects of uncertainty and reluctance, respectively.

- (4) *yinggai bu cuo ba*  
 should neg bad BA  
 ‘Should be pretty good, (I’d say).’

In utterance (4), as in (2), the speaker moves to place on  $\text{Table1}_{\text{choices}}$  the proposed update  $\text{CG}[A] = \{< \{w_{AB}, w_{Ab}\}, \emptyset >\}$  and corresponding discourse referent as before. In this context, however, the utterance is a response to a question from the addressee. This changes the game: the addressee *cannot* reasonably be expected to advance the content from  $\text{Table1}_{\text{choices}}$ , having just requested this information herself. A  $\text{Table1}_{\text{choices}}$  move in such a context merits a reassessment of the intent of the move. In such a case, the hearer can reason that the speaker is showing unwillingness to move  $\text{CG}[A] = \{< \{w_{AB}, w_{Ab}\}, \emptyset >\}$  to  $\text{Table2}_{\text{proffer}}$ , knowing full well that his interlocutor cannot make this move either. A logical inference in this case is that the speaker, rather than soliciting confirmation, is expressing epistemic uncertainty.

- (5) *ni qu ba*  
 2sg go BA  
 ‘Go (if you must).’

In utterance (5), as in (3), the speaker moves to place on  $\text{Table1}_{\text{choices}}$  the proposed update  $\text{CG}[\text{Do } X!] = \{< \{w_{AB}, w_{Ab}\}, \{w_{aB}, w_{ab}\} >\}$  and corresponding discourse referent. Unlike (3), however, this utterance occurs in a context in which the hearer has in fact *pre-approved* (that is, actively encouraged, by requesting permission) an update of this kind. Making a move to  $\text{Table1}_{\text{choices}}$  for the sake of seeking approval is therefore redundant. The hearer can reason in this case that the speaker expects to become committed to the preference state favoring the action in question, but is intentionally choosing not to proffer the update directly. A logical inference in this case is that the speaker’s delay is expressing reluctance about the hearer’s carrying out of the action.

## 5. *Ba* as a window to indirectness

*Ba* can provide a window to (in)directness of its anchor’s meaning. This is because it only modifies the direct update of the anchor, as examples such as (12) suggest.

- (12) *wo xuyao yi gen bi ba*  
 1sg need one CL pen BA  
 ‘I need a pen, right?’

By itself, the anchor “I need a pen” can serve as an indirect request. However, modification with *ba* can serve to seek confirmation about the speaker’s need for a pen, and never about the hearer’s giving the speaker a pen. That is, (12) cannot mean “How about you give me a pen?”. Similarly, in the corpus example (13), the particle is interpreted as seeking confirmation for adding the proposi-



tion “It should be put back in order” to the CG, even though the anchor is a clear indirect request, and the entire utterance is ultimately interpreted as a request.

- (13) *ni zuotian shui na, huifu yuanzhuang shi yinggai de ba*  
 2sg yesterday sleep there, return original-state COP should PRT BA  
 ‘You slept there yesterday. It should be put back in order, correct?’

### 5.1. Interrogatives are not requests (generally)

As we noted in §2, *ba* is generally bad with interrogatives. Moreover, no examples were found in the three corpora we searched. However, many speakers accept interrogatives with *ba* in ‘impatience’ scenarios, such as (14)<sup>4</sup>.

- (14) The speaker is at a car dealership, and has asked the salesman about the price of the new car several times. The salesman keeps going on about the excellent qualities and features of the car. Finally, the speaker says:  
*zhe liang che (daodi) duoshao qian ba?*  
 this CL car (on earth) how much money BA  
 ‘How much (on earth) is this car?’ / ‘C’mon, tell me how much this car costs!’

Our proposal for *ba* explains those cases where *ba* is incompatible with questions, since we claim that *ba* presupposes that its anchor is not already a Table1<sub>choices</sub> move. So what might explain the rare examples that are felicitous? Two possibilities exist. A syntactic explanation is that in cases like (14), there is an implicit imperative embedding the question (e.g. that (14) is literally ‘Tell me, how much on earth is this car’). This is a lot of implicit material, which is why it requires an extra-clear special scenario to license it. However, this explanation is somewhat ad hoc – what exactly are the pragmatic conditions that license such implicit syntactic material?

Alternatively, note that questions are typically requests for information. A question, in our model, corresponds to putting on Table2<sub>proffer</sub> the proposal to add to altr(CG) the issue consisting of possible answers, and putting on Table1<sub>choices</sub> a proposal to update the info(CG) with one of the answers. The general expectation that interlocutors will try to advance the content towards the target results in the typical inference that the question is also a request for the hearer to give an answer.

An alternative explanation for the felicitous uses of *ba* in impatience scenarios, and one that we prefer, is that in the felicitous cases of *ba*-interrogatives, the proposed update is actually already on the Table – since, e.g., in (14) the speaker has already asked about the price. The *ba*-modified utterance is therefore coerced into a directive interpretation, whereby the (somewhat indirect) in-

<sup>4</sup>We thank Dun Deng for this example in particular, and for a very fruitful discussion of *ba* with interrogatives in general.

ference that the hearer should give an answer to the question becomes reified as the proposal to update the CG with a preference in favor of the hearer giving an answer. This is the same meaning as the (*ba*-modified) imperative directive “Tell me the answer”.

On this explanation, we see a slight relaxation of the notion that *ba* only modifies the direct meaning of the anchor. However, even in these interrogatives, the meaning that *ba* modifies is not so very indirect: after all, every question is, as a default, interpreted as a request for an answer; this inference is part of the direct meaning of the interrogative (proposals on Table 1<sub>choices</sub> that an answer be added to the CG) coupled with the nature of the conversational model (that the hearer is expected to advance that proposal towards the target). The fact that these felicitous uses are so very rare suggests that *ba* modifies the direct update of the anchor, unless there is a good reason to do something else. In the ‘impatience’ scenarios, the reason is that the direct update has already been performed several times in the conversation.

## 5.2. Performative modals and verbs

Sentences with deontic modals can be used performatively in Mandarin, as in English. For instance, (15) can be used to impose on the hearer the obligation to give the speaker a pen.

- (15) *ni yinggai gei wo yi zhi bi*  
 2sg should give 1sg one CL pen  
 ‘You should give me a pen’

On some theories (e.g. Schwager, 2006b,a, and subsequent work), the meaning of performative modals is very close to that of imperatives. Yet modification with *ba* takes away the performativity of this anchor, as shown in (16).

- (16) *ni yinggai gei wo yi zhi bi ba*  
 2sg should give 1sg one CL pen BA  
 ‘You should give me a pen, shouldn’t you’  
 NOT ‘How about you give me a pen’

The above example seeks hearer confirmation on existing obligation, and not on a new request. It is about adding information to the CG, and not about preferences and actions.

Turning to performative verbs, we note that *ba* takes away the performative flavor from the explicit performative anchors, but not their commissiveness, as (17) demonstrates.

- (17) *wo mingming zhe sou chuan wei longchuan ba*  
 1sg name this CL ship as dragon-boat BA  
 #‘I am naming this ship The Dragon, am I not?’  
 ‘How about I name this ship The Dragon’

One possible explanation for this pattern is that sentences with performative verbs and modals are direct assertions. Performativity emerges indirectly, and since *ba* only modifies the direct update of the anchor, it takes away the performativity of these examples. Note that the contrast with *ba*-modified interrogatives suggests a scale of indirectness, on which questions as requests for information are more direct than performative modals or explicit performatives. Explicit performatives, as tested by *ba*, are also direct commissives, to which we turn next.

### 5.3. Clause types in Mandarin

If we assume that *ba* modifies the direct update of the anchor, an intriguing possibility is presented by anchors that update preferences regarding joint speaker-hearer action – that is, hortatives such as (18); as well as those that update preferences regarding speaker action – that is, commissives such as (19) from Chu (2009).

- (18) *women yiqi qu chifan ba*  
 we together go eat BA  
 ‘Let’s/How about we go eat together’

- (19) The speaker has pledged \$100 to a charitable cause, but his interlocutor is unsatisfied and protests that the speaker should donate more. The speaker responds as follows:

*na wo jiu juan liangbai ba*  
 then I just donate two-hundred BA  
 ‘Well, then, (I guess) I’ll donate 200.’ (Chu, 2009)

The example in (19) is a classic example of the particle contributing an effect of reluctance.

Note that while the anchors in (18) and (19) take the same form as assertions, the presence of *ba* reveals two separate possible update types for this form, apparently corresponding to assertion-type and commissive- or hortative-type speech acts. For instance, a sentence of the surface form “I go first BA”, can mean “I go first, right?” (assertive anchor), or alternatively “How about I go first?” (commissive anchor).

This suggests the existence of hortative and commissive clause types in Mandarin. These can easily be accommodated in Starr’s model: a hortative or a commissive update is similar to a directive

update. It adds to the CG a preference in favor of a joint speaker-hearer action or in favor of a speaker action.

An alternative explanation is that these are declaratives and are indirectly interpreted as commissives and hortatives. If this latter explanation is right, this would mean that hortative and commissive interpretations for declaratives in (18) and (19) are more direct than request-for-information interpretations for interrogatives, as in (14), and much more direct than performative interpretations for declaratives with deontic modals, such as (16), and explicit performative verbs, such as (17).

## 6. Concluding discussion

Our proposal builds on much prior work, most immediately on the model of conversation explored in Farkas and Bruce (2010) and subsequent work, and the dynamic semantics of clause types discussed in Starr (2010); Murray (2014); Murray and Starr (2015). Could these models handle *ba*? An immediate problem that arises for Farkas and Bruce (2010) and subsequent work is that these models are limited to assertive and inquisitive updates which target the Stalnakerian CG. In Ettinger and Malamud (2013) we attempt to address this by extending the model to include updates that target the To-Do-List of the speaker (commissive-type) and of the hearer (directive-type), following Portner (2004, 2007). This has the important drawback that there is no plausible way to treat sentences that contain different types of clauses, such as (20) below.

- (20) *ni changge wo tiaowu ba*  
 2sg sing 1sg dance BA  
 ‘How about you sing and I’ll dance?’

In (20), the connective conjoins an imperative clause with a declarative or commissive, corresponding to different kinds of updates. Thus the anchor in (20) is not of a single mood and so, as Portner (2007) makes clear, there is no way to assign an update type to it. The conjunction in (20) clearly operates on (direct) updates, and not just the semantic contents. This cannot be easily modelled in Ettinger and Malamud (2013), especially once we consider additional connectives (e.g., *Sing or I will dance*).<sup>5</sup>

The need to go beyond assertive and inquisitive updates also has the consequence that the behavior of *ba* cannot be captured by the pragmatic model in Malamud and Stephenson (2014). The model builds on Farkas and Bruce (2010) to account for the differences among three utterance modifiers in English. In addition to the participants’ public commitments making up the CG, the model proposes a set of projected commitments for each participant. This allows for modification of assertive moves (which target commitments, and thereby the CG). To capture *ba* and cover directive, commissive, and hortative updates, the model can be extended in two ways. One is the path we

<sup>5</sup>See a detailed discussion in Murray and Starr (2015, among others).

take in this paper, to split the Table rather than commitment sets. Another is to add projected preference states (which would include issues and preferences) rather than projected commitment sets, for each speaker. It is beyond the scope of this paper to investigate such a model.

Finally, Murray (2014); Murray and Starr (2015) build on the unified semantics of clause types proposed in Starr (2010) to provide, among other things, an analysis of several utterance modifiers, namely, Cheyenne evidentials (cf. Murray 2010). In their system, evidentials add a not-at-issue proposition to the CG (that is, the proposition is added to the target preference state directly without the need for the hearer to agree). This not-at-issue proposition gives the source of evidence that the speaker has for the at-issue proposition (the anchor), for instance, that the speaker has reportative evidence for the anchor. Pragmatic inferences may then weaken the perceived epistemic commitment the speaker has for the anchor proposition (for instance, if the source of the reportative evidence was not very authoritative). Adopting this analysis for *ba*, we could propose that it adds the not-at-issue proposition that the speaker is not willing to fully update the target CG preference state with the anchor. This is a very meta-linguistic proposition, referring to the update and the target preference state. A conversational model that allows such propositions would wield enormous power. Perhaps such power is precisely what is needed to analyse the rich and varied set of utterance modifiers across languages, but for the present we prefer to explore a more constrained model to better understand how the pragmatics of speech acts arises from the semantics of clause types.

To sum up, we have examined the utterance-final particle *ba* in Mandarin, and proposed an analysis for it that gives a unified treatment of various speech acts, and a handle on meta-linguistic moves. The structure of the model together with the context of the utterance gives rise to implicatures, deriving the various effects of the particle.

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## What's included in the set of alternatives? Psycholinguistic evidence for a permissive view

Nicole Gotzner - Zentrum für Allgemeine Sprachwissenschaft (ZAS)

**Abstract.** According to a standard permissive view, the set of alternatives consists of various possible replacements of a focused expression (Rooth 1985, 1992). On the other hand, a more restrictive view assumes that certain alternatives are excluded from consideration such as elements which do not form a partition (e.g., Wagner 2006, 2012). I will try to adjudicate between these two theories by looking at the question which elements listeners consider as part of the alternative set. The data presented here suggest that listeners consider a broad set of possible replacements of a focused expression even when a set of particular elements is enumerated contextually. Therefore, the data are most in line with a permissive view of alternative sets such as the one proposed by Rooth (1985, 1992). Albeit, listeners do not consider the entire focus semantic value but rather a *partially-restricted set* – an intermediate set between the focus semantic value and the actual/relevant set of alternatives.

**Keywords:** Alternative set, focus semantics, focus particles, contextual restriction

### 1. Introduction<sup>1</sup>

The function of focus is to evoke a set of alternatives. However, it is an open theoretical question which elements are included in the alternative set and at which level restriction applies (see especially Rooth 1992; Blok & Eberle 1999; Cohen 1999 and Umbach 2001).

In his paper entitled *A note on contrast*, Katzir (2013) compares the standard Roothian view of alternatives to a more restrictive one. I will follow Katzir in using the terms *permissive* and *restrictive* here. On the permissive view advocated by Rooth (1985, 1992), the formal set of alternatives contains various possible replacements of a focused expression and restriction applies at the level of pragmatics (independent of compositional semantics). On a restrictive account, on the other hand, certain alternatives are excluded from consideration. For example, according to Wagner (e.g., Wagner 2006, 2012), alternatives need to form a partition/be mutually exclusive. His proposal is motivated by the examples in (1) listed below (see Katzir 2013 for a detailed discussion; examples are taken from Wagner 2006).

- (1) a. John only likes [red]<sub>F</sub> convertibles
- b. John likes blue convertibles
- c. John likes cheap convertibles

Wagner points out that the sentence *John only likes [red]<sub>F</sub> convertibles* negates that John likes blue convertibles but does not necessarily state anything about cheap convertibles. In other

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words, it seems that (1)-c is ignored as an alternative to (1)-a. Therefore, Wagner proposes that only those elements which are mutually exclusive can form part of an alternative set (e.g., *red* and *blue* but not *red* and *cheap*). His account relies on the assumption of contrast between elements of the alternative set.

In the standard view of alternative sets by Rooth (1992), on the other hand, alternatives simply need to match the focused expression in semantic type. For the given example, *cheap* is a potential alternative to (1)-a because it can replace the focused element *red*. In the framework of focus interpretation proposed by Rooth (1985, 1992), a focused expression has two meaning components, an ordinary value and a focus semantic value. Consider the following example presented in (2) (Rooth 1992, p. 2).

- (2) a. Mary likes [Sue]<sub>F</sub>  
 b. Ordinary value  $[[\cdot]]^o$ : like (Mary, Sue)  
 c. Focus semantic value  $[[\cdot]]^f$ : like (Mary,  $x \mid x \in E$ ), where E is the domain of individuals

The ordinary value of the sentence *Mary likes [Sue]<sub>F</sub>* corresponds to its usual meaning as derived by compositional semantics. The focus semantic value is derived by replacing the focused element with other suitable elements of the same semantic type (Mary likes  $x$ ). The intuition is that focus evokes a set of alternatives: In the given example this amounts to a set of persons Mary might like. By definition, the focused element is always a subset of the focus semantic value and it needs to contain an element distinct from the focused element (in the case of focus marking). However, the semantics of focus does not involve contrast in the sense that alternatives are excluded or negated on this view (see also Büring 2008 for a discussion of the notion of contrast in alternative semantics).

Rooth (1992) further spells out the theory of focus and proposes constraints on the set of alternatives. In particular, he assumes that the actual set of alternatives is not identical to the focus semantic value but it is a subset of it, which is further constrained by context. Contextual restriction is managed by a free variable C in LF, whose domain of quantification is determined by pragmatics. Hence, on the permissive view restriction of the set of alternatives does not apply at the level of semantics or *a priori*. Further, focus particles like *only* do not quantify over the entire focus semantic value but rather over the contextually-restricted set of alternatives.

Katzir (2013) shows how the puzzle posed by Wagner's examples in (1) can be reconciled in the standard permissive view by eliminating contradiction. Here, I take a psycholinguistic approach to explore the question which elements are included in the alternative set. In particular, I will probe the question whether listeners consider only a contextually-restricted set of alternatives or rather a broader set of possible alternatives. The aim of the following analysis is to see which account, the permissive or restrictive, makes better empirical predictions concerning the question of how the set of alternatives is composed when listeners encounter a focused expression. There is no doubt that alternative sets need to be restricted in some way (see especially Rooth 1992; Blok & Eberle 1999; Cohen 1999 and Umbach 2001). Despite this fact, I will show that listeners have access to a broader set of alternatives rather than only the small contextually-restricted set.

The nature of this set is *partially-restricted*<sup>2</sup> in that listeners do not consider the entire focus semantic. I will conclude that the data are most in line with a permissive view of alternative sets.

## 2. Previous psycholinguistic studies on the retrieval of alternatives

### 2.1 Activation of alternatives in the lexical decision task

Recently, a growing interest in the cognitive reality of alternative sets has emerged and several psycholinguistic studies have provided evidence that listeners entertain alternatives upon processing focal information (Braun & Tagliapietra 2010; Fraundorf, Watson & Benjamin 2010, 2013; Kim 2012, 2015; Byram-Washburn 2013; Gotzner, Spalek & Wartenburger 2013; Spalek, Gotzner & Wartenburger 2014, Gotzner, Wartenburger & Spalek accepted and Husband & Ferreira 2015; see Gotzner 2015 for a detailed overview). Here, I focus on investigations using the lexical decision paradigm, which provide direct insights into the retrieval of alternatives. In this paradigm, participants hear auditory stimuli and are presented with letter strings on the screen. Their task is to indicate whether a given letter string is a word or not (e.g., APPLE vs. UNPER). Participants' reaction times to an existing word are taken to indicate to what extent this particular word is activated. Put differently, reaction times in the lexical decision reflect whether a word is already present in a listener's mind, referred to as priming.

In a pioneering study, Braun & Tagliapietra (2010) used the lexical decision paradigm to test whether intonational focus activates alternatives. In particular, they compared utterances realized with contrastive and non-contrastive intonational contours and asked participants to recognize unmentioned semantic alternatives and words unrelated to the focused elements. The results showed that contrastive intonation speeded up reaction times to alternatives as compared with unrelated items (priming effect). Interestingly, such a priming effect was not observed when the sentences were realized with a non-contrastive intonational contour. Therefore, the results provide evidence that contrastive intonation creates a representation of an alternative set when no such set is enumerated contextually.

### 2.2. Contextual alternatives and the retrieval of additional alternatives

Concerning the question which elements are included in the set of alternatives, a study by Gotzner et al. (accepted) provides some initial evidence favoring a permissive view of alternative sets along the lines of Rooth (1992) (see also Gotzner 2015, Chapter 4). In this study, we explored the question whether listeners consider additional unmentioned alternatives when we provide them with a contextual set of elements. Participants listened to short discourses that introduced a set of three elements and mentioned two of those elements again (see (3)).<sup>3</sup>

<sup>2</sup> I thank Judith Tonhauer for dubbing this term.

<sup>3</sup> The correction in the critical sentence was used to ensure that all elements were mentioned the same number of items and to smooth the discourse. Note also that the focused element in the critical sentence of speaker 2 is in narrow focus position since all other material is given in the utterance of speaker 1.

- (3) Context sentence (speaker 1):  
 In der Obstschüssel liegen Pfirsiche, Kirschen und Bananen.  
 'In the fruit bowl, there are peaches, cherries, and bananas.'

Continuation sentence (speaker 1):  
 Ich wette, Carsten hat Kirschen und Bananen gegessen.  
 'I bet Carsten ate cherries and bananas.'

Critical sentences (speaker 2):  
 Nein, er hat nur /\_ [Pfirsiche]<sub>F</sub> gegessen.  
 'No, he only/\_ ate [peaches]<sub>F</sub>.'

We varied whether the focus particle *only* or no particle appeared in the third critical sentence while the focused element was intonationally marked in both conditions (narrow focus). The rationale was that the computation of alternatives is necessarily involved with focus particles, because such particles grammatically depend on a set of alternatives (Rooth, 1992; see also Beaver & Clark, 2008). Therefore, we expected to observe stronger activation of alternatives and/or stronger competition among members of the alternative set with *only* compared to no particle. After exposure to the discourses, a target word appeared on the screen that was either a mentioned alternative (PEARS), an unmentioned alternative of the same semantic category (APPLES) or an unrelated word (SOCKS).<sup>4</sup> The items we tested were (possible) alternatives to the NP in narrow focus position.<sup>5</sup>

In the first experiment, participants performed a lexical decision task. The results showed that reaction times were fastest for mentioned alternatives, intermediate for unmentioned alternatives and slowest for unrelated items. These results demonstrate that (i) mentioned alternatives receive the highest amount of activation (by virtue of being mentioned and/or repeated) and that (ii) additional unmentioned alternatives become activated. In other words, listeners most strongly considered the mentioned alternatives, suggesting that these alternatives are the most relevant ones. Crucially, listeners also considered further possible alternatives. Moreover, we found that responses were slower in the condition with *only* compared to no particle referred to as an interference effect. This interference effect of the focus particle *only* indicates that identifying the relevant alternatives is subject to competition among members of the alternative set. Put differently, a comparison is being made among the set of possible alternatives.

In a second experiment, we further investigated (i) the question whether listeners consider additional unmentioned alternatives and (ii) the nature of the interference effects of focus particles. We used a probe recognition task, which is a variant of the lexical decision task. In this task, participants heard the same auditory discourses and were then asked to indicate whether a

<sup>4</sup> These items were matched in word length and frequency (see Gotzner et al. 2015 for details).

<sup>5</sup> It may be argued that focus projects to the VP level in the given examples. But in any case Breen, Fedorenko, Wagner, and Gibson (2010) present evidence that speakers and listeners reliably distinguish between narrow and broad focus.

word had appeared in the discourse or not. The probe recognition task requires listeners to create a mental model of the discourse and to match the given word with that model. So, participants need to compare the word they see on the screen with what they recall from the discourses. Results again showed that participants were slower at recognizing the mentioned alternatives as well as unmentioned alternatives in the condition with *only* compared to no particle. In contrast, such an interference effect of focus particles did not show for unrelated items. Hence, the results provided further evidence that listeners consider mentioned as well as unmentioned alternatives. Further, we found similar interference effects for the additive scalar particle *sogar* ('even') as with *nur* ('only') (see König, 1991 for a comparison of the two types of particles). This indicates that the observed interference effects are due to the grammatical dependence of focus particles on an alternative set and not the exclusive meaning of *nur* ('only'). Overall, the study showed that listeners entertain a set of mentioned and unmentioned alternatives and that focus particles induce additional competition among members of the alternative set.

We assume that these competition mechanisms ultimately help narrowing down the set of alternatives to its relevant members – the contextually-restricted set over which focus particles quantify. Crucially though, listeners initially consider a broader set of alternatives and the restriction of this set requires time (see Husband & Ferreira 2015). In sum, these previous experiments indicate that alternative sets are established by two mechanisms: (i) activation of a broad set of possible alternatives and (ii) subsequent restriction to relevant alternatives by competitive inhibition.

Strikingly, in Gotzner et al. (accepted) a set of three elements was listed in the context but nonetheless participants were considering additional unmentioned alternatives. This finding is consistent with the assumption of the permissive view that multiple possible replacements are part of the set of alternatives (Rooth 1992). However, an important caveat to this assumption is that the unmentioned alternatives used in Gotzner et al. were of the same semantic/taxonomic category as the focused element. One might therefore argue that the observed effects were heavily based on general semantic priming mechanisms and not necessarily based on the computation of/access to alternatives. The effect of focus particles ameliorates this concern to some extent but to inform the permissive/restrictive debate we would like to rule out the semantic relatedness factor. To provide further insight on the debate, I will present an additional analysis of the unrelated items used in Gotzner et al. The goal is to see whether such items are considered as part of the alternative set in certain contexts.

### 3. Novel analysis: Are unrelated items considered as part of the alternative set?

#### 3.1. Rationale

In the following, I will make a similar restriction argument for the unrelated items used in Gotzner et al. (accepted) as for Wagner's examples of mutually exclusive adjectives (presented in (1) above). Consider the examples in (4).

- (4) Context: Anna wanted to buy apples, bananas and cherries at the fruit store. However, the store was almost empty.
- a. She only got to buy [apples]<sub>F</sub>.
  - b. She got to buy pears.
  - c. She got to buy socks.

The sentence (4)-a *She only got to buy apples* negates the alternative (4)-b that Anna bought *pears*. However, it does not make a statement about other types of things Anna could have bought like *socks*. So, (4)-c is again ignored as an alternative to (4)-a similar to what we saw in (1) for adjectives. This is also evident in the fact that the discourse could be continued by saying *In fact, she also got to buy socks* without any contradiction (though some information has to be accommodated here). Hence, on the restrictive view *socks* is not an alternative to *apples*. On a permissive view, on the other hand, *socks* would be included in the set of alternatives since it is a possible replacement of the focused element *apples*.

In Gotzner et al. (accepted), about half of the unrelated items were possible replacements of the focused element while the other half were not.<sup>6</sup> Consider the two examples displayed below:

- (5) **Possible replacement:**  
 Im Katalog sind Hemden, Hosen und Jacken.  
 'There are shirts, trousers, and jackets in the catalogue.'
- Ich wette, Matthias hat sich Hemden und Hosen gekauft.  
 'I bet Matthias has bought shirts and trousers.'

<sup>6</sup> A closer inspection of other previous psycholinguistic studies revealed that different types of unrelated targets have been used. Braun and Tagliapietra (2010) and Byram-Washburn (2013) used unrelated items that could replace the focused expression. In Husband and Ferreira (2015), on the other hand, most unrelated items could not replace the focused elements (e.g., *The grandmother purchased some [fabric]<sub>F</sub> for her new project*, unrelated item: HOLY).

Nein, er hat sich nur /\_ [Jacken]<sub>F</sub> gekauft.

'No, he only /\_ bought [jackets]<sub>F</sub>.'

Unrelated item = LYCHEES

(6) **No replacement:**

Auf der Wiese sind Bienen, Fliegen und Mücken.

'There are bees, flies, and mosquitos on the meadow.'

Ich wette, Karl hat Mücken und Bienen gefangen.

'I bet Karl has caught mosquitos and bees.'

Nein, er hat nur /\_ [Fliegen]<sub>F</sub> gefangen.

'No, he only/\_ caught [flies]<sub>F</sub>.'

Unrelated item = SOFAS

In (5), the unrelated item *lychees* can potentially replace the focused expression in the critical sentence 'No, he only/\_ bought [jackets]<sub>F</sub>' even though the sentence might not make a statement about *lychees*. Depending on the account, permissive or restrictive, the *lychees* in (5) can be considered as an alternative to *jackets* or not. In (6), on the other hand, the unrelated item *sofas* cannot replace the focused element in the critical sentence 'No, he only/\_ caught [flies]<sub>F</sub>'. Hence, it is not an alternative to *flies* on either of the two accounts.

According to Rooth (1985, 1992), the focus semantic value is derived by substituting the focused elements with elements of the same semantic type. This implies that unrelated items could be part of the alternative set if they can replace the focused expression. Note that the theory does not state that elements of the alternative set are part of the same semantic/taxonomic category. For example, imagine the scenario presented in (7).

(7) Context: On Peter's shopping list, there is shower gel, apples and bread. The store he went to was almost empty.

He only got to buy [bread]<sub>F</sub>.

In the context of a shopping list with shower gel, apples and bread the sentence *He only got to buy [bread]<sub>F</sub>*, asserts that Peter did not buy shower gel or apples. The items of the list are not part of the same taxonomic category but nevertheless *shower gel* is a potential alternative because it can be inserted in the sentence frame *Peter bought x* (see Byram-Washburn 2013 for experimental evidence that alternative sets can be created by contextual mention of items from different taxonomic categories).

Crucially, the unrelated items used in Gotzner et al. (accepted) were not even mentioned in the context sentences. Since the context sentences introduced a specific semantic category and a specific contextual setting, items that are unrelated to the focused element or the context might

not be relevant. However, in Rooth (1992) no explicit distinction is made between unmentioned alternatives of the same taxonomic category and unrelated possible alternatives. Therefore, we may predict that unrelated possible alternatives are activated as well.

In the analysis presented below, I coded the unrelated items used in Gotzner et al. (accepted) according to whether they were possible replacements of the focused element in the critical sentences or not. I included this binomial factor in an additional analysis of the lexical decision data. The lexical decision data were used in order to assess the difference in activation of unmentioned (semantically related) alternatives and unrelated possible alternatives/replacements. The purpose of this additional analysis was to see whether listeners consider such unrelated possible replacements as part of the alternative set.

### 3.2 Predictions

For unrelated items which are not a possible replacement of the focused expression both accounts, the permissive and the restrictive account, make the same prediction, since these items are no potential candidates for a given alternative set. In particular, we expect to observe the same pattern of results presented in Gotzner et al. (accepted): Mentioned alternatives should be recognized fastest, unmentioned alternatives intermediate and unrelated items slowest.

The critical comparison adjudicating between the permissive and the restrictive account is the recognition of unrelated possible replacements as compared with unmentioned alternatives (the elements of the same taxonomic category as the focused element). On a standard permissive account, such unrelated possible replacements should pattern along with the unmentioned alternatives, indicating that such items are activated/considered as part of the alternative set. The restrictive account, on the other hand, does not predict such a priming effect for unrelated items, so these items should be recognized slower than the unmentioned alternatives.

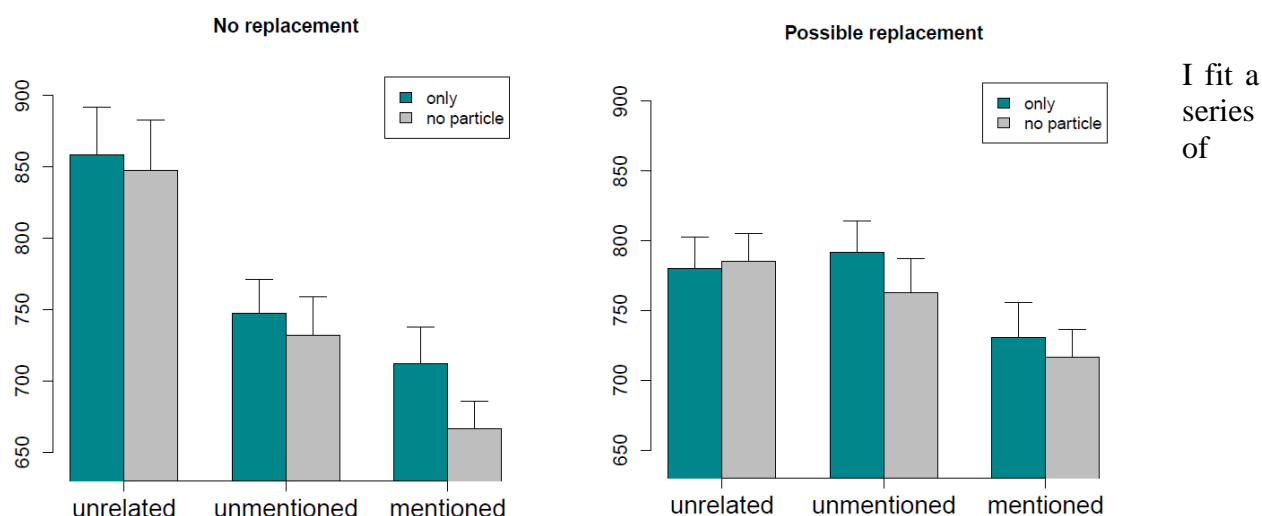
### 3.3. Coding

Three coders (a trained research assistant, a naive native German speaker and myself) coded the unrelated items according to whether they could replace the focused expression in the critical sentences or not. Only those items where judgments of the three coders converged were included in the analysis. Sixteen of the target words were possible replacements, eleven were not and three could not be clearly categorized. An additional binomial variable *possible replacement* (yes/no) was included in a mixed model analysis.

### 3.4. Results

Figure 1 shows the mean RTs across particle condition and target type. The left column presents items that could not replace the focused element and the right column shows possible replacements.

Figure 1: Mean RTs across target types for possible and non-replacements (lexical decision, error bars represent standard errors). Unrelated items are neither related to the focused expression nor context whereas mentioned and unmentioned alternatives are semantically-related to the focused expression.



mixed models following the procedure described in Baayen (2008). In the analysis, I included the factors particle condition (*only* vs. *no particle*), target type (mentioned, unmentioned, unrelated), trial number and the additional binomial factor possible replacement/no replacement as well as random effects for participants and items and random slopes for trial number. Possible replacements of the condition without a particle of the unmentioned alternatives were chosen as the baseline level. I only included an interaction term of the factors replacement and target type. The three-way interaction between particle condition, replacement and target type did not contribute to model fit ( $\chi^2(5) = 7.18, p = .20$ ). 50 additional outliers were removed from the final model based on the distribution of observed and fitted values.

The main effect of *only* was not significant ( $p = .13$ ), probably due to the fact that there were less items and observations in this model compared to the one by Gotzner et al. (accepted). As observed with the original data set, there was a significant difference between unmentioned and mentioned alternatives ( $t = -5.67, sd = .013, p < .0001$ ). Interestingly, however, the difference between unmentioned alternatives and unrelated items was not significant ( $p = .74$ ), indicating that unrelated possible replacements were recognized equally fast as unmentioned alternatives.



We were specifically interested in the effect of the variable replacement. The model revealed a main effect of the variable replacement: possible replacements were recognized faster than non-replacements ( $t = -2.49$ ,  $sd = .029$ ,  $p < .05$ ). Critically, there was also an interaction between the unmentioned alternatives and unrelated items concerning the factor replacement ( $t = 7.78$ ,  $sd = .02$ ,  $p < .0001$ ). This interaction indicates unmentioned alternatives were recognized faster than unrelated non-replacements while there was no such difference between unmentioned alternatives and unrelated possible replacements (as shown by the overall comparison presented above).

Finally, there was an interaction between mentioned alternatives and unmentioned alternatives concerning the replacement factor ( $t = 2.2$ ,  $sd = .02$ ,  $p < .05$ ), reflecting that the difference between mentioned and unmentioned alternatives was bigger for items categorized as possible replacements. This interaction might be due to the fact that the data set was not perfectly balanced (there were 16 possible replacements and 11 non-replacements) but it is not of theoretical relevance. The results of the mixed model are displayed in Table 1.

Table 1: Mixed model replacement analysis ( $n = 1696$ ,  $\log\text{-likelihood} = 484.2$ )

	Estimate	Lower Bound	Upper Bound	pMCMC
(Intercept)	6.5931	6.5343	6.6479	0.0001
Only	0.0121	-0.0039	0.0283	0.1396
Mentioned	-0.0742	-0.1007	-0.0480	0.0001
Unrelated	-0.0047	-0.0303	0.0218	0.7444
No replacement	-0.0727	-0.1271	-0.0155	0.0106
Trial number	-0.0016	-0.0021	-0.0011	0.0001
mentioned: no replacement	0.0444	0.0033	0.0853	0.0326
unrelated: no replacement	0.1609	0.1179	0.2006	0.0001

### 3.5. Discussion

The additional analysis of the lexical decision data replicated the effect that mentioned semantically-related alternatives are recognized fastest. Interestingly, it showed that unrelated replacements of the focused elements were recognized equally fast as unmentioned semantically-

related alternatives, suggesting that listeners considered a broader set of alternatives rather than a limited one. The analysis further revealed that items that could not replace the focused expression were recognized slowest, indicating that such items are not considered as part of the alternative set. This pattern of results is in line with the permissive account of alternative sets (Rooth 1985, 1992). In particular, the data suggest that unrelated items are part of the alternative set if and only if they are a possible replacement of a focused expression. The crucial aspect is that these unrelated items were not part of the same semantic network as the focused expression and they were not related to or mentioned in the context either. The permissive view assumes that items from different taxonomic categories can be considered as part of an alternative set. On the restrictive view, on the other hand, the unrelated items in these contexts might be excluded from consideration and there is no reason why these elements should be considered *per se*. In sum, the experiments favour a theory in which a formal set of alternatives contains various possible replacements instead of a theory where restriction applies locally/semantically. Note that I am not claiming all additional possible alternatives are in the focus of attention of a listener. Rather, the observed effects arise because focus introduces/leads to encoding of a variable sensitive to alternatives, which match the focused expression.

Importantly, I do not dispute that the alternative set is restricted/limited in some way. However, the data suggest that listeners have access to a broader set of alternatives before all contextual factors that restrict this set have applied. In Rooth's terms, listeners seem to have access to the variable *C* before its domain of quantification is identified. What is more, the data show that the actual set of alternatives is determined during real time processing of the utterance. Byram-Washburn (2013) provides further evidence showing that listeners use contextual information to build the set of alternatives. More specifically, she found that items of different taxonomic category were primed if they were introduced together contextually. The point of the data presented here was to show that listeners consider additional alternatives to those that are enumerated contextually. It would, however, be unreasonable to assume that listeners consider the entire focus semantic value. Rather we see that they are considering what I refer to as a partially-restricted set – intermediate between the focus semantic value and the set of actual alternatives.

The finding that listeners consider additional alternatives to a contextually-enumerated set is consistent with the literature on homonym comprehension and the comprehension of negation and metaphors. In particular, this research indicates that even in a rich context that biases a particular meaning of an expression, inappropriate meanings of that expression receive some amount of activation (e.g., Swinney, Onifer, Prather & Hirshkowitz 1979; Gernsbacher & Faust 1991 and see Giora 2012 for an overview on metaphors). Similarly, in the comprehension of negation listeners first represent the affirmative proposition followed by the negated one in a subsequent step (e.g., Kaup & Zwaan 2003). What might be the reason that listeners consider a broader set of alternatives to focused expressions? First of all, this might be a consequence of the way our cognitive system is organized and it seems that the construction of alternative sets relies in part on general cognitive mechanisms such as spreading activation (see Gotzner 2015 and Husband & Ferreira 2015). Second, certain alternatives are retained in memory (as shown in

Fraundorf et al. 2010, 2013 and Spalek et al. 2014), possibly to serve communicative goals (see especially Giora 2012 for such an account). In line with this assumption, studies by Kaiser (2010) indicate that participants are more likely to mention an alternative to a contrastively-focused expression later in the discourse.

To make a strong claim about the restrictive view proposed by Wagner (2006), it would be important to set up an experiment with the specific examples discussed by Wagner, comparing target items that are either mutually exclusive adjectives or not. The data presented here are more consistent with a permissive view of alternative sets but they cannot rule out this specific account. It is also important to note that ultimately focus particles like *only* quantify over the contextually-restricted set of alternatives. That is, a sentence with *only* excludes a small set of relevant alternatives, otherwise such sentences could never be appropriate (see Umbach 2001; Rooth 1992). The effect of *only* in the analysis presented here was not specific to possible replacements of a focused expression which was possibly due to the low number of observations. Gotzner (2015) provides additional evidence that focus particles interfere with the retrieval of unmentioned alternatives but not with general associates of a focused expression, indicating that some restrictions have already applied (see the next section for further discussion).

There is also one important caveat to the argument about possible replacements presented here. The distinction between possible replacements and non-replacements I and previous studies made was not purely based on syntactic considerations or semantic type match (as suggested by the Roothian framework). In many examples, possible replacements were determined by selectional restrictions of the verb and often some amount of world knowledge was involved. Nevertheless the results presented here suggest that this intuitive notion of possible replacements is a crucial factor in the establishment of alternative sets. It remains to be specified which exact factors restrict the set of alternatives, which I will turn to in the next section. The main point made here is that listeners do not only consider the small set of relevant alternatives but rather a partially-restricted set – an intermediate representation between the focus semantic value and the relevant alternatives.

#### 4. Factors influencing the restriction of the alternative set

We have seen that listeners have access to a broader set of alternatives rather than only the small set of relevant alternatives. Now, we would like to know which factors influence the restriction of the domain of quantification of the set of alternatives.

In Rooth (1992), the restriction of alternatives is entirely left open to pragmatics and not further spelled out, which has been criticized by Umbach (2001) and Cohen (1999). Umbach (2001) shows that anaphoric relationships play an important role in the restriction of alternative sets and therefore concludes that the selection of alternatives is a discourse-related phenomenon. Cohen (1999) argues that the Roothian view does not allow for a compositional computation of alternatives of complex sentences. He develops an account of alternatives based on

presupposition and discusses a variety of constraints on alternatives such as the selectional restrictions of the verb phrase (see also Blok & Eberle 1999). In a similar vein, Wagner (2012) shows that the head noun determines the alternatives to an adjective. For example, {*used*, *new*} may be appropriate alternatives if the head noun is *bicycle* but not when it is *boyfriend*.

The dissertation by Kim (2012) provides experimental evidence for a variety of factors that influence the restriction of alternative sets (see also Kim 2015). She employed a visual world paradigm to find out how the online interpretation of focus operators unfolds over time and how it interacts with the preceding context. In Experiment 1, participants were presented with auditory discourses that either contained the particle *only* or not (e.g., *Mark has some candy and apples. Jane only/ has some [oranges]<sub>F</sub>*). Kim found that participants were faster at disambiguating the focused element (a picture of oranges) from a phonological competitor (a picture of oars) when the discourses contained the particle *only*. This finding indicates that participants were using the semantic alternative mentioned in the context sentences (*apples*) to predict the upcoming focused element when they encountered *only*. In another experiment, Kim (2012) compared the lexical contributions of the particles *only* and *also* in contexts where the focused element was either mentioned in the first sentence or novel (but of the same semantic category). The eyegaze patterns showed that *only* and *also* elicit different expectations concerning the upcoming referents: Whereas participants were more likely to fixate a subset member of a semantic category (e.g., *apples* from the category fruit) in the case of *only*, they were more likely to fixate the superset of a category (a picture with different kinds of fruit) in the case of *also*. Kim attributes these findings to the meaning differences among the two groups of particles. She concludes that listeners keep track of the discourse status of an entity (old/new) and use this information to identify the alternatives required to interpret upcoming focused expressions.

In another set of experiments, Kim explores the impact of world knowledge, comparing situations that vary in informativity. She shows that in a narrow context (e.g., *a newsstand*) participants are better at predicting the focused element (*magazines*) compared to a wider context (*drugstore*). A study by Fraundorf et al. (2013) provides further evidence concerning the impact of world knowledge on the consideration of alternatives. They investigated the impact of font emphasis on memory encoding of alternatives with varying degrees of plausibility and found effects of font emphasis on plausible alternatives (e.g., *British scientists* as an alternative to *French scientists*) but not on less plausible ones (e.g., *Martian scientists*) even though both were mentioned in the discourse. These findings suggest that the set of actual alternatives is constrained by considerations of plausibility and that listeners only encode a limited set of alternatives in their memory representation of a discourse.<sup>7</sup> Kim further shows that there is a locality bias in that listeners search for the antecedent of the presupposition of *also* in the closest discourse both in terms of recency and hierarchical structure.

<sup>7</sup> Byram-Washburn (2013) provides further evidence that listeners use contextual information to build the set of alternatives. More specifically, she found that items that were not of the same taxonomic category were primed if they were introduced together contextually (similar to the examples presented in (7)).

The experiments by Kim (2012) and Fraundorf et al. (2013) indicate that mentioned plausible alternatives are in the focus of attention of the listener. This is consistent with the finding from the study presented here in that the mentioned semantically-related alternatives always received the highest amount of activation. The results from these studies and my study complement each other. The studies by Kim and Fraundorf et al. show which factors restrict the actual set of alternatives whereas the present study showed that listeners consider additional alternatives to the contextually-restricted set. These additional alternatives are likely to decay in memory over the course of time such that listeners only remember the contextually-restricted set of alternatives (see Spalek et al. 2014 and Fraundorf et al. 2010). Gotzner (2015) presents additional evidence that focus particles do not quantify over elements that are generally-associated with the focused expression but cannot replace it (e.g., *apple* and *maggot*, see Chapter 5). In conjunction, these results suggest that listeners consider a broader set of alternatives (yet not an unlimited one) and that focus particles operate on the set of relevant alternatives.

## 5. Conclusions

The work presented here is in line with the distinction between a focus semantic value and a contextually-restricted set of alternatives proposed by Rooth (1992). It was found that listeners consider a broader set of possible replacements of a focused expression. They do, however, not consider the entire focus semantic value but rather a partially-restricted set of alternatives.

Recent psycholinguistic experiments have provided important insights into the establishment of alternative sets in online language processing. In particular, it seems that the construction of alternative sets relies on two mechanisms (i) the initial activation of a broader set of alternatives and (ii) the narrowing down to the set of actual alternatives by competition mechanisms (see especially Gotzner et al. accepted and Husband & Ferreira 2015). Further experiments show how a variety of contextual factors influence the contextual restriction of alternatives such as mention, recency, discourse structure (locality) and plausibility (Kim 2012, 2015; Fraundorf et al. 2013; Byram-Washburn 2013). I have looked at the derivation of alternatives from the opposite angle, investigating whether listeners consider additional alternatives. The findings show that at some point listeners have considered a broader set of alternatives, which is predicted by a Roothian type of account.

Overall, the studies show that alternative sets constitute an important cognitive unit. We also hope that the paradigm presented here will inspire the investigation of further theoretical questions concerning the composition of alternative sets and that this type of research will help to develop an algorithm that determines the contextual set of alternatives.

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# Singular count pseudo-partitives<sup>1</sup>

Julian Grove — *University of Chicago*

**Abstract.** Inversion-constructions, like *too tasty of a cake* and *a disaster of a conference*, have generally been treated separately from superficially similar-looking pseudo-partitives, like *three gallons of water*. I argue for an analysis that unifies the syntax and semantics of the two constructions through a proposal about the head *of* that appears in both. Both constructions involve the composition of two properties: one is contributed by the head noun; the other is contributed by the modifier, i.e., the measure-phrase in pseudo-partitives and the noun phrase or degree phrase in inversion-constructions. Moreover, while pseudo-partitives involve the composition of two properties of individuals, inversion-constructions involve the composition of two properties of states. A single semantic constraint—non-divisiveness of the property denoted by the modifier—is seen to play a role in both types of constructions, and, in particular, to predict both the monotonicity of modifiers in pseudo-partitives and the gradability of modifiers in inversion-constructions.

**Keywords:** degree-inversion, nominal-internal predicate-inversion, pseudo-partitives, partitives, modification, states, monotonicity

## 1. Introduction

Two particular constructions observed crosslinguistically are generally treated as separate phenomena. These are the pseudo-partitive, as in (1), and the type of construction involving what appears to be inversion, or re-ordering, of some NP-modifier to a position before the article preceding the NP, as in (2).

- (1) a. three gallons of water  
b. three pounds of cakes
  
- (2) a. too tasty of a cake  
b. a disaster of a conference

The two constructions exhibit superficial similarities that might suggest similar analyses. Both contain head nouns preceded by modifiers that restrict their denotations, and each has the noun and modifier straddling the word *of*. Indeed, that these aspects of each construction might be related is suggested by the similar syntax of inversion-constructions and partitives or pseudo-partitives

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crosslinguistically:<sup>2</sup>

(3) Dutch<sup>3</sup>

- a. een etter van een jongen  
a jerk of a boy
- b. een doos van uw heerlijke koekjes  
a box of your delicious cookies

(4) Hebrew<sup>4</sup>

- a. yofi šel sefer  
beauty of book  
'a beauty of a book'
- b. shvey kilo (šel) tapuxim  
two kilo of apples

(5) Italian

- a. il tuo cretino di fratello  
the your cretin of brother  
'your cretin of a brother'
- b. una bottiglia di vino  
a bottle of wine

(6) Spanish

- a. esta maravilla de niño  
this marvel of child  
'this marvel of a child'
- b. una botella de vino  
a bottle of wine

(7) French

- a. cet idiot de Jean  
that idiot of Jean
- b. une bouteille de vin  
a bottle of wine

In this paper, I argue that these superficial similarities reflect deeper syntactic and semantic similar-

<sup>2</sup>Unless otherwise noted, the following examples are taken from Corver (1998), pp. 216-217.

<sup>3</sup>(b) is taken from Girbau (2010), p. 62.

<sup>4</sup>Thanks to Itamar Francez for the Hebrew examples.

ities between the two types of constructions. In particular, inversion-constructions like (2) are specific instances of the pseudo-partitive construction conventionally identified with examples like (1) (and as the title suggests, could therefore be regarded as ‘singular count pseudo-partitives’). Below, I propose a semantics for the head *of* appearing between the modifier and head noun that I claim to be responsible for generating the two types of constructions. A consequence of a unified analysis of the two constructions is that expressions occupying the modifier position in both must receive similar analyses; I argue that both expressions denote properties: modifiers in pseudo-partitives (e.g., *three gallons*) denote properties of individuals, while modifiers in inversion-constructions (e.g., *too tasty*) denote properties of states.

In the following section, I present some background on the semantics of pseudo-partitives and propose an analysis of the composition of the head noun and measure-phrase. In Section 3, I show how the analysis extends to inversion-constructions. Section 4 elaborates and verifies predictions of the analysis, and the last section concludes.

## 2. Pseudo-partitives and the monotonicity constraint

A well-known constraint on pseudo-partitives is that they must contain measure-phrases that are monotonic on the part-structure of the individual characterized by the following substance-noun (Schwarzschild 2002, 2006). This “monotonicity” constraint is illustrated by the following contrast.

- (8) a. sixty gallons of water  
b. \*sixty degrees Fahrenheit of water

A measure-phrase like *sixty degrees Fahrenheit* will violate the constraint as long as the individual characterized by the substance-noun—in this case, a portion of water—relates non-monotonically to the encoded measurement. Here, monotonicity is seen as a constraint on two relations: the inherent ordering on degrees provided by the meaning of the measure-phrase, and the “part-of” relation that holds among individuals in the domain of a mass noun like *water* (for discussion of the latter, see Link 1983). In particular, the former relation must be monotonic on the latter, so that, as portions increase—i.e., as one moves from portions to larger ones properly containing them—so do degrees. Since this constraint is not satisfied for *sixty degrees Fahrenheit* (more water doesn’t necessarily mean higher temperature), (8-b) is ruled out.

### 2.1. Encoding the constraint: Schwarzschild (2002)

One straightforward way of enforcing the monotonicity constraint on measure-phrases is to encode it directly into the semantics of pseudo-partitives, as Schwarzschild (2002) does. On Schwarzschild’s

(9) **MON**  $\mathbf{mp} \rightarrow \lambda X \lambda z [X(z) \ \& \ \mathbf{mp}(\mu(z)) \ \& \ \mu \text{ is monotonic on } X]$   
(Schwarzschild 2002, p. 237)

Relevant to present purposes is that this way of implementing the monotonicity constraint makes use of intervals of degrees.  $\mu$  maps individuals to degree-intervals, and the property of degree-intervals denoted by the measure-phrase predicates of them. The view of measure-phrase modification assumed by this implementation of monotonicity precludes regarding measure-phrases as denoting properties of individuals, which conflicts with the goal of uniting measure-phrases with modifiers in inversion-constructions. The next section therefore recasts monotonicity as a constraint on individual-properties.

Another approach to the monotonicity constraint in pseudo-partitives involves ruling out the properties of individuals that would be denoted by non-monotonic measure-phrases.<sup>5</sup> The constraint I take to be relevant to modifiers in pseudo-partitives is that they denote properties that are non-divisive (Krifka 1989), as defined in (10).

<sup>5</sup>An approach that regards measure-phrases as property-denoting is Brasoveanu (2007), who motivates the property-denoting status of measure-phrases based on agreement data from Romanian. Brasoveanu shows that subject-verb and pronominal agreement always reflect the number and gender of the measure-phrase of a pseudo-partitive, rather than the following substance noun. He takes such facts to indicate the head status—and therefore, property-denoting status—of the measure-phrase in the construction. As a result, a principle of “individuation-by-measure” is proposed, according to which a measure-phrase may undergo a degree-to-individual type-shift only if it is informative about quantity (i.e., if it is monotonic). Moreover, only those measure-phrases that undergo the type-shift may head a property-denoting pseudopartitive. I don’t adopt this principle here, but build the monotonicity constraint into the semantics of the construction.

An  $\langle \alpha, t \rangle$ -type predicate  $P$  has non-divisive reference ( $\neg \mathbf{DIV}(P)$ ) iff  
 $\neg \forall x_\alpha [\forall y_\alpha [[P(x) \ \& \ y \leq_{D_\alpha} x] \rightarrow P(y)]]$

A non-divisive property is one for which it is not the case that, if it is true of an individual, then it is also true of any other individual ordered below it. Given the ‘part-of’ relation of Link (1983) as that inducing the relevant ordering, a property is non-divisive if it is not the case that, for any individual for which it is true, it is true of all of its subparts. The distinction between properties that are divisive and those that are not makes the correct cut between non-monotonic and monotonic properties, respectively, as in (11).

(11) Non-divisive, monotonic: *sixty gallons, several pounds, many liters*

(12) Divisive, non-monotonic: *sixty degrees Fahrenheit, thirty karats*

Monotonic measure-phrases like *sixty gallons* denote non-divisive properties since any subportion of a sixty-gallon portion will measure less than sixty gallons. Measure-phrases like *many liters* pass this test even though they do not involve numerals, as there is always some subportion of a portion measuring many liters which does not itself measure many liters. On the other hand, certain measure-phrases, like *very few gallons* or *at most sixty gallons*, which can appear in pseudo-partitives, might appear to constitute counterexamples to the above distinction, as they are divisive when interpreted as single constituents. For example, any subportion of a portion measuring at most sixty gallons also measures at most sixty gallons. The solution to this apparent problem, which involves QR of the relevant degree-expression, will become clear once the compositional analysis is presented.

Non-monotonic measure-phrases, however, always denote divisive properties of portions, just as the measure-phrases themselves are distributive. All subportions of a portion measuring thirty degrees Fahrenheit also measure this amount, just as all subportions of a thirty-karat portion of gold also measure thirty karats. When non-monotonic measure-phrases are placed in predicate position, their distributivity comes out.

- (13) a. These cherries are thirty degrees Fahrenheit.  
 b. These gold rings are eighteen karats.

The distributivity of the measure-phrases is shown by the fact that they have entailments for each individual cherry and each gold ring in (13-a) and (13-b), respectively. If their distributivity carries over to the modifier-position of pseudo-partitives, they will be ruled out as violations of non-divisiveness.

### 2.3. The analysis

I now present a semantics for the pseudo-partitive that encodes monotonicity as a constraint on the non-divisiveness of measure-phrases. In particular, I attribute the constraint to a presupposition of the head *of* that enters into pseudo-partitive constructions.

$$(14) \quad \llbracket of \rrbracket = \lambda P_{\langle e, t \rangle} . \lambda Q_{\langle e, t \rangle} : \neg \mathbf{DIV}(Q) . \lambda x_e . P(x) \ \& \ Q(x)$$

Given this analysis, *of* will take as its specifier monotonic measure-phrases like *sixty gallons* but not non-monotonic ones like *thirty degrees Fahrenheit*, as the latter will not meet its definedness condition.

It is now also possible to give an analysis of apparent counterexamples to non-divisiveness like *very few gallons* and *at most sixty gallons*. In particular, I assume that the phrases *very few* and *at most sixty* QR, leaving a structure like (15), where *gallons* is interpreted as a  $\langle d, \langle e, t \rangle \rangle$ -relation, whose first argument is a degree between individuals and the numbers of gallons they measure.



Although the property denoted by *at most sixty gallons* fails non-divisiveness, the interpretation of the structure in (15) passes it. This result obtains because, when *of* composes with the measure-phrase in (15), the degree-denoting trace will be interpreted relative to an assignment function, which assigns to it a particular degree. In that case, the property denoted by the structure in (15) is non-divisive for the same reason that the one denoted by a measure-phrase like *sixty gallons* is.

### 3. Monotonicity in inversion-constructions

Now that the basic analysis has been laid out for pseudo-partitives, it can be extended to inversion constructions like (2), repeated in (16).

- (16)
- a. too tasty of a cake
  - b. a disaster of a conference

In this section, I argue that the same head *of* which was given a semantics to implement monotonicity in pseudo-partitives is involved in constructions like (16). Rather than measure-phrases, however, the relevant modifiers in these constructions are degree phrases like *too tasty* and noun-

phrases like *a disaster*. But regarded as properties of individuals, the meanings of these phrases do not meet the definedness condition imposed by *of*; they are divisive. Instead, I will argue that modifiers in inversion-constructions denote properties of states, rather than properties of individuals. As a rough sketch, I consider an inversion-construction like (16-a) to have a semantics as illustrated in (17).

$$(17) \quad \left\| \begin{array}{c} \diagup \quad \diagdown \\ a \quad \text{jerk} \quad \text{of} \quad a \quad \text{linguist} \end{array} \right\| = \lambda_{s_s}. s \text{ is a jerk-state} \ \& \ s \text{ is a linguist-state}$$

In other words, I take the entire construction to denote a stative property, eventually to be predicated of an individual either via a functional head or a type-shift responsible for introducing the relevant thematic relation between states and the individuals who hold them. On an analysis in which the parts of an inversion-construction are stative-property denoting, the semantics for the head *of* responsible for composing them will have to be extended to handle states.

$$(18) \quad \llbracket of \rrbracket = \lambda P_{\langle s, t \rangle}. \lambda Q_{\langle s, t \rangle}. \neg \mathbf{DIV}(Q). \lambda s_s. P(s) \ \& \ Q(s)$$

Recall that the definition of non-divisiveness requires of a property that it be true of some individual but not true of all other individuals ordered below it. The ordering relevant to the individual domain is that induced by the “part-of” relation of Link (1983), so that non-divisive properties are true of some individuals but not all of their subparts. Extended to states, the definition requires that a property be true of some state, but not all states ordered below it. But this extension of non-divisiveness raises the question of what it means for states to be ordered. The next subsection draws on Wellwood (2012) to answer this question.

### 3.1. Stative orderings

Wellwood (2012) proposes that like individuals, as well as events (Bach 1986), states may be ordered by a linguistically-accessible relation. She assumes that adjectives lexically denote stative properties, but gives an analysis of their use with degree modifiers (as in *too tasty*) in which they appear with a covert *much*, following Bresnan (1973). Additionally, following Schwarzschild (2006) and Wellwood et al. (2012), she notes that *much* obeys the same monotonicity constraint seen with measure-phrases in pseudo-partitives when it modifies properties of individuals and events. (19) illustrates the monotonicity constraint on the interpretation *much*.

- (19) a. Mary drank too much water.  
 b. Bill ran too much.  
 c. ??John died too much.

(19-a) allows an interpretation of *too much water* on which Mary drank too much by weight or volume, but not too much by temperature. As discussed above, the former two relations are monotonic, while temperature is not. Likewise, (19-b) allows an interpretation of *too much* on which Bill ran too much by time or by distance, but not too much by speed. Moreover, given a part-structure on events mirroring that seen with individuals, relations like duration and distance are monotonic on eventive orderings, while speed is not. That is, as one moves from events to larger events containing them, duration and, for running events, distance increases, but speed does not. Finally, (19-c) is unacceptable on any interpretation because the domain of events of the property denoted by *die* is not ordered: dying events do not have other dying events as their subparts. As a result, there is no ordering with respect to which the monotonicity constraint of *much* could be defined.

Given the distribution of *much*, Wellwood proposes a semantics for it according to which it maps individuals and events to degrees in a monotonic fashion. That is, individuals may be mapped to degrees of weight or volume, and events may be mapped to degrees of duration. In conjunction with her proposal that stative-property denoting adjectives may combine with a covert *much*, she predicts that states may be ordered, just as individuals and events are. And just as *much* maps to degrees monotonically with properties of ordered individuals and events, it must do so too with properties of ordered states.

The conclusion Wellwood draws is that adjectives with stative orderings—that is, those for which a degree argument may be introduced by a covert *much*—are just those adjectives which are gradable. Thus, the contrast illustrating gradability in (20) is due to whether or not the domain of the underlying stative property denoted by the adjective is ordered. In (20-a), it is, and thus the adjective may combine covertly with *much* to obtain a degree argument, and as a result, it allows for modification by *too*. In (20-b), it is not, preventing the adjective from combining covertly with *much*, since a prerequisite for the monotonicity of *much* to be satisfied is an ordering on the domain of the property it combines with.

- (20) a. The watch is too expensive.  
 b. ??The watch is too digital.

Wellwood therefore replaces the more conventional semantics according to which gradable adjectives are distinguished from non-gradable ones in that the former have a degree argument with what she considers to be a more basic distinction: that between properties with ordered and unordered domains. Stative properties with ordered domains are those that may be augmented with

a degree argument by *much*, allowing for further modification by degree modifiers, while those without ordered domains are what are descriptively referred to as ‘non-gradable’.

### 3.2. Non-divisiveness of stative properties

In the current analysis, I follow Wellwood in adopting the proposal that there are linguistically-accessible orderings on states—those on the domains of properties denoted by gradable adjectives. As given in (18), repeated in (21), the analysis of inversion-constructions states a definedness condition on the head *of* that combines with the modifier and the following noun phrase—that the property denoted by the modifier be non-divisive.

$$(21) \quad \llbracket of \rrbracket = \lambda P_{\langle s, t \rangle} . \lambda Q_{\langle s, t \rangle} : \neg \mathbf{DIV}(Q) . \lambda s_s . P(s) \ \& \ Q(s)$$

Given Wellwood’s proposal that adjectives that denote properties with ordered domains are gradable, as they may combine covertly with *much*, the definedness condition in (21) can be seen to have the following two consequences. First, modifiers in inversion-constructions should denote properties true of some states, but not of other states ordered below them. In other words, such properties should be true of states mapped by some monotonic relation to a particular degree, but not true of other states mapped by the same relation to lower degrees. A modifier denoting such a property is one that will be classified as gradable on conventional diagnostics since, in order to be true of some states in its domain but not others, its domain must be ordered in the first place.

Second, on the current analysis, not just any gradable-property denoting modifier should be allowed in inversion-constructions—just those that denote non-divisive properties. As a result, modifiers denoting properties true of every state in their domain—even if this domain is ordered—should be ruled out. Minimum-standard adjectives like *bent* denote just this kind of property. Being even slightly bent is enough to count as bent. Thus, *bent* is true of every state in its domain, whereas a maximum-standard adjective like *full* is true of only the maximal state in its ordering (see Husband 2012 for related discussion). Therefore, modifiers permitted by the analysis are, for example, maximum-standard adjectives like *full* and relative adjectives like *tall*, both of which may be true of some states but not others ordered below them. The next section is devoted to cashing the analysis out in terms of specific linguistic predictions.

## 4. Predictions of the analysis

The predictions to be explored in this section fall into two categories. The first category is specific to predictions resulting from the non-divisiveness of stative properties required for inversion-constructions. One of these predictions, for example, is that modifiers in inversion-constructions are always gradable. The second category is specific to predictions resulting from the claim that



the modifier and head noun in inversion-constructions are stative-property denoting. Independent linguistic diagnostics of stativity are brought to bear in testing this claim.

#### 4.1. Gradability of the modifier

The prediction modifiers should be gradable is difficult to test for adjectives in English because the syntax of inversion-constructions appears to require adjectives to occur with degree modifiers anyway.

(22) \*tasty of a cake

Since degree modifiers may only combine with gradable adjectives, gradability is required in adjectival inversion-constructions for independent reasons.

Inversion-constructions involving nouns, however, allow them to occur bare. Assuming a diagnostic of gradability for nouns, it is therefore possible to test the prediction that modifiers should be gradable. The contrasts between (23) and (24) illustrate that the prediction is borne out.

(23) a. a disaster of a conference  
 b. a marvel of a guy  
 c. a sweetheart of a kid  
 d. an idiot of a student  
 e. an asshole of a librarian  
 f. a jerk of a linguist

(24) a. \*a conference of a disaster  
 b. \*a guy of a marvel  
 c. \*a kid of a sweetheart  
 d. \*a student of an idiot  
 e. \*a librarian of an asshole  
 f. \*a linguist of a jerk

In (23), the modifiers are nouns that pass tests for gradability given in Morzycki (2009), the same tests that the modifiers in (24) fail. One of these tests is the ability of a noun to appear with a nominal degree modifier like *utter*. As (25) shows, only the modifiers in (23) appear felicitously in this context.

- (25) a. an utter {disaster, marvel, sweetheart, idiot, asshole, jerk}  
 b. #an utter {conference, guy, kid, student, librarian, linguist}

To test the same prediction for adjectives, it would be necessary to look at a language whose inversion-constructions allow adjectives to occur bare. Norwegian provides such a case, as the following examples illustrate.<sup>6</sup>

(26) Norwegian attributive adjectives

- a. en høy man  
 a tall man  
 b. en lykkelig mann  
 a happy man

(27) Norwegian inverted adjectives

- a. høy en mann  
 tall a man  
 b. lykkelig en mann  
 happy a man

The adjectives *høy* ('tall') and *lykkelig* ('happy') may modify nouns attributively, as in (26), but, crucially, may also occur in inversion-constructions without any modifiers, as in (27), unlike in English. The prediction to test, therefore, is that non-gradable adjectives, unlike gradable ones, may not invert. The following examples show that this prediction is borne out.

(28) Attributive adjectives: non-gradable

- a. en død mann  
 a dead man  
 b. en Italiensk mann  
 a Italian man  
 c. en digital klokke  
 a digital watch

(29) Inverted adjectives: non-gradable

- a. \*død en mann  
 dead a man

<sup>6</sup>Thanks to Camilla Buknotten for these judgments.

- b. \*Italiensk en mann  
Italian a man
- c. \*digital en klokke  
digital a watch

While *død* ('dead'), *Italiensk* ('Italian'), and *digital* ('digital') may in principle modify nouns, as in (28), they may not invert, unlike their gradable counterparts, as (29) shows.

As mentioned above, not all gradable nouns should be felicitous as modifiers in inversion-constructions—just those that denote non-divisive properties. Therefore, minimum-standard adjectives are predicted to be ruled out. The following examples show this prediction to be borne out, as well.

(30) Attributive adjectives: minimum-standard

- a. en humpete vei  
a bumpy road
- b. en bøyd stang  
a bent rod

(31) Inverted adjectives: minimum-standard

- a. \*humpete en vei  
bumpy a road
- b. \*bøyd en stang  
bent a rod

On the other hand, the analysis also makes the following prediction. Minimum-standard adjectives should be felicitous just in case they occur with a degree modifier that causes them to denote a non-divisive property. A degree modifier that increases the degree that the state must satisfy beyond the minimum will cause the resulting stative property to be non-divisive and, therefore, felicitous as an inverted modifier. Comparing (31) with (32) shows that this prediction is also borne out.

(32) Inverted adjectives: minimum-standard with modifier

- a. så humpete en vei  
so bumpy a road
- b. så bøyd en stang  
so bent a rod

In conclusion, predictions from both English and Norwegian appear to support the hypothesis that modifiers in inversion-constructions are constrained to denote non-divisive properties of states.

Both English and Norwegian show a restriction to gradability of the relevant modifiers, and, moreover, Norwegian shows the predicted restriction to non-divisiveness of the relevant modifier.

#### 4.2. Stativity of the modifier and head noun

A second type of prediction made by the proposed analysis involves diagnostics of stativity. Three diagnostics are presented in this section: one involving the availability of cooccurrence with nominal degree modifiers, one involving depictive secondary predication, and a final diagnostic involving the availability of relative clause modification.

##### 4.2.1. The distribution of nominal degree modifiers

Following Morzycki (2009)'s tests for nominal gradability, it can be seen that not just singular count nouns, but mass nouns and plurals, can be regarded as gradable.

- (33) a. Mary is an utter jerk.  
       b. Those guys are utter jerks.  
       c. This paper is utter nonsense.

On the proposal according to which gradability is a property of expressions denoting properties of ordered states, the presence of the nominal degree modifier *utter* in the examples in (33) indicates the presence of a state argument somewhere in the composition of the noun phrases. As the following examples show, however, only the state arguments of singular count nouns appear to be available for further modification in pseudo-partitives.

- (34) a. How much of a jerk is Mary?  
       b. \*How much (of) jerks are those guys?  
           (cf. *How many jerks are those guys?*)  
       c. How much (\*of) nonsense is this paper?

While the interpretation of (34-a) is one on which what is questioned is the degree to which Mary is a jerk, (34-b) is ungrammatical on any interpretation, while (34-c) can only be regarded as questioning an extensive degree, rather than an intensive one. That is, (34-c) cannot be paraphrased by *To what extent is this paper nonsense?*, but only by *How much paper is there?*. Apparently, the state argument of mass nouns and plurals becomes closed off to further modification once a certain amount of structure is added, while the state argument of singular count nouns does not. The

relevant amount of structure seems to be just enough to form a pseudo-partitive. Therefore, on the current account, on which pseudo-partitives and inversion-constructions involve the same syntax, while inversion-constructions compose properties of states, the latter are predicted to display a similar behavior. In this case, as well, the state argument of mass nouns and plurals should become closed off. (35) illustrates that this is the case.

- (35) a. too friendly of a linguist  
 b. \*too friendly (of) linguists  
 c. \*too tasty (of) cake
- (36) a. a jerk of a linguist  
 b. \*a jerk (of) linguists  
 c. \*a disaster (of) conferences

The correlation in judgments between examples like (34) that attempt to directly question the state argument of nouns in pseudo-partitives and inversion-constructions like (35) and (36) is predicted on an analysis of the latter in which the head nouns are required to have state arguments available for modification.

#### 4.2.2. Depictive secondary predication

A second diagnostic involves examples of depictive secondary predication like (37).

- (37) He entered the room annoyed.

The secondary predicate in such examples contributes the entailment that there is a state of the relevant kind (in this case, annoyance) that temporally overlaps with the event characterized by the verb. In other words, (37) means that the subject was annoyed while entering the room. In order to capture this entailment, Pylkkänen (2002) introduces a head, with the meaning in (38), responsible for introducing depictive secondary predication.

- (38)  $\llbracket dep \rrbracket = \lambda f_{\langle e, \langle s, t \rangle \rangle} . \lambda x_e . \lambda e_v . \exists s_s [f(x)(s) \ \& \ e \circ s]$

Such a head requires the adjective it combines with to have a state argument available for composition. Given the data in the last section illustrating that the state argument remains available outside the noun phrase only for singular count nouns, the current analysis makes the following

prediction: among nouns, only singular count nouns should be available for secondary predication. Though there is some variability in judgments for these sentences, (39) and (40) appear to bear out this prediction.

- (39) a. The dough ball came out of the oven a pizza.  
 b. ??The dough ball came out of the oven pizza.  
 c. ??The dough balls came out of the oven pizzas.
- (40) a. The batter will come out of the oven a cake.  
 b. ??The batter will come out of the oven cake.  
 c. ??The cups of batter will come out of the oven cakes.

In conclusion, there is evidence that singular count nouns, but not mass nouns and plurals, may denote stative properties in English. Moreover, given this evidence, the prediction that only singular count nouns may enter inversion-constructions in English is borne out, as (35) and (36) illustrated.

#### 4.2.3. Relative clause modification

A final prediction resulting from the claim that the modifier and head noun in inversion-constructions are stative-property denoting is that they should not be able to be modified by an individual-property denoting expression like a relative clause. This prediction results because a modifier denoting a property of individuals should be unable to compose with a modifier denoting a property of states. It, too, appears to be borne out.

- (41) a. I read a long book that Camilla recommended.  
 b. ??I read too long of a book that Camilla recommended.

While in (41-a), the relative clause *that Camilla recommended* modifies a noun phrase that denotes a property of individuals, in (41-b), it modifies the head noun in an inversion construction, which denotes a property of states. Insofar as (41-b) is acceptable, it appears to involve modification, not of the head noun, but of the entire inversion-construction, presumably after either a type shift or some functional head in the clause has transformed it into a property of individuals.

In summary, three types of evidence support the hypothesis that inversion-constructions involve the composition of stative properties. The positions of stative modifiers like *utter* and *much* show that the state arguments of plurals and mass nouns become closed off outside the noun phrase—in particular, after enough structure to form a pseudo-partitive has been added to them. Singular count

nouns, on the other hand, make their state arguments available for further composition, correctly predicting that inversion-constructions should only be felicitous with singular count nouns. Secondary predication provides another test of the stativity of singular count nouns, in that these, but not mass nouns and plurals, may be used as depictive secondary predicates. Finally, the unavailability of relative clause modification of the head noun in inversion-constructions further supports their status as stative-property denoting.

## 5. Conclusion

The main goal of this paper has been to show that the constructions conventionally classified as pseudo-partitives, on the one hand, and inversion-constructions, on the other, can be given a unified analysis that reflects their superficially similar syntax. In unifying them, it was shown that it is possible to give a compositional analysis of pseudo-partitives—one that enforces the monotonicity constraint—while still regarding both the modifier and the head noun as denoting properties of individuals. While the constraint is no longer, as in Schwarzschild (2002), considered to be hard-wired into the grammar, e.g., via the denotation of a functional head guaranteeing monotonicity, a proxy for it was instead shown to be found in the domain of properties of individuals—that is, non-divisiveness. Moreover, data from English and Norwegian show that the same constraint, but on inversion-constructions, can be seen in the domain of stative properties.

One particular question left unaddressed in this paper is what is allowed to “invert” in the inversion-constructions of a given language. Unlike most previous analyses of the construction (e.g., Bowers 1975, 1987; Kennedy and Merchant 2000; Matushansky 2002), the current proposal assumes that the syntax of the modifiers involves base-generation, rather than movement, of the modifier before the head noun. Such a hypothesis suggests an account on which the availability of a given modifier in a language with inversion is based on syntactic selection. For example, while English may allow only degree phrases and noun phrases to occupy the modifier position, languages like Norwegian may additionally allow bare adjective phrases, explaining the non-obligatoriness in such languages for degree modification of the inverted adjective.

Another question which I leave unaddressed here, but which will have to figure into a complete account of inversion-constructions, is how a property of states is converted into a property of individuals in their interpretation. Above were mentioned two possibilities: conversion by a type-shift, and selection by a null functional head that introduces the relevant thematic relation between states and individuals. According to previous analyses of the distribution of null functional heads in the nominal projection, for example, the one pursued in Chierchia (1998)’s analysis of bare nouns, such heads need to be licensed by some governing lexical head. Their distribution, as illustrated, for example, by bare nouns in Italian in (42), shows that they are generally unlicensed in subject position.

- (42) a. Leo ha mangiato patate.  
           Leo PST eat potatoes  
           ‘Leo ate potatoes’  
       b. \*Studenti hanno telefonato.  
           students have phoned

(Chierchia, 1998, pp. 283-284)

If null functional heads in the nominal projection in English are subject to similar constraints, then it may be possible to tease apart an account based on type-shifts from one based on null structure. As Bresnan (1973) points out, inversion-constructions do in fact become degraded when placed in subject position, potentially supporting an account based on a null functional head.

- (43) a. Mary is too nice of linguist.  
       b. Mary read too long of a book.  
       c. ??Too nice of a linguist walked in.
- (44) a. Mary is a jerk of a linguist.  
       b. Mary read a mammoth of a book.  
       c. ??A jerk of a linguist walked in.

While inversion-constructions generally appear felicitously in predicate and object position, they seem to become degraded as subjects. If a null functional head is involved in their interpretation as properties, then the licensing conditions involved might explain their distribution. These issues, however, will have to be left to future investigation.

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## Expressive, much?

Daniel Gutzmann — University of Frankfurt  
Robert Henderson — Wayne State University

**Abstract.** This paper investigates a novel use of *much* in a construction that has not yet been recognized in the literature—*Angry, much?*—which we dub “expressive *much*”. Our primary proposal is that expressive *much* is a shunting operator in the sense of McCready 2010, which targets a gradable predicate and adds a speaker’s evaluative attitude about the degree to which an individual stands out on the relevant scale. In particular, we argue that it does so in a way that allows it to perform an “expressive question”, which can be understood as a counterpart to a polar question, but in the expressive meaning dimension.

**Keywords:** expressives, degree semantics, *much*

### 1. Introduction

The distribution of *much* has played a major role in debates about the inventory of degree-denoting expressions in natural language and their compositional interpretation. The reason is that *much* appears across a variety of degree constructions. For instance, while *much* usually cannot modify degree adjectives, it is necessary under ellipsis (Corver 1997). That is, if *so* is a pro-form copy of the adjective, then (1a) should be as bad as (1c). Instead, the contrast between (1a) and (1b) shows that *much* is necessary for grammaticality.

- (1) a. Mary is warm, but Bill is too *much* so.  
b. \*Mary is warm, but Bill is too so.  
c. \*Mary is warm, but Bill is too *much* warm.

Second, *much* has nominal quantifier and frequentative adverbial uses that generate high degree readings with expressions that are not *prima facie* degree denoting. For instance, as a VP modifier in (2a), *much* requires that John did not sneeze frequently. Similarly, as a degree determiner with mass nouns, as in (3a), *much* ensures that the Bill did not drink a large quantity of beer.<sup>1</sup>

- |     |                                     |     |  |
|-----|-------------------------------------|-----|--|
| (2) | a. John didn’t sneeze <i>much</i> . | (3) | a. Bill didn’t drink <i>much</i> beer. |
|     | b. Did John sneeze <i>much</i> ?    |     | b. Did Bill drink <i>much</i> beer?    |
|     | c. *John sneezed <i>much</i> .      |     | c. *Bill drank <i>much</i> beer.       |

While only a few examples, (1)-(3) show that *much* does not have a uniform syntactic distribution, and may not have a uniform semantic interpretation. For this reason, previous authors disagree on the number of homophonous versions of *much* there are in English, as well as what their denotations should be. The present paper adds to this literature by investigating a use of *much* in a

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<sup>1</sup>In contrast to other uses of *much*, these readings have roughly the distribution of an NPI.

construction that has not yet been recognized in the literature. What we find is that it behaves in yet another novel way, posing a challenge for unified theories of *much*.

The construction, which we dub “expressive *much*” (henceforth *x-much*), is illustrated in (4), which is a naturally occurring example taken from a comic book.<sup>2</sup>

- (4) A: [Slamming the door just in front of B:] Well, Scott isn’t here. So scram.  
 B: Wow. **Rude, much?**

The *x-much* construction in (4) immediately raises a series of syntactic, semantic, and pragmatic questions. For instance, while marked with question punctuation, the kind of speech act performed by the use of *x-much* is not at all obvious. In this example it certainly does not seem to be answer-seeking. On the semantic side, note that *much* appears to be modifying a gradable adjective, which is not usually licit (*modulo* its mandatory appearance in ellipsis constructions like (1a)). In addition, the *x-much* construction above is clearly “elliptical”. This raises questions about its syntactic properties, as well as how its semantic properties are compositionally derived. As we will see, *x-much* exhibits these special properties and more across all three dimensions: syntactic, semantic, and pragmatic. In order to account for its properties in a unified way, our primary proposal is that *x-much* is a shunting operator in the sense of McCready 2010, which targets a gradable predicate and adds a speaker’s evaluative attitude about the degree to which an individual stands out on the relevant scale. In particular, we will argue that it does so in a way that allows it to perform an “expressive question”, which can be understood as a counterpart to a polar question, but in the expressive meaning dimension.

Before beginning, though, a quick methodological note is required. While it is not difficult to find English speakers with intuitions about *x-much* (one of the authors, in fact, commands the construction), it is clearly not part of standard English. This can make it difficult to do grammaticality judgments, especially in more complex and artificial contexts where register clash is a danger. For this reason, we rely as much as possible on naturally occurring examples from comic books and social media, especially Twitter and Instagram. This type of data is especially helpful for determining the felicity conditions of *x-much* because they include images that display the world against which *x-much* is used. In the case of social media, before including an example in our corpus, we first checked the user’s feed to ensure that they otherwise appeared to be a native speaker of English.

## 2. Syntax of *x-much*

We start the investigation by considering the syntactic distribution of *x-much*. The use of *much* in this construction stands out in that it can be preceded by a target phrase of a wide variety of types. First, as we have already seen in example (4), *x-much* can target adjectives like *rude*.

We also find *x-much* targeting verbal heads, that is, expressions of category V°. This is illustrated

<sup>2</sup>Throughout this paper, we use **bold face** to highlight relevant aspects of examples.

in the following examples.

- (5) A: It's not your precious 720, and what it *is* is none of your concern! Now be off with you!  
 B: Geez! **Overreact much?!**
- (6) A: Guessing Upper West Side? For the shirt?  
 B: **Presume much?**



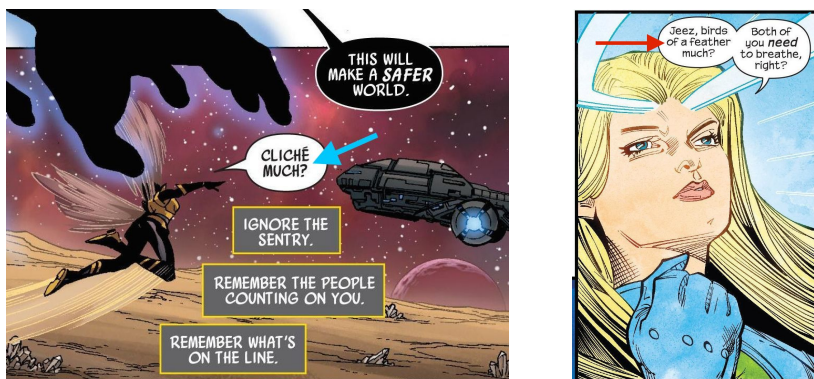
In addition to verbal heads, there are also examples of *x-much* modifying full VPs, like in the following examples. Speakers, though, have the intuition that these are slightly degraded, and more degraded the heavier the VP happens to be.

- (7) A: We're definitely not getting back together if that's what you think.  
 B: Wow. **Flatter yourself much?**
- (8) Jeez, **live in denial much**, Chase?



Finally, just as there are attested examples of *x-much* preceding expressions of category  $V^o$  and VP, we also find *x-much* modifying noun heads and NPs, as is illustrated by the following examples.

- (9) A: This will make a safer world.  
 B: **Cliché much?**
- (10) Jeez, **birds of a feather much?** Both of you need to breathe, right?



These data show that *x-much*, unlike other uses of *much*, felicitously combines with expressions of all core lexical categories. The second major syntactic generalization about the *x-much* construction is that once formed, it cannot be further modified or embedded by any semantic operation. For instance, examples (11a) and (11b) show that an *x-much* construction cannot be conjoined or disjoined with a second clause. It cannot be part of a conditional, neither as the antecedent (11c), nor as the consequent (11d). As (11e) illustrates, the *x-much* construction cannot be modified by modals. Finally, example (11f) shows that the *x-much* construction cannot be embedded under propositional attitude predicates.

- (11)
- a. \*Angry, much and he left.
  - b. \*Angry, much or not?
  - c. \*If angry much, I will not talk to you.
  - d. \*If Parker shows up late, angry much?
  - e. \*Maybe angry, much?
  - f. \*He said/asked angry much?

The fact is that *x-much* derives expressions that do not interact with other expressions in any way. This contrasts with ordinary (NPI)-*much* or other kinds of modification. As we will argue later, this non-interaction can be explained if *x-much* is considered a shunting expression in the sense of McCready 2010. To support this analysis, though, we first need to demonstrate that the *x-much* construction has the conversational force of expressives more generally.

### 3. The conversational force of *x-much*

Just as we have shown that *x-much* has a different syntactic distribution than (NPI)-*much*, we can also demonstrate that *x-much* can only appear in clauses with expressive force. This is different from (NPI)-*much*, which shows no such restriction. For this reason, we come to treat *x-much* itself in as an expressive operator, which takes at-issue content and shunts it to the expressive domain. While this is the analysis we come to, at first pass, one might think then that *x-much* is some sort of grammaticalized elliptical question. The reason is that uses of *x-much* in the wild often almost always occur with a question mark. This analysis would say that the two examples in (12) are equivalent, modulo ellipsis.

- (12) a. Angry, much? b. Are you angry much?

While tempting, this analysis cannot work. First, note that unlike true questions, the *x-much* construction is not genuinely answer-seeking. We can see this from the behavior of *x-much* with respect to polarity particles in the answer.

- (13) A: Are you angry much?  
B: No. / Yes.
- (14) A: Angry, much?  
B: #No. / #Yes.

Polar questions canonically expect a polarity particle response. The fact that the discourse in (14) is infelicitous shows that *x-much* must not be able to raise issues in the same way that a polar question does. The question mark is then misleading.

Furthermore, previous work on response particles (e.g., Farkas and Bruce 2009), and especially in their use as reactions to sentences with appositives (e.g. AnderBois et al. 2013), has shown that bare polarity particles, especially the negative one, can also be used to react to at-issue assertions, such as in (15).

- (15) A: John's pretty angry. B: No.

The fact that (14) is blanket infelicitous also then suggests that *x-much* does make an at-issue assertion. This is further supported by the fact that it clearly cannot be used to provide an answer to an explicit question, unlike an assertion of intuitively similar propositional content.

- (16) A: What's up with Harry?  
B: [Pointing at Harry:] # Angry, much?
- (17) A: What's up with Harry?  
B: [Pointing at Harry:] He's super angry.

While neither an answer-seeking question nor an assertion, perhaps *x-much* has a different discourse status, for instance, an obligatory rhetorical question—i.e., a non-answer-seeking question. There are at least two arguments that this cannot be the case. First, Sadock (1971) shows that rhetorical questions can be modified by expressions like *after all*, while bona fide answer-seeking questions cannot be. The following example shows that *x-much* resists modification by such modifiers.

- (18) You and the addressee both know that John has a quick temper. Furthermore, the addressee has just related a story about John flying off the handle.
- a. Figures. After all, isn't John angry all the time?  
b. Figures. #After all, angry, much?

A second test is that NPIs are only appropriate in rhetorical questions, not ordinary questions (Caponigro and Sprouse 2007). This is demonstrated by the contrast between (19) and (20). Ex-

ample (21) shows that *x-much*, which we already know does not form an ordinary question, also rejects NPIs.

- (19) a. After all, did John really give a damn?  
b. After all, did you even lift a finger?
- (20) a. I'm really curious. #Did John really give a damn?  
b. I'm really curious. #Did you even lift a finger?
- (21) a. #Lift a finger, much?  
b. #Give a damn, much?

Having ruled out treating the *x-much* construction as an assertion or question, we come to our positive proposal, which is that *x-much* forms an expressive (Potts 2005). In particular, the use of an *x-much* construction makes a not-at-issue assertion that a salient individual has the property in question. This is not its only contribution, though. It additionally conveys an evaluative attitude about this fact. While it is hard to pinpoint the quality of this evaluative attitude, we propose that it is something akin to “laughable” or “ridiculous”. In most cases, this comes down to the expression of some sort of disdain, which accords with native-speaker intuitions about its use. That said, we cannot treat *x-much* as uniformly expressing a negative evaluative attitude. We find naturally occurring examples used positively in a playful way.

In this first example, for instance, the girls clearly do not have swag. They are making a joke about how they used to look. We can identify this example as a joke because, like many such examples, it is accompanied by the “laugh until crying” emoji. The example in (23) is an even more clearly ironic use of *x-much*. The author does not mean to claim that the subject of the photo is cool and has style. In fact, he clearly does not.

- (22) Um swag much



- (23) Swag much??



While used ironically, these example do not seem to express disdain. Instead, the evaluative attitude expressed is that the fact of the matter is somehow ridiculous. Our proposal is meant to



capture these jocular uses, as well as the more common cases where the speaker conveys disdain by expressing the ridiculousness of some individual standing out so thoroughly on the relevant scale.

#### 4. Semantic properties of *x-much*

The previous section argued that *x-much* derives an expressive construction, one that conveys an evaluative attitude about the degree to which an individual stands out on the relevant scale. The second aspect is clearly semantic in nature, and so this section tackles the question of the semantic contribution of *x-much*. A first-pass analysis of *x-much* would try to assimilate it to other post-predicate uses of *much*, like those in (24) and (25).

- (24) Do you come around here much?                      (25) Bill doesn't dance much.

The core problem for this kind of analysis is that post-predicate *much* only allows frequency readings, but *x-much* admits a wider class of readings. First, *x-much* allows high degree readings that are missing with post-predicate *much*. For instance, the following examples from twitter contain pictures that display that Harry's cousin and the chicken wings truly do stand out on the lexically given scales, namely height and spiciness.

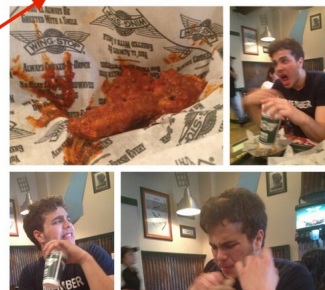
- (26) wow tall much?

 chicken wings @sarcasticwbu · 27 Apr 2012  
wow tall much? RT @CalmYourCarrots: Harry's cousin makes Niall look like a real life leprechaun... pic.twitter.com/Y02gLW6t



- (27) spicy much jorge?

 carolina @CarooDavi · 5 Apr 2013  
#picstitch spicy much jorge? pic.twitter.com/de6xLIZ0IL



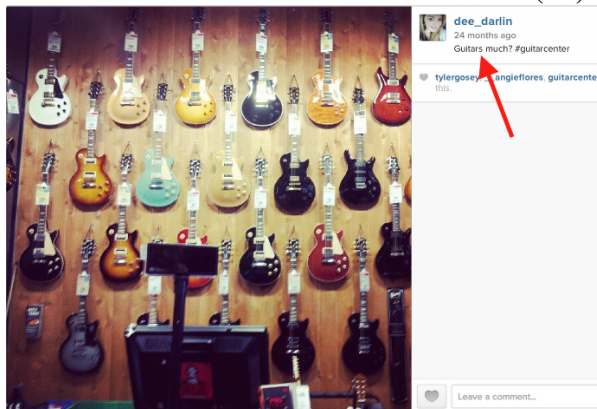
Crucially, the following examples show that high-degree readings are unavailable for canonical examples of post-predicate *much*. This means that we cannot easily assimilate *x-much* to canonical post-predicate *much*.

- (28) Is Harry's cousin tall much? ≠ Is Harry's cousin very tall?  
(29) That wing wasn't spicy much. ≠ That wing wasn't very spicy.

The second argument is that if *x-much* modifies a noun, it allows large cardinality / quantity readings that are missing with post-predicate *much*. For instance, it is clear in the following examples that it is the large amount of guitars and wine respectively that prompt the use of the *x-much* construction.



## (30) Guitars much?



## (31)

## Wine much?



Once again, large cardinality / quantity readings are unavailable for the more familiar post-predicate *much*, as the following examples illustrate.

(32) Were there guitars much? ≠ Were there many guitars?

(33) There wasn't wine much. ≠ There wasn't much wine.

One thing to note here is that while post-predicate *much* does not have the high degree reading, *x-much* actually shares this reading with determiner *much*, though only with mass nouns.

(34) Did you drink much wine?

(35) \*Did you play much guitars?

The fact that *x-much* can entail high cardinality with count nouns as in (30), while other uses of *much* cannot, illustrated in (35), is another strong argument that *x-much* should be treated differently.

Finally, while we have seen two arguments that we cannot treat *x-much* as post-predicate *much* with the addition of some expressive component, the semantics of *x-much* does partially overlap with post-predicate *much*. In particular, they share high frequency readings. In the following tweet, Meggers' friend is making fun of her for her frequent absences. Crucially, (37) has the exact same high frequency reading with post-predicate *much*. In particular, it is looking to resolve the issue of whether Meggers was absent to a high degree.

(36) absent much meggers?



(37) Was Meggers absent much?

In summary, just as *x-much* has a wider syntactic distribution than (NPI)-*much*, it also has a wider semantic distribution. That said, its contribution is uniform. With gradable adjectives, it requires the individual stand out on the scale provided with the adjective. With mass and count nouns, *x-much* has large quantity and large cardinality readings, respectively. Finally, with verbs and verb phrases, *x-much* has high frequency readings. Because *x-much* only shares frequency readings with other uses of *much*, and post-predicate *much* in particular, we cannot say that *x-much* only differs from other uses of *much* in that it carries some expressive component. Instead, we must give a *de novo* analysis of the semantics of *x-much*.

## 5. Formal proposal

In order to account for the observed properties of *x-much*, we assume a multidimensional semantics in the Pottsian tradition (Potts 2005). In particular, our analysis is based on the idea of *hybird semantics* in Gutzmann 2015b, that is, a multidimensional semantics in which the ordinary truth-conditional layer of meaning is supplemented with an additional meaning dimension that captures the *use-conditional* meaning of an utterance. This use-conditional tier does not hold feature expressive content in the narrow sense—as contributed by, say, expressive adjectives, slurs, or interjections—but also other aspects like the discourse-functional meaning of various particles (Gutzmann 2013; McCready and Takahashi 2013), vocatives (Eckardt 2014; Predelli 2008), sentential force (Portner 2007; Gutzmann 2015b), or even the givenness of backgrounded material (Kratzer 2004).<sup>3</sup> For illustration, consider an utterance of the following sentence, which contains the expressive attributive adjective *damn*.

(38) That **damn** Parker got the best shot of Spiderman.

The idea of a multidimensional approach to use-conditional content, and hybrid semantics in particular, is that *damn*, if used as in (38), contributes just to the expressive/use-conditional dimension of meaning without any truth-conditional effect on its argument. Using, for the sake of illustration, a simple paraphrase for *damn*, we can give the truth-conditional and use-conditional content of (38) as follows.

<sup>3</sup>In contrast to Potts's second dimension that focused on his notion of *conventional implicatures*, the use-conditional dimension does not include appositives or other supplements, for which a use-conditional analysis seems inadequate. Cf., amongst many others, Amaral et al. (2007); AnderBois et al. (2013); Koev (2013); Nouwen (2007); Schlenker (2010); Syrett and Koev (2014) for some discussion.

$$(39) \quad \llbracket (38) \rrbracket = \left\langle \begin{array}{l} \textit{Parker got the bets shot of Spiderman,} \\ \textit{The speaker has a negative attitude towards Parker} \end{array} \right\rangle$$

The interpretation of (38) consists of a tuple. The first member corresponds to its truth-conditional, and the second its use-conditional content, which we give both as plain paraphrases here.

The general idea of hybrid semantics, which goes back to Kaplan's 1999 influential manuscript, is rather independent of the actual implementation. However, the multidimensional logic called  $\mathcal{L}_{CI}$ , as pioneered by Potts (2005), provides a natural formalization of hybrid semantics and sparked a lot of subsequent work that extended and modified Potts's original system.<sup>4</sup> Of particular interest for our purposes is McCready's 2010 extension, which he calls  $\mathcal{L}_{CI}^+$ . The two main innovations of this logic are that it introduces two new kinds of use-conditional content, both of which come with their own semantic type and corresponding composition rule. First,  $\mathcal{L}_{CI}^+$  is able to deal with *mixed* expressions, that is, expressions that in contrast to *damn* in (38), contribute to both meaning dimensions simultaneously. Racist slurs like *Kraut* are prime examples for this, as they make a neutral ethnic predication on the truth-conditional dimension, while expressing a negative racist attitude on the use-conditional dimension, as in Williamson 2009; Saka 2007. However, what is more important for the purposes of an analysis of the *x-much*-construction, is the addition of so-called shunting expressions. What is special about such shunting expressions can again best be described with reference to how they differ from simple expressives like *damn* in (38). Note that, from a plain truth-conditional perspective, *damn* does not do anything to its argument. That is, truth-conditionally speaking, the content of *damn Parker* equals that of plain *Parker*.<sup>5</sup>

$$(40) \quad \llbracket \textit{damn}(\textit{parker}) \rrbracket^t = \llbracket \textit{parker} \rrbracket^t$$

Because of this behavior in the truth-conditional dimension, expressives like *damn* can be called *expletive* use-conditional items (Cruse 1986; Gutzmann 2013) and they are said to be *non-resource sensitive* (Potts 2005), since their argument is not consumed by the application but can be used more than once (once in the use-conditional tier, and a second time when it is used truth-conditionally).

In Potts's original study, this was considered to be the only way according to which expressive items could compose with truth-conditional arguments. However, as was shown by McCready (2010), there are also expressives that, instead of making their argument available again, "shunt" their truth-conditional argument away to the use-conditional dimension in a resource sensitive fashion, leaving nothing back in the truth-conditional layer. For instance, McCready (2010, § 3.3) discusses the Japanese expression *yokumo*. When used in a declarative, this adverb transforms an ordinary assertion into a kind of negative exclamative. It does this by taking the propositional content as its argument, returning a negative attitude towards it, together with a display of surprise

<sup>4</sup>Alternatives to the framework in the Pottsean tradition are suggested, amongst others, by Barker, Bernardi, and Shan (Barker et al.), Gutzmann (2015a), and Kubota and Uegaki (2011), who use continuations, or Giorgolo and Asudeh (2011, 2012), who use an approach based on the application of monads to natural language (Shan 2001).

<sup>5</sup>Notation: we use the superscripted *t* to designate just the truth-conditional dimension of the interpretation of an expression. The analog holds for a superscripted *u* and use-conditional content.

at the use-conditional dimension. We can state this informally as follows.

$$(41) \quad |yokomu S| = \left\langle \begin{array}{c} \emptyset, \\ \text{The speaker thinks } S \text{ is bad and is surprised by } S \end{array} \right\rangle$$

Crucially, applying *yokumo* to a sentence does not leave anything meaningful behind in the truth-conditional dimension. Hence, a *yokumo* sentence cannot be used to make an assertion, but instead performs an expressive speech act. Obviously, this seems to be similar to what happens when *x-much* is applied to its target phrase. But before we state a shunting analysis of *x-much*, let us first present the formal system in more detail.

In spite of using McCready's shunting expressions, we will not use his  $\mathcal{L}_+$ . Instead we will employ a modification of the entire Pottsean framework developed by one of the authors elsewhere (Gutzmann 2015b), for the simple reason that it also allows for expressive modification; something that will be needed when we consider the role of intonation in the *x-much*-construction later.

The system of  $\mathcal{L}_{TU}$ , as it is called, introduces new types for use-conditional content, much like  $\mathcal{L}_{CI}$  and  $\mathcal{L}_{CI}^+$ . However, instead of having multiple new types for the various ways expressive content can compose, together with corresponding application and elimination rules, it uses just one new kind of type and a total of two composition rules. It achieves this by switching to a strictly multi-dimensional system in which every natural language expression is represented by a 3-dimensional logical expression. But let us first start with the type definitions.

- (42) *Types for  $\mathcal{L}_{TU}$*
- $e, t$  are basic truth-conditional types for  $\mathcal{L}_{TU}$ .
  - $u$  is a basic use-conditional type for  $\mathcal{L}_{TU}$ .
  - If  $\tau$  is a truth-conditional type for  $\mathcal{L}_{TU}$ , then  $\langle s, \tau \rangle$  is a truth-conditional type for  $\mathcal{L}_{TU}$ .
  - If  $\sigma$  and  $\tau$  are truth-conditional types for  $\mathcal{L}_{TU}$ , then  $\langle \sigma, \tau \rangle$  is a truth-conditional type for  $\mathcal{L}_{TU}$ .
  - If  $\sigma$  is a type for  $\mathcal{L}_{TU}$  and  $\tau$  is a use-conditional type for  $\mathcal{L}_{TU}$ , then  $\langle \sigma, \tau \rangle$  is a use-conditional type for  $\mathcal{L}_{TU}$ .
  - The set of all types for  $\mathcal{L}_{TU}$  is the union of all truth-conditional and use-conditional types.

The two composition rules we will make are called multidimensional application and use-conditional elimination, respectively. In contrast to Potts's system, we follow McCready (2010) and use a proof-style notation.<sup>6</sup>

$$(43) \quad \text{Multidimensional application}$$

$$\frac{\alpha_1 : \langle \sigma, \tau \rangle \blacklozenge \alpha_2 : \langle \rho, \nu \rangle \bullet \alpha_3 \quad \beta_1 : \sigma \blacklozenge \beta_2 : \rho \bullet \beta_3}{\alpha_1(\beta_1) : \tau \blacklozenge \alpha_2(\beta_2) : \nu \bullet \alpha_3 \odot \beta_3}$$

<sup>6</sup>Officially, the 3-dimensional objects are triples. However, we use the bullet and diamond as a nod to the original  $\mathcal{L}_{CI}^{(+)}$ -system.

(44) *Use-conditional elimination*

$$\frac{\alpha_1 \blacklozenge \alpha_2 : u \bullet \alpha_3}{\alpha_1 \blacklozenge \alpha_1 \bullet \alpha_3 \odot \alpha_2}$$

The rule for multidimensional application involves pointwise functional application in the first two dimensions and the merging of use-conditional propositions (i.e. expressions of type  $u$ ) in the third dimension. The rule for use-conditional elimination takes fully saturated use-conditional content from the second dimension and stores it into the third dimension, while repopulating the second dimension with the content from the first dimension.

How these two rules interact is explained the easiest by way of going through a simple example.

(45) That damn Daniel is dancing.

We use the following 3-dimensional representation for the derivation of (45). We ignore the demonstrative article as well as the tense and aspect of the original example.

- (46) a.  $I_e \quad \blacklozenge \text{damn} : \langle e, u \rangle \bullet U$   
 b.  $\text{daniel} : e \quad \blacklozenge \text{daniel} : e \bullet U$   
 c.  $\text{dance} : \langle e, t \rangle \blacklozenge \text{dance} : \langle e, t \rangle \bullet U$

As usual,  $I_e$  is an identity function on expressions of type  $e$ . That is, for every expression  $\alpha$  of type  $e$ ,  $I_e(\alpha) = \alpha$ . The expression  $U$  in the third dimension as a dummy expression that corresponds to “empty” use-conditions. It denotes the set of all contexts and hence a trivial use-conditional proposition that is always fulfilled.

With these representations, we can derive the meaning of (45) by a combination of the two combinatoric rules given above.<sup>7</sup>

$$(47) \quad \frac{\frac{\frac{\text{damn}}{I_e \blacklozenge \text{damn} : \langle e, u \rangle \bullet U} \text{Lx} \quad \frac{\frac{\text{Daniel}}{\text{daniel} : e \blacklozenge \text{daniel} : e \bullet U} \text{Lx}}{\text{daniel} : e \blacklozenge \text{damn}(\text{daniel}) : u \bullet U} \text{MA}}{\text{daniel} : e \blacklozenge \text{daniel} : e \bullet \text{damn}(\text{daniel}) : u} \text{UE} \quad \frac{\text{is dancing}}{\text{dance} : \langle e, t \rangle \blacklozenge \text{dance} : \langle e, t \rangle \bullet U} \text{Lx}}{\text{dance}(\text{daniel}) : t \blacklozenge \text{dance}(\text{daniel}) : t \bullet \text{damn}(\text{daniel}) : u} \text{MA}$$

As is illustrated by this derivation, the role of the second dimension is to store all expression that are relevant for the calculation of use-conditional content, which includes both use-conditional functions as well as potential truth-conditional arguments.

Given the derivation in (47), we can equate the interpretation of (45) with the interpretation of the three dimensions of the derived 3-dimensional expression.<sup>8</sup>

<sup>7</sup>Some notes: Since  $\llbracket I_e(\text{daniel}) \rrbracket = \llbracket \text{daniel} \rrbracket$ , we drop the identity function and just write **daniel** in the derivation. Also, we just write  $\alpha$  for  $U \odot \alpha$ , since  $\llbracket U \odot \alpha \rrbracket = \llbracket \alpha \rrbracket$ .

<sup>8</sup>We can then use a projection function, to define interpretation functions, that pick up just one dimension, such that  $|S|^I = \pi_1|S|$  provides the truth-conditional content and  $|S|^U = \pi_3|S|$  the use-conditional content. Likewise, we can

$$(48) \quad |That\ damn\ Daniel\ is\ dancing| = \langle \llbracket \mathbf{dance}(\mathbf{daniel}) : t \rrbracket, \llbracket \mathbf{dance}(\mathbf{daniel}) : t \rrbracket, \llbracket \mathbf{damn}(\mathbf{daniel}) : u \rrbracket \rangle$$

That is, the truth-conditional content of (45) (in the first dimension) is given by the proposition that Daniels is dancing, while its use-conditions (in the third dimension) is given by the interpretation of **damn(daniel)**, that is, that the speaker has a negative attitude towards Daniel.

Now, *damn* in (45) is an expletive use-conditional item, which can be witnessed by the fact that it has an identity function in its first dimension (which corresponds to argument type of the function in the second dimension). So, how shall we model shunting types in  $\mathcal{L}_{TU}$ ? Remember that in McCready's  $\mathcal{L}_{CI}^+$ , shunting expressions have a dedicated type and composition rule. Since such a strategy is not available in  $\mathcal{L}_{TU}$ , it must build the difference in composition behavior into the lexical representation. This can be done by introducing a trivial element  $T$  (in analogy to the trivial use-conditional  $U$ ) and have the first dimension of a shunting expression map any input onto that trivial state. That is, for *yokumu*, we get the following representation.

$$(49) \quad \lambda p.T \blacklozenge \mathbf{yokumo} : \langle \langle s, t \rangle, u \rangle \bullet U$$

With this translation, we can derive a *yokumo*-sentence just as before by using a combination of multidimensional application and use-conditional application. The only difference is that the first dimension of *yokumo* is such that it's argument is “consumed”, only leaving behind the trivial truth-conditional element  $T$ .

$$(50) \quad \frac{\frac{\mathbf{yokumo}}{\lambda p.T \blacklozenge \mathbf{yokumo} : \langle st, u \rangle \bullet U} \text{Lx} \quad \frac{\frac{S}{\mathbf{p} : \langle s, t \rangle \blacklozenge \mathbf{p} : \langle s, t \rangle \bullet U} \text{Lx}}{T \blacklozenge \mathbf{yokumo}(\mathbf{p}) : u \bullet U} \text{MA}}{T \blacklozenge T \bullet \mathbf{yokumo}(\mathbf{p}) : u} \text{UE}$$

From this derivation, we then get the following 3-dimensional interpretation for a *yokumo*-sentence.

$$(51) \quad |yokumo(S)| = \langle \llbracket T \rrbracket, \llbracket T \rrbracket, \llbracket \mathbf{yokumo}(\mathbf{p}) : u \rrbracket \rangle$$

Note that the interpretation of the first dimension does not contain any meaningful content, which models the fact that shunting expressives do not leave any truth-conditional content behind.<sup>9</sup>

With this general approach to use-conditional/expressive content and analysis of shunting expressions as the background, we can now state the lexical representation for *x-much*. Like, *yokumo*, it must have a “shunting-function” in its first dimension. The important difference, however, is that

use  $|S|^s = \pi_2|S|$  for the second dimension, which may be called *s*-dimension.

<sup>9</sup>The interpretation equals the one that  $\mathcal{L}_{CI}^+$  also yields. However, using a tautology may not be the best way to model this effect. First, actual tautologies in natural language still license a response like *Of course!* – which is not true for a shunting sentence. Secondly, one could, in principle add a negation to the derivation in (51), which would result in a contradiction in the truth-conditional dimension, but without any effect on the use-conditional content. However, empirically, this is not possible. A technically better way to model this could be to introduce a dedicated output type, that can neither serve as the input of a functional expression nor be used for sensibly perform assertions. See Barker, Bernardi, and Shan (Barker et al.) for a suggestion along such lines (in a different setting though).

*x-much* does not take propositional arguments, but instead takes a degree relation of the usual type as its argument.

$$(52) \quad \lambda G.T \blacklozenge \mathbf{xmuch} : \langle \langle d, \langle e, t \rangle \rangle, u \rangle \bullet U$$

Using this 3-dimensional semantic representation, we can derive a *x-much*-construction like (4) by applying *x-much* to a degree-denoting expression and using use-conditional elimination afterwards.

$$(53) \quad \text{Rude, much?} \quad \frac{\frac{\text{rude}}{\text{rude} : \langle d, \langle e, t \rangle \rangle \blacklozenge \text{rude} : \langle d, \langle e, t \rangle \rangle \bullet U} \text{Lx} \quad \frac{\frac{\text{much}}{\lambda G.T \blacklozenge \mathbf{xmuch} : \langle \langle d, \langle e, t \rangle \rangle, u \rangle \bullet U} \text{Lx}}{\frac{T \blacklozenge \mathbf{xmuch}(\text{rude}) : u \bullet U}{T \blacklozenge \mathbf{xmuch}(\text{rude}) : u \bullet \mathbf{xmuch}(\text{rude}) : u} \text{UE}} \text{MA}$$

From this, we then get the following interpretation. First, since  $T$  denotes the set of all worlds, the truth-conditional content is trivial.

$$(54) \quad |Rude, much?|^t = \llbracket T \rrbracket = W$$

As for the lexical semantics for *x-much*, we give a denotation along the lines of (55), which then gives us the interpretation in (56) for the use-conditional dimension of (53).

$$(55) \quad \llbracket \mathbf{xmuch} \rrbracket = \text{the function } f, \text{ such that for any degree relation } G, \text{ contextually determined individual } x \text{ and standard of comparison for } Std_G, f(G) = \{c : \text{there is a degree } d \text{ such that } x \text{ is } G \text{ to degree } d \text{ in } c \text{ and } d \text{ largely exceeds } Std_G \text{ in } c \text{ and } c_S \text{ think that degree is ridiculous}\}$$

$$(56) \quad |Rude, much?|^u = \llbracket \mathbf{xmuch}(\text{rude}) \rrbracket = \{c : \text{there is a degree } d \text{ such that } x \text{ is rude to degree } d \text{ in } c \text{ and } d \text{ largely exceeds } Std_G \text{ in } c \text{ and } c_S \text{ think that degree is ridiculous}\}$$

To sum up, the use of *x-much* is felicitous—or, as Kaplan (1999) put it, “expressively correct”—if the inferred referent exhibits the property denoted by the target to a very high degree (given the standard of comparison) and if the speaker judges that degree to be ridiculous or excessive. This approximates the contribution of *x-much* closely enough. But the shunting analysis also captures the fact that the entire contribution of the *x-much*-construction is in the use-conditional dimension and that it therefore is not asserted, while still committing the speaker to its content. The analysis also correctly captures the fact that *x-much* cannot compose with truth-conditional operators like conjunction and disjunction, as no meaningful truth-conditional content is left behind after *x-much* is applied to its argument.

## 6. Directedness

One aspect we have not addressed so far is why the *x-much* construction, when written, is used with a question mark. The answer is, we think, twofold. First, when spoken, it is used with a rising intonation akin to that used in bona fide rising declaratives, which are also mostly written with question marks due to their question-like conversational force (Gunlogson 2003). Secondly,

as we will argue, the effect of this rising intonation is that the entire *x-much*-construction may be considered to be a special kind of question which is similar to a biased polar question, but in the expressive dimension instead of the truth-conditional level. This has, as we will see, special ramifications for their discourse status.

The first observation to be made is that an *x-much*-utterance needs an interlocutor to which it is directed. You cannot just utter it for yourself. For instance, consider the follow scenario.

- (57) [Walking through the forest alone, a giant tree crashes down in front of you.]
- a. #Scary, much?
  - b. That was very scary!
  - c. Scary!
  - d. How scary that was!

The *x-much*-utterance in (57a) is ruled in contexts like this in which there is no addressee. In contrast, using a plain declarative as in (57b) or just elliptical version of it as in (57c) is perfectly fine (*pace* all approaches to think of declaratives as putting forward a proposal). Interestingly, exclamatives, which seem to be very similar to utterances of *x-much*, are also possible in such a context, as witnessed by (57d).

A similar observation can be made for questions posed with rising declaratives. As illustrated by the following, different forest scenario, using a rising declarative in self-directed speech is ruled out, while the use of a simple polarity question is fine.

- (58) [Walking through the forest alone, you come upon what you think might be an old oak.]
- a. Is that an oak?
  - b. #That's an oak?

That is, *x-much* seems to be necessarily directed at someone besides oneself, just like rising declaratives. However, given the aforementioned fact that *x-much* utterances have the same intonation as rising declaratives, it should be of no surprise that both share this kind of directedness. In particular, Gunlogson 2003 has argued that it is precisely the rising intonation that, in combination with the contribution of simple declaratives, gives rising declaratives their question-like conversational force. In the rest of this paper, we briefly explore the ramifications of taking the intonation in *x-much*-constructions at face value, assigning it the same kind of meaning as in rising declaratives, and combining it with the expressive semantics of *x-much* as presented in the previous section.

The basic idea of Gunlogson's analysis of rising declaratives is that the rising intonation has the effect of trying to place the proposition at hand on the addressee's commitment set, which in turn presupposes that such an addressee exists in the first place. That is, the difference between rising and ordinary, falling declaratives is that the latter update the speaker's commitment set, while the former target the hearer's set (see also Davis 2011).



Along these lines, what we propose is that the rising intonation of *x-much*-utterances has a parallel effect. Instead of updating the speaker commitment set with expressive content, it instead places the expressive proposition on the hearer's commitment set. However, since what is put forward to the addressee comes in the form of expressive content, the addressee cannot react in a direct, at-issue way and hence, it does become a bona fide question. That is, much like exclamatives or other expressive utterances which can be thought of as being “expressive assertions” that cannot update the speaker commitment set without being negotiable, we can think of *x-much*-utterances as “expressive questions”, that seek to update the hearer's commitment set.

		speaker update	hearer update
(59)	negotiable	declaratives	rising declaratives
	unnegotiable	exclamatives	<i>x-much</i> -utterances

In this sense, the *x-much* construction is good tool to seek mutual alignment of expressive attitudes without putting them directly on the discourse table, which explains their use to establish a connection (mostly when used about another person/object) or to accuse the hearer of exaggerating.

## 7. Conclusion

This work provides the first detailed discussion of English *x-much*, and in doing so, makes a series of novel empirical and theoretical claims. First, we have shown that *x-much* is different from more familiar uses of *much* in terms of its syntactic, semantic, and discourse properties. In particular, *x-much* is an expressive operator of the shunting kind, targeting a gradable predicate and adding a speaker's evaluative attitude about the degree to which an individual stands out on the relevant scale. Second, we have suggested that the rising intonation that necessarily accompanies the construction's use can be assimilated to that which accompanies a rising declarative. In this way, *x-much* might behave like a kind of expressive question seeking alignment of attitudes. While we did not have space to tackle this aspect of the meaning of *x-much* in detail, studying the relation between use-conditional content and the different discourse update types is an understudied area and ripe for subsequent research that we intend to do. Showing, as we have done here, that English has a novel use of *much* that derives inherently directed expressives is a solid first step.

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## ***Only if: If only we understood it***

Elena Herburger – Georgetown University

**Abstract.** I argue that the puzzle that *only if* conditionals continue to pose is solved if their bare conditional prejacent is analyzed as having existential force. The existential conditional I propose is also argued to help shed light on the semantic behavior of conditionals under negative quantifiers and to explain why we often feel that the negation of an entire conditional is equivalent to the negation of its consequent.

**Keywords:** *only*, conditionals, negative quantifiers, CEM

### **1. Introduction<sup>1</sup>**

#### 1.1. The problem

Owing to work reaching as far back as the Middle Ages (Horn 1989), we have a deep understanding of the semantics and pragmatics of *only*. And in some form or other the interpretation of conditionals has exercised logicians, philosophers and linguists since Aristotle. Given how much we know about the semantic contributions of *only* and that of *if* it should be trivial to compositionally analyze their joint appearance in examples like those in (1):

- (1) a. You only succeed if you work HARD. (CAPS=focus)
- b. Only if you work HARD do you succeed.

It turns out, however, that once we put together what we think we independently know about *if* with what we know about *only* we fall short of deriving the truth conditions of *only if* (McCawley 1974, Barker 1993, von Stechow 1997 and Dekker 2001). Does this mean that what we think about *only* is not right, or that what we think about *if* is not right? In this paper I argue that the *only if* puzzle indicates that what we think about *if* is not all there is to *if*.

#### 1.2. The meaning of *only*

As is well known, *only* requires a focus in its overt c-command domain and its interpretation is sensitive to where that focus is assigned (Rooth 1985). Thus, (2a) rules out that trees that are not Ginko trees reach said level of beauty, and smelliness, and (2b) excludes that Beat hikes in the French, Italian, Austrian or German Alps.

- (2) a. Only GINKO trees are this pretty in the fall, and smell this bad.
- b. Beat only hikes in the SWISS Alps.

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<sup>1</sup> I am grateful for comments I received from members of the audience at Sinn und Bedeutung 19 in Göttingen and from Martin Hackl, Simon Mauck, Aynat Rubinstein and Barry Schein.

As (2) also illustrates, *only* can combine with elements of different syntactic types. This behavior can be captured through a series of related meanings for *only* (Rooth 1985), or, alternatively, one can abstract away from *only*'s surface position and analyze it as a propositional operator that combines with a prejacent (von Stechow 1997). On this now widely adopted view, stated in (3), *only* presupposes its prejacent and negates all alternative propositions derived by substituting the focused element in the original sentence with elements of like semantic type. The alternative propositions excluded are ones not already entailed by the one expressed by the prejacent.<sup>2</sup> Thus, (4) presupposes that Gisela went to Berlin and negates all the relevant alternatives, e.g. (5):

$$(3) \quad [[\text{only}]] (A_{\langle st, t \rangle}) (p_{\langle st, t \rangle}) = \lambda w: p(w) = 1. \forall q \in \text{NW}(p, A): q(w) = 0 \\ \text{NW}(p, A) = \{q \in A: p \text{ does not entail } q\} \quad (\text{Fox 2006})$$

(4) Gisela only went to BERLIN.

(5) It is **not** the case that Gisela went to **Prague**. It is **not** the case that Gisela went to **Bern**. It is **not** the case that Gisela went to **Vienna**. It is **not** the case that Gisela went to **Vaduz**. It is **not** the case that Gisela went to **Bern and Berlin**. Etc.

### 1.3. The meaning of bare conditionals

Turning now to *if*, it is widely assumed that *if*  $p$   $q$  has universal force.<sup>3</sup>

(6) Universal Conditional:  
*If*  $p$   $q$  is true iff all  $p$ -cases are  $q$ -cases.

The universal conditional underlies many different analyses. But the essence of the claim is independent of whether *if* is seen as a mere device to mark the restrictor of a tacit universal modal operator, as in the Lewis/Kratzer restrictor analysis (e.g. Kratzer 2012), or whether *if* is treated as a genuine two place operator (e.g. Gillies's 2010 iffiness). Nor is the basic idea tied to whether the antecedent is seen to be quantifying over all antecedent worlds (C.I. Lewis's 1918 strict conditional) or just those that are minimally different from the evaluation world (D. Lewis's 1973 variably strict conditional). Finally, the universality of conditionals is also

<sup>2</sup> It is a matter of some debate whether the prejacent is really just presupposed, as assumed in (3), or whether it is semantically entailed in a pragmatically special, backgrounded or "assertorically inert" manner (e.g. Atlas 1993, Herburger 2000, Horn 2002). For the purposes of this discussion it does not matter and I adopt the first option. Another question that has recently been raised is whether the alternatives that are relevant for *only* should be defined over sentences rather than propositions (Katzir and Fox 2011). While this is an important question, I think that we can also safely set it aside here.

<sup>3</sup> Horn (2000) traces this view back to Wallis (1687), who equates *si* to *omnis casus quo*.

independent of whether the cases that conditionals quantify over are conceived of as possible worlds, situations, n-tuples or events. Setting all these “details” aside, under the account in (6) the bare conditional in (7) has the logical form in (8):

(7) If you work hard you succeed.

(8)  $[\forall x: R(x) \wedge \text{you-work-hard}(x)] \text{you-succeed}(x)$   
 ‘All relevant cases where you work hard are cases where you succeed.’

### 1.3. The *only if* puzzle

Though the analyses of *only* and *if* just summarized seem well motivated, when we combine them to derive the meaning of *only if* we do not obtain the result we would hope for; (1a,b) are predicted to be true as soon as not *all* failures to work hard lead to success. This, however, is too weak to capture that they are felt to be false as soon as *any* instance of not working hard results in success (McCawley 1974, Barker 1993, von Fintel 1997). Put differently, if  $p'$  is a relevant focus alternative to  $p$  that is negated by *only*, see (3), the resulting negation is a rather weak one since  $p'$  is also universally quantified:

(9)  $\neg[\forall x: p'\text{-case}(x)] q\text{-case}(x)$

Since the problem stems from the relative semantic weakness of negation taking scope over a universal quantifier (‘not all’) it stands to reason that the solution to the *only if* puzzle will require that negation not take scope over a universal quantifier. One possibility, discussed in section 2, is to posit the Conditional Excluded Middle (CEM). Noting that this option is not without problems I then explore the alternative possibility that the negation in *only if* conditionals does take wide scope over a quantifier, but the quantifier is existential (section 3). Section 4 argues that the existential conditional proposed in section 3 appears not just under *only* but more generally in downward entailing contexts, including the scope of negative quantifiers and negation itself. The specifics of the analysis of conditionals are laid out in section 5.

## 2. The *only if* puzzle and CEM

### 2.1. CEM 1: Stalnaker conditional

The exclusionary force of *only if* would be accounted for if the negation of a conditional amounted to the negation of its consequent. There is of course an analysis of conditionals which is designed to have this very property:

(10) Stalnaker conditional: (Stalnaker 1968, 1980)  
*If p q* is true iff in the closest world where  $p$  is true  $q$  is true also.

*If*-clauses on this account are akin to singular definite descriptions, picking out the unique closest world where the antecedent is true. Given that the outer negation of a sentence with a singular definite description is equivalent to its inner negation (see (11)), the Stalnaker conditional renders the negation of an entire conditional equivalent to the negation of its consequent. This is an intended result as it captures that in many instances the negation of a conditional seems indeed equivalent to the negation of its consequent. From (11) it follows that the Law of the Excluded Middle in (12a) amounts to the Conditional Excluded Middle (CEM) in (12b):

$$(11) \quad \neg[\lambda x: F(x)] G(x) \Leftrightarrow [\lambda x: F(x)] \neg G(x)$$

$$(12) \quad \begin{array}{ll} \text{a.} & [\lambda x: p\text{-case}(x)] q\text{-case}(x) \vee \neg[\lambda x: p\text{-case}(x)] q\text{-case}(x) & \text{Excluded Middle} \\ \text{b.} & [\lambda x: p\text{-case}(x)] q\text{-case}(x) \vee [\lambda x: p\text{-case}(x)] \neg q\text{-case}(x) & \text{CEM} \end{array}$$

Since on the Stalnaker conditional the negation of a conditional is equivalent to the negation of its consequent, it would seem well equipped to capture exclusionary force of *only if* conditionals (Barker 1993). Applied to (1a,b) it would give us for instance (14):

$$(13) \quad \neg[\lambda x: p'\text{-case}(x)] q\text{-case}(x) \Leftrightarrow [\lambda x: p'\text{-case}(x)] \neg q\text{-case}(x)$$

(14) In the closest world where you **work little** you do **not** succeed. In the closest world where you **work when you feel like it** you do **not** succeed. In the closest world where you **do not work at all** you do **not** succeed. Etc.

Unfortunately, however, treating conditional antecedents as singular definite descriptions also has some drawbacks. One common objection is that there is not always a single closest world in which the antecedent is true, as for instance in (15), where there is a tie between worlds in terms of closeness (Lewis 1973, Uniqueness Assumption):

- (15) a. If Bizet and Verdi had been compatriots, Bizet would have been Italian.  
b. If Bizet and Verdi had been compatriots, Verdi would have been French.

Another concern is that there may not always be a finite set containing the closest antecedent worlds (Lewis 1973, Limit Assumption):

(16) If this line \_\_\_\_\_ were over one inch long...

In light of this, Lewis (1973) proposes the variable strict analysis, according to which a counterfactual conditional is true exactly when the consequent is true in some close antecedent world and when there are no closer antecedent worlds where the consequent is not true. Because the closeness of worlds continues to matter, important results of Stalnaker's analysis are preserved (failure of Strengthening of the Antecedent and Contraposition). Yet, at the same time, since *if*-clauses are not analyzed as picking out the unique closest antecedent world, ties between worlds, as in (15), and an infinity of ever closer antecedent worlds, as in (16), cease to pose

problems. But, of course, the variably strict conditional is a version of the universal conditional, and consequently does not validate CEM. Lewis does not think this a bad result, on the contrary.<sup>4</sup> But if one wants to rely on CEM to solve the *only if* puzzle, Lewis's variable strict analysis is of little help.

## 2.2. CEM 2 and *only if*: von Fintel (1997)

To be able to appeal to CEM to explain *only if*, and still keep a version of Lewis's variably strict analysis, von Fintel (1997) proposes to analyze *if*-clauses as generic quantifiers. Unlike universal quantifiers, generic operators show homogeneity under negation (Fodor 1970, Löbner 1983). (17), for instance, does not deny that all (normal) dogs like thunder. Rather, it denies that any do:

(17) Dogs don't like thunder.

The homogeneity of generic noun phrases in negated sentences means that a generic version of the universal conditional validates CEM:

(18)  $\neg [\text{GEN}x: p\text{-case}(x)] q\text{-case}(x) \Leftrightarrow [\text{GEN}x: p\text{-case}(x)] \neg q\text{-case}(x)$

Because von Fintel's (1997) generic conditional supports CEM it seems well positioned to capture the exclusionary force of *only if* while simultaneously steering clear of the problems of that beset the Stalnaker conditional. But the analysis also raises some questions.

## 2.3. Challenges for CEM accounts of *only if* conditionals

One worry one might have about any account of *only if* that exploits CEM, including the generic one, is that CEM does not seem to be valid in the general case. This is why Barker (1993), who observes that CEM would help with the *only if* puzzle, does not adopt such an account. Apart from the possible collapse between *would* and *might* conditionals that CEM may or may not give rise to (Lewis 1973, Stalnaker 1980, see also footnote 3), there are other examples where CEM does not hold; (19a) is judged false when uttered by someone looking at a coin about to be flipped, but so is (19b), contra CEM (Leslie 2009).<sup>5</sup>

<sup>4</sup> Lewis notes that CEM results in an unwanted collapse of the semantics of *might* and *would* conditionals. This is so because on the reasonable assumption that *might* and *would* are duals, *if p then might q* is equivalent to *it is not the case that if p then it would be that not q* ( $\phi \Diamond \rightarrow \psi \Leftrightarrow \neg \phi \Box \rightarrow \neg \psi$ ). If one then assumes CEM, *if p then might q* ( $\phi \Diamond \rightarrow \psi$ ) is rendered equivalent to *if p then would q* ( $\phi \Box \rightarrow \neg \neg \psi$ ). This is an unwelcome result as *might* and *would* conditionals can clearly mean different things. In response, Stalnaker (1980) argues that *might* is not really the dual of *would*. I will not further discuss this issue here but hope to address it in future research.

<sup>5</sup> A possible way out may to say that (19a) and (19b) are not both false, but indeterminate and should be accounted for in terms of supervaluations (Stalnaker 1980, Klinedinst 2010).



- (19) a. This fair coin will come up heads if flipped. F  
 b. This fair coin will not come up heads/will come up tails if flipped. F

Another potential problem, particular to von Fintel's (1997) account, is that generic quantification appears a bit too weak to capture the exclusionary force of *only if* (Cohen 2004): If some non-generic cases of goofing off lead to success are the sentences in (1) not false?

Finally, CEM accounts of *only if* also run into difficulties as far as the presuppositions of *only if* conditionals are concerned. If an *only if* conditional presupposes a bare conditional prejacent then if the prejacent is generically quantified, (1a,b) are predicted to presuppose that all (normal) hard work leads to success. But while (1a,b) assert that hard work is a *necessary* condition for success, they do not presuppose that all (normal) instances of hard work will be rewarded by success. In other words, they do not presuppose that normal hard work is a *sufficient* condition for success and are not synonymous with an *if and only if* conditional. Similarly, the coherence of (20a), which contrasts with the incoherence of (20b), shows that the *only if* conditional does not presuppose that hard work is a sufficient condition for success.<sup>6 7</sup>

- (20) a. You succeed only if you work hard. But sometimes when you work hard you don't succeed. Coherent  
 b. You succeed if and only if you work hard. #But sometimes when you work hard you don't succeed. Contradictory

To summarize, while the generic conditional adroitly avoids the problems with the Stalnaker conditional, it does not seem to fully capture the exclusionary force of *only if* conditionals, nor does it make correct predictions regarding the presuppositions of *only if* conditionals.

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<sup>6</sup> This observation can already be found in McCawley (1974: 634), who notes that "it [= (i)] no more commits the speaker to the belief that he will leave in all such cases than (3c) [= (ii)] commits him to the belief that all Southerners voted for Hubert." I address the parallels between bare plurals and conditionals under *only* illustrated here in a bit more detail in section 4.2.

- (i) Tom will leave only if John comes back by midnight.  
 (ii) Only Southerners voted for Hubert.

<sup>7</sup> I think an account of *only if* that relies on the Stalnaker conditional would also be subject to a version of this criticism because it, too, would predict that an *only if* conditional presupposes a "regular" conditional; it would presuppose that in the closest world where you work hard you do indeed succeed. Since the closest world where you work hard is also the world that is relevant for the *if and only if* conditional (20a) and (20b) would be falsely predicted to be equivalent.

### 3. Existential conditionals under *only*

At this point, I would like to explore a different possibility, namely that along with the universal conditional we have an existential one:<sup>8</sup>

- (21) Universal conditional:  
In certain contexts, *if p q* is true iff all *p*-cases are *q*-cases.
- (22) Existential conditional:  
In certain contexts, *if p q* is true iff some *p*-cases are *q*-cases.

My first goal is to show that *if p q* under *only* is the existential conditional. I then argue that this is also true more generally of conditionals appearing in negative or downward entailing contexts.

#### 3.1. Exclusionary force of *only if*

As soon as we assume that the *if*-clauses under *only* are existential quantifiers their exclusionary force directly follows from the semantics of existential quantification in the scope of negation. The alternatives to (1a,b) that are negated by *only* then amount to something the following:

- (23) It is **not** the case that in **some (any)** cases where you work a little you succeed. It is **not** the case that in **some (any)** cases where you work when you feel like it you succeed. It is **not** the case that in **some (any)** cases where you do not work at all you succeed. Etc.

#### 3.2. Existential presuppositions of *only if* sentences

Not only does the existential conditional predict the exclusionary force of *only if*, it also makes interesting predictions regarding their presuppositions. Though (1a,b) do not presuppose that all hard work leads to success, they do presuppose something, namely that *some* instances of hard work are rewarded with success. This is why (1a,b) can be used to encourage somebody to work hard; hard work at least gives you a shot at success even if it does not guarantee it. Consider also:

- (24) Only if you drink kale juice do you live to be 130.

(24) is bizarre because it presupposes that in some instances where you drink kale juice you live to be 130 (suggesting furthermore, as many conditionals do, that there is a causal link between antecedent and consequent). For all we know, that is not true; there is no case where you drink kale juice and live to be 130, simply because the chances to live to a 130 are practically zero to

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<sup>8</sup> The possibility of an existential conditional is also toyed with in McCawley's (1974) and von Stechow's (1997) discussion of *only if* conditionals. It is not adopted because it conflicts with the universal (generic) conditional and because neither author seems to be comfortable positing an ambiguity. I have no such qualms.

begin with. In sum, analyzing the preajcent of an *only if* conditional as an existential conditional not only captures its exclusionary force it also predicts the existential presuppositions we find.

## 4. Additional support for the existential conditional

### 4.1. Negative contexts

Conditionals that appear as the preajcent of *only* are not alone in having existential force. I think the same can be said of conditionals in other negative contexts, in particular conditionals in the scope of negative quantifiers, under *doubt*, and also conditionals under negation.

#### 4.1.1. Scope of decreasing quantifiers

Conditionals in the scope of negative quantifiers are known to pose an interesting challenge. Higginbotham (1986) notes that while in a sentence like (25a) *if* could be translated as a material conditional, this is not true of *if* in (25b); it would mean that there is no student for whom goofing off is a sufficient condition for success or, equivalently, that every student goofs off and fails, cf. (26b):

- (25) a. Every student will succeed if he or she works hard.  
b. No student will succeed if he or she goofs off.

- (26) a.  $\forall x(\text{Student}(x) \rightarrow (\text{Work-hard}(x) \rightarrow \text{Succeed}(x)))$   
b.  $\neg \exists x(\text{Student}(x) \rightarrow (\text{Work-hard}(x) \rightarrow \text{Succeed}(x)))$   
 $\Leftrightarrow \forall x (\text{Student}(x) \rightarrow \neg(\neg \text{Goof-off}(x) \vee \text{Succeed}(x)))$   
 $\Leftrightarrow \forall x (\text{Student}(x) \rightarrow (\text{Goof-off}(x) \wedge \neg \text{Succeed}(x)))$

Of course, the material conditional is probably not a good translation for any conditional but the point is that, “paradoxes of the material conditional” aside, it is a far worse translation for (25b) than for (25a). I briefly discuss three different ways of dealing with the contrast in (25) before trying to show how the existential conditional solves the problem.

The first option (Higginbotham 1986) simply says that *if* under negative quantifiers like *no student* does not translate as the material conditional ‘ $\rightarrow$ ’, but as a conjunction ‘ $\wedge$ ’ (cf. also Dekker 2001’s dualization operator). Instead of (26b) the logical form of (25b) would be (27):

- (27)  $\neg \exists x (\text{Student}(x) \wedge \text{Goof-off}(x) \wedge \text{Succeed}(x))$

Higginbotham (*ibid.*) worries about the non-compositionality of this analysis, which has the meaning contribution of *if* vary depending on whether it appears in the scope of a universal or a negative quantifier. There is, moreover, an empirical problem to contend with. (28a) and (28b)

are not really equivalent (Leslie 2009):<sup>9</sup> (28a) is falsified by Meadow, who will get a good grade no matter what, simply because her mobster father pressures the teacher. But if Meadow actually happens to work hard, maybe to spite Dad, she does not falsify (28b):

- |      |    |   |   |
|------|----|---|---|
| (28) | a. | No student will succeed if he or she goofs off. | F |
|      | b. | No student will succeed and goof off.           | T |

An alternative analysis of conditionals under negative quantifiers builds on the theory that *if* itself has no meaning but marks the *if*-clause as a quantificational restrictor, in this case adding to the restriction of the determiner *no*. Von Fintel (1998) argues that this restrictor view explains the difference between (25a,b) by assimilating them to (29a,b), respectively:

- |      |    |  |
|------|----|--|
| (29) | a. | Every student who works hard will succeed. |
|      | b. | No student who goofs off will succeed.     |

However, as von Fintel and Iatridou (2002) and Higginbotham (2003) point out, the truth conditions of (25b) and those of its putative paraphrase in (29b) do not quite match. Hard-working Meadow will again cause trouble (Leslie 2009); she will falsify (25b) because, with Dad looming over the teacher, there is no way Meadow will fail, no matter what she does or does not do. But, regardless of her father, Meadow will not falsify (29b), simply because she does not actually goof off.<sup>10</sup> It seems that just like the ‘and’ theory, the restrictor theory does not do justice to the fact that conditional antecedents are about possible events or situations, not necessarily actual ones. A way to save the restrictor theory is pointed out in Leslie (2009): modalize the restriction (cf. Klinedinst 2010 for some criticism).

A third way to account for conditionals under negative quantifiers, laid out in Higginbotham (2003) and advocated in von Fintel and Iatridou (2002), relies on CEM and the decomposition of negative quantifiers into a negation and a universal quantifier. Whereas Higginbotham (2003) observes this in connection with the Stalnaker conditional, which, as we saw above, supports CEM, von Fintel and Iatridou (2002) assume the universal conditional and posit CEM on top of it. Thus, given the decomposition of the determiner *no*, (30a) is equivalent to (30b), which in turn

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<sup>9</sup> Leslie attributes counterexamples of this nature to Higginbotham (2003) and von Fintel and Iatridou (2002), who discuss them in connection with the restrictor analysis (see text below).

<sup>10</sup> Or, to give an example from Higginbotham (2003), the truth conditions of (i) depend on how a professor that is in fact not offered a generous pension would react were he or she offered such a pension. For the interpretation of (ii) on the other hand only professors that are actually offered a pension matter.

- |      |  |
|------|--|
| (i)  | Every professor will retire early if offered a generous pension. |
| (ii) | Every professor offered a generous pension will retire early.    |

is rendered equivalent to (30c) by CEM. (30c) states that for all students in all cases where they goof off they do not succeed. This captures the desired truth conditions.

- (30) a. [No  $x$ : Student( $x$ )] [All  $w$ : Goof-off( $x$ , in  $w$ )] Succeed ( $x$ , in  $w$ )  
 b. [All  $x$ : Student( $x$ )]  $\neg$ [All  $w$ : Goof-off( $x$ , in  $w$ )] Succeed ( $x$ , in  $w$ )  
 c. [All  $x$ : Student( $x$ )] [All  $w$ : Goof-off( $x$ , in  $w$ )]  $\neg$  Succeed ( $x$ , in  $w$ )

Apart from the fact that CEM needs to be posited, the account hinges on the validity of CEM, just like the account of *only if* in terms of CEM did. It is in this connection that Leslie (2009) points to (31), which we already encountered as (19) above, noting, if I understand her correctly, that what arguably corresponds to the embedded conditional in (31), namely (32a), does not obey CEM; the falseness of (32a) does not imply the truth of (32b) because both are in fact false. If, however, the conditional in (32a) does not obey CEM it seems stipulative to say that the same kind of conditional when embedded under *no fair coin* in (31) should obey CEM.

(31) No fair coin will come up heads if flipped.

- (32) a. This fair coin will come up heads if flipped. F  
 b. This fair coin will not come up heads/will come up tails if flipped. F

Having briefly considered the *if*-means-‘and’ approach, the restrictor approach, and the CEM approach, I would now like to explore the possibility that the conditionals under negative quantifiers are like those under *only* in having existential rather than universal force<sup>11</sup>. On this view, (25a), where the conditional appears under the universal quantifier *every student*, has the logical form in (33a), which employs a universal conditional. In contrast, the logical form of (25b), given in (33b), involves the existential conditional:

- (33) a. [Every  $x$ : Student( $x$ )] [ $\forall w$ : Work-hard( $x$ ,  $w$ )] Succeed( $x$ ,  $w$ ) (=25a)  
 b. [No  $x$ : Student( $x$ )] [ $\exists w$ : Goof-off( $x$ ,  $w$ )] Succeed( $x$ ,  $w$ ) (=25b)

As (33) shows, assuming that the conditional under a negative quantifier like *no student* is existential rather than universal straightforwardly captures its truth-conditions; (33b) says that no student is such that there are *any* instances where he or she goofs off and still succeeds. By providing another instance of the existential conditional it lends further support to the claim that the prejacent of *only if* conditionals is also of this sort.

#### 4.1.2. Conditionals under *doubt*

Continuing our quest of existential conditionals, we can also consider (34):

(34) I doubt that John will succeed if he goofs off. (Fintel and Iatridou 2002)

<sup>11</sup> I first heard about this possibility in a class lecture of Barry Schein’s in the early 1990s.

(34) expresses doubt as to whether goofing off and success are compatible, rather than doubt as to whether goofing off is a sufficient condition for success, which would be pragmatically bizarre. I take this to suggest that the conditional here is also existential and that (34) means that the speaker doubts that there is *any* case where John goofs off and succeeds nonetheless.

#### 4.1.3. Conditionals under negation

All conditionals with existential readings encountered so far appear in downward entailing environments of some sort, namely in the scope of *only*, under negative quantifiers like *no student* and under *doubt*.<sup>12</sup> This naturally raises the question whether conditionals that appear under negation also have the existential reading:

- (35) a. It's not the case that John will succeed if he goofs off.  
b. John won't succeed if he goofs off.

Once we assume that (35a,b) are indeed interpreted as in (36), as involving an existential conditional, that is, we can actually explain why the negation of a conditional is often felt to be equivalent to the negation of its consequent: it follows from the logical equivalence between the outer negation of an existential quantifier, cf. (36), and the inner negation of a universal quantifier, cf. (37). The existential conditional derives that the negation of a conditional is equivalent to the negation of the consequent of a conditional—only the two are not the same conditional because they do not have the same quantificational force.

(36)  $\neg[\exists w: \text{Goof-off}(j,w)] \text{Succeed}(j,w)$

(37)  $[\forall w: \text{Goof-off}(j,w)] \neg \text{Succeed}(j,w)$

But what about counterexamples to CEM like that in (19)/(32)? I would like to venture the following conjecture in this regard:

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<sup>12</sup> *Only* is not downward entailing in the classical sense, as was essentially already noted in the Middle Ages (Horn 1989). Rather, it licenses a downward instance to the extent that the presupposition/backgrounded entailment of the subset case is added as a premise to the argument (von Stechow 1999). (i) thus downward entails (ii) if we add a premise that somebody entered the race early. Similarly, *doubt* is also not downward entailing unless we add some further stipulations. These matters aside, however, they are negative in the relevant sense.

- (i) Only Socrates entered the race.  
(ii) Only Socrates entered the race early.

- (38) Instances where the negation of a conditional is not felt to be equivalent to the negation of the consequent arise when the negated conditional is used to deny a universally quantified conditional, inheriting, because of the denial, its universal force.

Recall that (39) is false. Its negation must therefore be true (Excluded Middle).

- (39) If this fair coin is flipped it will come up heads. F

But, crucially, ‘its negation’ means that what is negated has the same quantificational force as the original. It is when (40a,b) are used to deny (39) that they are true because they are then similar in meaning to (40c) and interpreted as in (41):

- (40) a If a fair coin is flipped it will not come up heads. T  
 b. It’s not the case/true that if a fair coin is flipped it will come up heads. T  
 c. If a fair coin is flipped it will not necessarily come up heads. T

- (41)  $\neg[\forall w: [Ax: \text{Fair-coin}(x)] \text{Flipped}(x,w)] \text{Land-heads}(x, w)$  T

Note that on this interpretation the negation of (39) is not equivalent to (41), which is false:

- (42) If this fair coin is flipped it will come up not heads/tails. F

In other words, we do not get a CEM-like effect when the negation of a conditional is the denial of a conditional, including its universal force. It is when the sentences in (40) are interpreted in a “regular” way—as existential conditionals under negation, as in (43)—that they are also false and equivalent to (42), creating the appearance of CEM:

- (43)  $\neg[\exists w: [Ax: \text{Fair-coin}(x)] \text{Flipped}(x,w)] \text{Land-heads}(x, w)$  F

*Doubt* should also lend itself to denying a previous utterance. Indeed, when used as a denial (44B) can be taken to say that not all cases of tossing the coin are ones where it lands heads.

- (44) A: If this fair coin is flipped it will come up heads.  
 B: I DOUBT that if this fair coin is flipped it will come up heads. It may also come up tails.

To summarize, I propose that conditionals under negation have existential force. This explains the impression that speakers have that the negation of a conditional is equivalent to the negation of its consequent—it is only an impression because we are not really speaking of the same conditional—one is universally quantified, the other existentially. What look like counterexamples to CEM are instances where the negated conditional has the same universal force as the non-negated conditional. This typically arises in contexts of denial.

## 4.2. Bare plurals under *only* and negation

Bare plurals offer a further argument for analyzing *only if* in terms of an existential conditional. Already McCawley (1974) and von Stechow (1997) draw a parallel between bare conditionals under *only* and bare plurals under *only*, noting in particular that even bare plurals that normally have quasi-universal readings, e.g. subjects of individual level predicates, show existential reading under *only*. For instance, (45b) does not presuppose that adults in general eat arugula:

- (45) a. Adults eat arugula.  
b. Only adults eat arugula.

If the ambiguity of bare plurals stems from an ambiguity between a quasi-universal and an existential operator, as is widely assumed, (45) offers more evidence for there being a preference for an existential reading of an ambiguous  $\forall/\exists$  quantifier under *only*. Pushing the parallel between bare conditionals and bare plurals even further, we can now also try to actually *explain* the homogeneity of bare plurals; the impression of homogeneity arises because a sentence like *Dogs don't bark* means something along the lines of 'It is not the case that there are any normal dogs that bark.' In other words, the bare plural under negation is existential. Exceptions to this generalization should be instances where a previous sentence with a generic reading is denied.<sup>13</sup>

## 5. Analysis

### 5.1. *If*-clauses as plural definite descriptions

I have argued that bare conditionals can have existential along with their more familiar universal readings. It would, however, be too simple to analyze the antecedents themselves as ambiguous

<sup>13</sup> One may wonder if this suggestion might also extend to the homogeneity shown by plural definite descriptions. It would if plural definite descriptions are also ambiguous between universal and existential readings, as argued in Krifka (1996) in connection with (i) and (ii):

- (i) The windows are open. (some)  
(ii) The windows are closed. (all)

Krifka (*ibid.*) suggests in this context that if grammar does not fix the interpretation, semantic strength in a particular context is a determining factor. This would explain the existential readings in downward entailing contexts. However, one difference between plural definite descriptions and bare conditionals and bare plurals that suggests that maybe the ambiguity of definite descriptions is, at best, not quite the same, is that under *only*, unlike under *not*, definite descriptions do not seem to show an existential reading. (iii) seems to entail that all women attended the meeting.

- (iii) Only the women went to the meeting.



between universal or existential quantifiers. Schein (2003) offers various arguments showing that *if*-clauses are plural definite descriptions of possible events and adverbs of quantification are interpreted *in-situ* as taking scope over the consequent (see also Schlenker 2003 and Bhatt and Pancheva 2006). (46) on this analysis is interpreted as in (47):

(46) If you work hard you usually succeed.

- (47)  $[\iota X: \forall e (X(e) \leftrightarrow \text{you-work-hard}(e))]$  (a)  
 $[\text{Most } e': X(e')] [\exists X': \exists e'' X'(e'') \wedge \forall e' (X'(e'') \rightarrow R(e'', e'))]$  (b)  
 $[\forall e''': X'(e''')] \text{you-succeed}(e''')$  (c)
- ‘The events where you work hard are such that (a)  
 for most among them there are related events (b)  
 all of which are events where you succeed.’ (c)

The analysis of conditionals that I am adopting is ‘iffy’ (Gillies 2010) in that *if* has meaning and is not just the marker of a quantificational restriction:

- (48)  $[[\text{if}]] = \lambda f_{\langle e, t \rangle} . \lambda g_{\langle E, t \rangle} . [\iota E: \forall e (E(e) \leftrightarrow f(e)=1)] g(E)=1$

Another important aspect of Schein’s (2003) analysis is how it deals with the non-monotonicity of conditionals. Rather than restricting the interpretation of the antecedent to the closest case(s) (Stalnaker/Lewis similarity measure), non-monotonicity is attributed to a tacit *ceteris paribus* clause that is sandwiched between antecedent and consequent (between what corresponds to lines (b) and (c) in (47)). Conditional antecedents consequently provide downward entailing contexts (as on the universal conditional, and unlike on the variably strict one). This straightforwardly explains the appearance of NPIs (Schein 2003) and the interpretation of disjunction in *if*-clauses (Herburger and Mauck 2015). At the same time, the *ceteris paribus* clause explains failures of Strengthening of the Antecedent and Contraposition. It is for reasons of space that I do not include the *ceteris paribus* clause.

## 5.2. The tacit adverb—an ambiguous silent *ever*

With *if*-clauses denoting plural definite descriptions, on the account that I adopt the difference between universal and existential conditionals does not reside in the quantificational force of the antecedent but rather in the quantificational force of a tacit adverb taking scope over the consequent. On the universal reading, *If you work hard you succeed* has thus the logical form in (49a), on the existential reading that sketched in (49b):

- (49) a.  $[\iota X: \forall e (X(e) \leftrightarrow \text{you-work-hard}(e))]$  (a)  
 $[\forall e': X(e')] [\exists X': \exists e'' X'(e'') \wedge \forall e' (X'(e'') \rightarrow R(e'', e'))]$  (b)  
 $[\forall e''': X'(e''')] \text{you-succeed}(e''')$  (c)

- b.  $[\neg X: \forall e (X(e) \leftrightarrow \text{you-work-hard}(e)))]$  (a)  
 $[\exists e': X(e')]. \dots$  (b)

One can think of this difference as one where bare conditionals contain a tacit adverb *ever* that, similar to the overt adverb *ever*, is ambiguous between a universal reading ('always') and an existential reading ('sometimes'), where the latter is an NPI and restricted to downward entailing contexts. The existential reading of overt *ever*, is illustrated in (50) and the first three lines of (52), the universal reading of the overt *ever*, which is somewhat limited in distribution (but not like an NPI), is shown in (51) and the last line of (52):

- (50) a. I don't think I have ever seen as stunning a hibiscus plant as this one.  $\exists$   
 b. Don't ever try this at home!  $\exists$
- (51) a. Ever the optimist, he said that everything would work out just fine.  $\forall$   
 b. I will stay here forever.  $\forall$
- (52) If ever two were one, then surely we.  $\exists$   
 If ever man were lov'd by wife, then thee;  $\exists$   
 If ever wife was happy in a man  $\exists$   
 [...]  $\exists$   
 That when we live no more, we may live ever.  $\forall$   
 (To my Dear and Loving Husband, Ann Bradstreet)

Since *only* (like negation and *doubt*) licenses NPIs, it follows that conditionals under *only* (like those under negation and *doubt*) exhibit the existential reading. The account also makes an interesting prediction: when an *only if* conditional contains an overt adverb, the quantificational force of the conditional should not necessarily be existential but rather correspond to that of the overt adverb, whatever it may be. This prediction seems right; (53) rules out that the events where one does not work hard are such that all, most, many etc. of them lead to success:

- (53) Only if you work HARD do you always/usually/often/etc. succeed.

- (54) ONLY  $[\neg X: \forall e (X(e) \leftrightarrow \text{you-work-hard}(e)))]$  (a)  
 $[\text{All/Most/Many } e': X(e')] [\exists X': \exists e'' X'(e'') \wedge \forall e' (X'(e'') \rightarrow R(e'', e'))]$  (b)  
 $[\forall e'': X'(e'')] \text{you-succeed}(e'')$  (c)

Conditionals with overt adverbs embedded under negative quantifiers, *doubt* and negation show similar behavior. Thus, (55a) says that for no student is it the case that the events where he or she studies very little are such that all/most/many of them result in events of getting an A.

- (55) a. No student always/usually/often/etc. gets an A if he or she studies very little.  
 b. I doubt that Meadow always/usually/often/etc. gets a D if she studies very little.  
 c. Meadow does not always/usually/often/etc. get a D if she studies very little.

Finally, since plural definite descriptions show homogeneity effects, one may wonder if by adopting the Schein-Schlenker analysis of *if* we do not already get CEM and thereby already solve the problem of *only if* and conditionals in downward entailing contexts. A moment's reflection, however, shows that that is not really the case. Whether we derive a CEM-like effect or not really depends on whether the adverb is existential (CEM-effect) or universal (no CEM-effect). Note also that the weak presuppositions of *only if* conditionals—the examples in (1) presuppose that *some* instances of hard work lead to success, not that all do—independently show that we need the existential conditional.

### 5.3. Afterthought: The relation between antecedent and consequent events

Among the many loose ends I have undoubtedly left, there is one I want to tie up a bit before I conclude. When propositional logic is all we have the best we can do to translate *only if*  $q$   $p$  is  $p \rightarrow q$ , that is, the same as *if*  $p$   $q$ . Matters of compositionality aside, this works reasonably well for examples where temporal/causal order does not matter, as for instance in (56):

- (56) a. If Socrates is a man he is mortal.  
b. Only if he is mortal is Socrates a man.

When, however, temporal or causal order matters, as it often does, we find that *only if*  $q$   $p$  is clearly not equivalent to *if*  $p$ ,  $q$  (McCawley 1993):

- (57) a. If you heat butter, it melts.  
b. Only if butter melts do you heat it.
- (58) a. If you're insured, you have nothing to worry about.  
b. You're insured only if you have nothing to worry about.

The reason the equivalence fails seems to be that, generally, *if*-clauses, whether they are under *only* or not, describe matters that are temporally or causally prior to those described by the consequent clauses. This suggests that the relation  $R$  in the logical forms above at least can be understood as 'Follow' (Schein 2003).

## 6. Conclusion

*Only if* conditionals become less puzzling once we assume that the preadjacent of *only* in these instances is a bare conditional with an existential reading. This reading also appears under negative quantifiers, verbs like *doubt* and negation. The impression that the negation of an entire conditional is equivalent to the negation of that very same conditional's consequent is but an impression; we are really dealing with an existentially quantified conditional when the negation takes scope over the entire conditional and a universally quantified one when the negation takes scope only over the consequent. Instances where a negation takes scope over a universally quantified conditional involve denial negation. *If*-clauses themselves are plural definite

descriptions of possible events, and the difference in quantificational force between universal bare conditionals and existential ones lies in a tacit and ambiguous adverb of quantification ‘ever’.

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# Economy of structure and information: Oddness, questions, and answers<sup>1</sup>

Roni Katzir — *Tel Aviv University*

Raj Singh — *Carleton University*

**Abstract.** We examine two conflicting perspectives on oddness: Magri (2009, 2011)’s theory, which derives oddness from blind inferences that clash with common knowledge, and Spector (2014)’s theory that derives oddness from trivial alternatives. Building on these works, we offer a third alternative, one that relies on a discourse condition that says that a good assertion is one that provides a good answer to a good question. A remaining difficulty is the persistence of oddness when the relevant sentences are embedded in environments that are predicted to satisfy the proposed appropriateness conditions.

**Keywords:** Hurford’s constraint; questions; oddness; scalar implicature; exhaustivity; redundancy; economy; presupposition.

## 1. Introduction

### 1.1. On oddness and mismatches (Magri, 2009, 2011)

Magri (2009) observes a systematic pattern of oddness with scalar items, such as ‘some’. The following examples illustrate:

- (1) a. # Some Italians come from a warm country
- b. # John transmitted a stupid family name to some of his children

Magri proposes that oddness in such cases is due to a clash of scalar implicatures (SIs) with world knowledge. In (1a), for example, the SI that not all Italians come from a warm country, when combined with the assertion, clashes with our knowledge that all Italians come from the same country. Similarly, the SI of (1b) that John did not transmit a stupid family name to all of his children, when combined with the assertion, clashes with our knowledge that children of the same parents receive the same family name.

### 1.2. Spector (2014)’s challenge and proposal

Spector (2014) notes that in close variants of Magri’s examples, oddness arises even without any

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conceivable clash between strengthened meanings and world knowledge. Spector makes his case on the basis of examples such as those in (2) and (3). The sentences in (2) use ‘all’, the strongest element on the scale, and have neither an SI nor an ignorance inference. The sentences in (3) have SIs – that John has no more than one wife and that Mary put on no more than two gloves – but those are fully compatible with world knowledge. Still, the sentences in (2) and (3) are odd.

- (2) a. # All Italians come from a warm country
- b. # John transmitted a stupid family name to all of his children
- (3) a. # John has one wife
- b. # (It was cold out, so) Mary put on two gloves

To account for the oddness of (2) and (3), Spector (2014) proposes that oddness in these cases – and in Magri (2009)’s original paradigm – arises not through strange SIs but rather through unhelpful alternatives. In particular, he suggests (extending in part an earlier proposal in Spector 2007) that in cases such as the above, all the alternatives are trivial given common knowledge: they are either contextually equivalent to the assertion or it is already known whether they are true or false.

- (4) Let  $\phi$  be a proposition and  $C$  a context. A proposition  $\phi'$  is said to be *trivial in  $C$  given  $\phi$*  if one of the following holds:
  - a.  $\phi'$  is a  $C$ -contradiction,  $\phi' \cap C = \emptyset$
  - b.  $\phi'$  is a  $C$ -tautology,  $C \subseteq \phi'$
  - c.  $\phi'$  is  $C$ -equivalent to  $\phi$ ,  $\phi \cap C = \phi' \cap C$
- (5) NO TRIVIAL ALTERNATIVES! (Spector, 2014, p. 154): If  $\phi$  is associated with a set of alternatives  $ALT$  in context  $C$ , there must be at least one element of  $ALT$  that is not trivial in  $C$  given  $\phi$ .

For example, in both (1a) and (2a) the alternatives are  $\{\textit{Some Italians come from a warm country}, \textit{All Italians come from a warm country}\}$ . Given world knowledge, the two alternatives are contextually equivalent: all Italians come from the same country, so (1a) and (2a) contribute the same information. Assuming there are no additional alternatives to (1a) and (2a), (5) predicts that neither sentence should be felicitous. For (1b) and (2b), the scalar items are again *some* and *all*, leading to a similar pattern of alternatives as with (1a) and (2a); the assumption that fathers transmit the same family name to all their children thus yields the same pattern of triviality, correctly predicting from (5) that both variants would be infelicitous.

Similar considerations apply to the sentences in (3), though with different scalar items – and consequently different sets of alternatives – than in (1) and (2). In (3a) the alternatives are  $\{\textit{John has one wife}, \textit{John has two wives}, \textit{John has three wives}, \dots\}$ , the first of which being the assertion

itself, and all the other ones being *C*-contradictions assuming the context is that of a monogamous society. In (3b) the alternatives are {*Mary put on one glove*, *Mary put on two gloves*, *Mary put on three gloves*, ...}. Here the first two are contextually equivalent – in a normal context, if Mary put on one glove she also put on the other – and the remaining alternatives are *C*-contradictions. As in the *some/all* cases, the numerical cases in (3) have sets of alternatives that are all trivial, thus deriving their oddness from (5).<sup>2</sup>

### 1.3. A conceptual concern with triviality

Spector (2014)'s broader pattern of oddness calls for a unified treatment, and his proposal succeeds in capturing it, thus offering exactly this kind of account. Below we will examine cases that we think should also fall under such an account but which Spector's proposal does not capture. Before discussing such empirical problems, we briefly note a conceptual concern with the idea of a ban on trivial alternatives: why should it be odd if the alternatives are contextually unhelpful? Differently from assertions (and their strengthened meanings), the alternatives are not attempted contributions to discourse, and it is not clear why they should be subject to any felicity conditions. Spector suggests that all-trivial sets of alternatives might be bad collectively, due to two considerations: (a) such sets are useless for purposes of SIs and similar processes; and (b) alternatives should be expressions that the speaker could have chosen instead of the prejacent. With respect to the first consideration, we note that various felicitous constructions have been argued to have sets of alternatives that do not lead to SIs or similar effects, for example due to a contradiction between the alternatives (see Fox and Hackl 2006):<sup>3</sup>

- (6) John has more than three children

With respect to the second consideration, we note that if an alternative is *C*-equivalent to the prejacent, it counts as trivial according to definition (4) but could have been used by the speaker to convey the same information as the prejacent. In sum, we are left with a felicity condition, (5), that currently lacks clear motivation.

<sup>2</sup>At least in some cases, including the wife and glove examples in (3), it seems that we have some reasonable expectations about the alternatives, but we could easily be wrong about them. To maintain the triviality-based account, then, one may need to replace 'contextually trivial' with 'contextually reasonably well determined'. (We are not sure how such an approach could be implemented.)

<sup>3</sup>In a neutral context, (6) suggests that the speaker does not know how many children John has, and one might try to use this inference to account for the contrast between the felicitous (6) and the odd examples above. However, (6) remains felicitous even in contexts that explicitly contradict ignorance inferences (see Fox 2014 for the use of contexts in which the speaker is taken to be knowledgeable but unhelpful to tease apart ignorance inferences and SIs).



## 1.4. Outline

Motivated by the conceptual concern with (5), we will look, in section 2, at a different perspective concerned with constraints on the introduction of questions into discourse. Our proposed question condition requires that the speaker answer a ‘good question,’ which we take to be one that is commonly accepted by speaker and hearer as being in need of resolution in the current context. Then, in section 3, we will provide what we think is a natural complement to the question condition: an answer condition, which posits that linguistic objects that are inferior along linguistically significant dimensions (complexity and semantic strength) cannot be offered as answers, even when they are as relevant as better linguistic objects. Needlessly inferior objects are bad answers. Section 4 discusses a complication that the present account faces, having to do with oddness effects in complex sentences. Section 5 concludes.

## 2. The question condition

### 2.1. From individual alternatives to questions

The concern we mentioned regarding Spector’s proposal motivates looking at factors other than the triviality of individual alternatives. We propose that the utterances in (2) and (3) are odd because they address questions that the hearer could not possibly have been interested in. If we are right, accommodating an unreasonable question is something conversational participants are unwilling to do, at least not without justification.

The intuition we follow, often discussed in the literature (see Roberts 1996, Büring 2003, and Beaver and Clark 2008), is that discourse is required not just to gradually narrow down our uncertainty about the world, as in the conversational model of Stalnaker (1978, 2002), but to do so while respecting discrete, jointly accepted steps. Questions provide the relevant discrete steps that structure discourse, and we state the requirement that such steps must be jointly accepted as a condition on good questions:

- (7) A question  $Q$  is a *good question* at a point  $t$  in the conversation if it is common knowledge at  $t$  that all participants in the conversation are interested in settling  $Q$ .<sup>4</sup>

Given the notion of good questions in (7), we can now state our first condition on assertions. This condition, stated in (8), requires an assertion to address what has already been established as a good question.

<sup>4</sup>This definition is vague and incomplete. Unfortunately, we can do no better at present. We also note that ‘interested’ might not be the best characterization of the participants’ attitude toward a good question. For our purposes, if it is clear that everyone has accepted the question into the discourse, even though it is inherently of no real interest to anyone, that will count as ‘interested in.’ As far as we can tell, the cases below can be derived with (7) in spite of its shortcomings. We hope that a better characterization of good questions can be left for a separate occasion.

- (8) QUESTION CONDITION: An assertion  $S$  must be congruent to some good question  $Q$  when it is uttered. On Rooth (1992)'s definition of congruence, this means that when  $S$  is uttered,  $Q \subseteq \llbracket S \rrbracket$ .

According to (8), an assertion cannot introduce a new question: an assertion must be relevant with respect to a good question. If a participant in the conversation wishes to add a new question, they must do so directly, by stating that question, rather than sneak it in through an assertion that addresses that question.<sup>5</sup>

Let us return to Spector (2014)'s examples in (3) above. While we might be wrong about John having one wife and Mary having two hands, it still seems strange, given world knowledge, to suggest we are interested in the question of how many wives John has and how many hands Mary has, especially since the answers provided in (3) do not shift our views on the plausibility of these questions. When the answer does help make the question useful, minimal variants of these sentences are fine:

- (9) a. Some (but not all) Italians come from a warm country – Italy is really two countries, one warm and one cold  
 b. John transmitted a stupid family name to some (but not all) of his children – his wife insisted that their youngest boy get her maiden name
- (10) a. John has two wives  
 b. Mary put on one glove

## 2.2. Prediction: an explicit question can improve an otherwise odd assertion

We note that, by preceding the sentences above with an appropriate question, we can make them improve without changing the triviality of the alternatives. For example, the sentences in (3) improve when used as answers to explicit questions about the scalar item responsible for the alternatives, as in (11):

- (11) a. (How many wives does John have?) John has one wife  
 b. (How many gloves did Mary put on?) It was cold out, so Mary put on two gloves

<sup>5</sup>It has been noted in the literature that it is sometimes possible to address a question that is different from the QUD. For example, Büring (2003) notes that the following question-answer dialogue is appropriate: A: *What did the pop stars wear?* B: *The FEMALE pop stars wore CAFTANS*. B's response is not congruent to A's question, yet the dialogue is fine. This is not as problematic for our account as it might appear to be: if you are interested in what the pop stars wore, then you are certainly interested in what the female pop stars wore. See Groenendijk and Stokhof (1984), and Lewis (1988).

In (11), the explicit question provided is unusual and possibly odd, but on Spector (2014)'s approach it is not clear why this should matter: if we are convinced that John adheres to the conventions of monogamy, the potentially true answers are those where he has either no wives or one wife, which means that the question does not change our beliefs about the alternatives, so the answer should still be odd. And similarly for the glove example.

On the face of it, these examples might be reconcilable with Spector's (2014) approach if we assume that by asking such questions explicitly, speakers can signal that they do *not* share common beliefs about the alternatives. And this might be enough to ensure the non-triviality of the alternatives. Against this analysis, note that the sentences improve in response to an explicit question even when the speaker *is* assumed to share common beliefs. For example, imagine a hiring committee that is interviewing many candidates, some of whom come from countries where monogamy is not the norm. Nevertheless, to ensure fairness of the process, they are required to ask the same questions of all candidates. If John is assumed to come from a place where monogamy is the norm, the question and answer in (11a) continue to be appropriate. Furthermore, (11a) can be used in answer to a question that does *not* signal that the speaker's beliefs are somehow non-conformist (adapted from Singh, 2009):

- (12) A: What can you tell me about this candidate, John?  
 B: Well, he's from Vermont, he has two dogs, he has one wife, and he likes to whistle.

The dialogue in (12) is perfectly normal. A's question is sensible and does not signal that A is ignorant of John's marital status; B's response is likewise not odd.

### 2.3. Beyond potentially trivial alternatives: accommodating presuppositions

A particularly clear case in which the predictions of our bad-question approach and Spector (2014)'s trivial-alternative approach diverge arises with presupposition accommodation out of the blue. Sometimes we can't plausibly expect anything about the alternatives. And yet, if we can ensure that the question itself is not a good question, the result is odd:

- (13) (Context: none. In particular, it is not common knowledge that the typewriter has been broken.)  
 a. # [Kim]<sub>F</sub> broke the typewriter  
 b. # It was [Kim]<sub>F</sub> who broke the typewriter  
 c. # The person who broke the typewriter is [Kim]<sub>F</sub>

Without prior context for the examples in (13), the hearer does not even know that the typewriter was broken, and so the speaker cannot plausibly expect the hearer to be interested in the question of who broke the typewriter. In such settings, the examples in (13) are unacceptable.<sup>6</sup>

For us, the unacceptability of the sentences in (13) out of the blue is a straightforward consequence of question-based oddness. Crucially, there seems to be nothing trivial about any of the individual alternatives in any of these cases. In (13a), for example, the alternatives would be something like *{Al broke the typewriter, Kim broke the typewriter, Frank broke the typewriter, ...}*. Other than *Kim broke the typewriter*, none of the alternatives is contextually equivalent to the assertion, and none of them is either a *C*-contradiction or a *C*-tautology. It is only in collecting these alternatives into a question that we obtain an implausible object.<sup>7</sup>

### 3. The answer condition

#### 3.1. Relevant but inferior answers

The question condition handles much of the oddness paradigm, but there are other cases of oddness – often superficially very similar to the examples above – where the question condition has little to contribute. A case in point is (14), from Spector (2014), extending a paradigm from Magri (2011) to be discussed in more detail below.

- (14) In this department, every professor gives the same grade to all of his students. Kim is a professor in this department.
- a. # This year, Kim assigned an A to some of his students
  - b. This year, Kim assigned an A to all of his students

The oddness of (14a) is unexpected according to the question condition. One possible question that (14a) might be addressing – namely, *{Kim assigned an A to some of his students, Kim assigned a B to some of his students, ..., Kim assigned an F to some of his students}* – can be taken to be a good question given the context. In fact, given the context, this question is equivalent to *{Kim*

<sup>6</sup>*It*-clefts, as in (13b), are also considered to be hard presupposition triggers (see Simons 2001, Abusch 2002, and Romoli 2015, among others; see Abrusán 2014 for a dissenting view). The distinction between hard and soft triggers, however, concerns the question of whether the relevant projected presuppositions can disappear in contexts of explicit ignorance. It is not clear that this should affect ease of (global) accommodation, which is our concern in (13b). (See Büring and Križ 2013 for a recent analysis of *it*-clefts and their meaning components, including the well-known similarities with definite descriptions such as (13c)).

<sup>7</sup>A prediction of our approach is that if we make it less implausible that we are interested in the question of who broke the typewriter, the relevant sentences should improve. While straightforward in principle, testing this prediction is complicated by the fact that raising the relevant question explicitly would mean that we no longer need to accommodate that someone broke the typewriter. However, one could look at contexts in which the hearer does not have a say in determining the question under discussion. For example, a novel, a newspaper article, or a speech can easily start with a sentence such as (13b). See von Stechow (2008).

assigned an *A* to all of his students, Kim assigned a *B* to all of his students, . . . , Kim assigned an *F* to all of his students }, which is presumably the question that the perfectly felicitous (14b) is trying to answer.

For cases such as (14a), we believe the problem lies not with the question that we are pretending to be interested in but in the way we are trying to address it. What might make an answer good or bad? To stand a chance of being a good contribution to discourse, an answer should probably be true and relevant.<sup>8</sup> Can an answer be true and relevant and still odd? Consider a true and relevant answer  $\phi$  that is a needlessly inferior linguistic object (that is,  $\phi' \prec \phi$  for some other true and relevant  $\phi'$ , where  $\prec$  stands for ‘strictly better than’). In principle,  $\phi$  might be: (a) bad, since it is needlessly inferior, or (b) good, since it serves its purpose in the given context. It is hard to think of an *a priori* way to settle the question of whether  $\prec$  should affect felicity, but the two possibilities make different empirical predictions that can be tested. As we discuss below, based on the oddness of (14a) and other cases, pointless inferiority result in oddness. This will motivate the following answer condition:<sup>9</sup>

- (15) ANSWER CONDITION: A *good answer*  $\phi$  given a question  $Q$  is a true answer that is *relevant* to  $Q$  and that is not needlessly worse than any other true  $\phi'$  that is relevant to  $Q$  (that is, there is no  $\phi' \prec \phi$  such that  $\phi'$  is true and relevant to  $Q$ )

One can imagine a variety of criteria for comparing linguistic objects, but in this paper we restrict ourselves to two fairly natural ones: semantic strength, which we discuss in section 3.2 and implicate in the oddness of (14a); and complexity, which we discuss in section 3.3 and relate to the oddness of so-called Hurford disjunctions.

To be able to talk about comparing linguistic objects in terms of both complexity and strength, we will need a way to combine two criteria for comparison into one. To do so, we first combine the weak pre-orders for structural complexity ( $\lesssim$ ) and semantic strength ( $\subseteq$ ) into a weak pre-order for *at-least-as-good-as* ( $\lesssim$ , as in (16a)) and then strengthen it to *better-than* ( $\prec$ , as in (16b)):<sup>10</sup>

- (16) a.  $\lesssim := \{(\phi, \psi) \mid \phi \lesssim \psi \wedge [\![\phi]\!] \subseteq [\![\psi]\!]\}$   
 b.  $\prec := \lesssim \setminus \lesssim^{-1}$

<sup>8</sup>We will not attempt to investigate truth and relevance here. We simply follow the literature on these matters. For relevance and its relation to questions, we follow Hamblin (1958), Groenendijk and Stokhof (1984), and Lewis (1988), among others. In particular, we take  $\phi$  to be relevant to  $Q$  if it eliminates whole cells in the partition defined by  $Q$ . In what follows, it will generally suffice to compare  $\phi$  to a true and otherwise better  $\phi'$  that is at least as relevant as  $\phi$ ; that is, for our purposes it will suffice to consider relative relevance – very little hinges on the precise definition of (absolute) relevance.

<sup>9</sup>An obvious question to ask is whether the preference for best answers is a separate pragmatic principle or an aspect of whatever mechanism derives SIs. At present we do not have an argument in either direction.

<sup>10</sup>See Katzir (2007) for further discussion. See also Lauer (2013) for a recent optimization system that takes structure and content into account.

### 3.2. Needlessly weak answers

#### 3.2.1. When ‘some’ and ‘all’ should be interchangeable but are not

Consider again (14) above, repeated here:

- (17) In this department, every professor gives the same grade to all of his students. Kim is a professor in this department.
- a. # This year, Kim assigned an A to some of his students
  - b. This year, Kim assigned an A to all of his students

In (17) – as in the examples in (1) above from Magri (2009) – the context provided makes the weaker (17a) equivalent to (17b). In this context, (17a) is odd. As noted earlier, it seems unlikely that oddness in this case is due to a bad question: given the context, it is not unreasonable to suppose that the odd (17a) and the acceptable (17b) are trying to answer the same question. Rather, we take the oddness of (17a) as showing that an answer that is needlessly weak – (17a) is strictly weaker semantically than (17b) but provides the same information in the given context – is infelicitous. More generally, we take this case as an instance of a violation of the answer condition in (15).

Following Magri (2011), we can embed the relevant examples in a downward-entailing environment to reverse the logical strength of the ‘some’ and ‘all’ variants and re-engineer the context to make the two variants equivalent. In this case, as Magri (2011) notes, it is the ‘all’ version in (18b) that is odd and the ‘some’ version in (18a) that is felicitous. This is again as expected by the answer condition: both answers provide the same information in the given context, so the needlessly weak one in (18b) becomes odd.

- (18) Every year, the dean has to decide: if the college has made enough profit that year, he gives a pay raise to every professor who has assigned an A to at least some of his students; if there is not enough money, then no one gets a pay raise.
- a. This year, every professor who assigned an A to some of his students got a raise
  - b. # This year, every professor who assigned an A to all of his students got a raise

#### 3.2.2. Complication: assertions vs. actual common knowledge

In (17) and (18) we focused on the logically weaker of two contextually equivalent answers and noted that it is odd. Spector (2014) observes that when we are dealing with more obvious cases of common knowledge, the logically stronger variant becomes odd as well.

- (19) In this country, every father gives the same last name to all of his children. Kim is a father in this country.
- a. # Kim transmitted a stupid last name to some of his children
  - b. # Kim transmitted a stupid last name to all of his children

Spector (2014) suggests that the contrast between (17), where only the logically weaker answer is odd, and (19), where both answers are odd, is due to a difference in our beliefs regarding the context. In (17) we are dealing with speaker's belief that is not necessarily common knowledge; it is quite possible that despite the speaker's assertion, we do not share the belief that every professor in the department gives the same grade to all their students. In (19), on the other hand, we actually have common knowledge, so this is the more telling paradigm as far as condition (5) is concerned.

We agree with Spector on the distinction between speaker's belief and common knowledge, but our explanation for the contrast between (17) and (19) is different. In (17), the question is legitimate but the logically weaker answer (17a) is needlessly bad. In (19), the weaker answer is similarly penalized by the answer condition, but here, due to common knowledge, even the question is bad, which explains why even the logically stronger answer is odd in this case.

Spector (2014)'s explanation and our own make different predictions. For Spector (2014), the problem with (19) is that the two alternatives are equivalent and thus trivial. For us, the question formed by the two alternatives is bad; in addition, the weaker alternative is bad independently, through the answer condition. If we disable the question condition, we predict that (19) will pattern with (17), while Spector (2014) predicts no change.

As in our discussion of (11) above, stating an explicit question neutralizes the question condition. (20) is the relevant test case. As in some earlier cases, the question provided may well be perceived as odd, but the critical point is that given this question, the stronger 'all' alternative becomes acceptable, as predicted by the combination of the question condition and the answer condition.

- (20) In this country, every father gives the same last name to all of his children. Kim is a father in this country. To how many of his children did he transmit a stupid last name?
- a. # Kim transmitted a stupid last name to some of his children
  - b. Kim transmitted a stupid last name to all of his children

### 3.2.3. MAXIMIZE PRESUPPOSITION!

As another case of answers that are needlessly weak, we can look at examples such as (21a) (see Hawkins 1991 and Heim 1991). As Heim (1991) observes, (21a) seems to be odd not because the

indefinite is incompatible with a singleton denotation (it is), but because of the availability of an alternative with a stronger presupposition, namely the one in (21b).

- (21) a. # A sun is shining  
b. The sun is shining

As Heim (1991) further notes, blocking (21a) by (21b) is hard to justify on naive Gricean grounds. Given world knowledge, the two sentences contribute the same information, so neither is contextually better than the other. Instead, Heim proposes a separate principle, MAXIMIZE PRESUPPOSITION! to rule out sentences with presuppositions that are weaker than necessary.<sup>11</sup> For the present proposal, MAXIMIZE PRESUPPOSITION! is an instance of the answer condition.

### 3.3. Needless complex answers

#### 3.3.1. Hurford coordination: the basic case

We can make an answer  $\phi$  pointlessly complex by (a) disjoining it with a stronger one, or (b) conjoining it with a weaker one. In both cases, the additional constituent does not change the truth conditions of  $\phi$ : suppose  $\llbracket \psi \rrbracket \subseteq \llbracket \phi \rrbracket \subseteq \llbracket \psi' \rrbracket$ , then  $\llbracket \phi \vee \psi \rrbracket = \llbracket \phi \wedge \psi' \rrbracket = \llbracket \phi \rrbracket$ . And in both cases, the result is known to be infelicitous. The oddness of disjunction with a stronger constituent was discussed by Hurford (1974):

- (22) a. # John visited France or Paris  
b. # John visited Paris or France

Similarly to the disjunction of an answer with a stronger one, the conjunction of an answer with a weaker one is odd. The oddness of conjunction with a weaker constituent was discussed by Chemla (2009) and Katzir and Singh (2014):<sup>12</sup>

- (23) a. # John visited France and Paris  
b. # John visited Paris and France

<sup>11</sup>However, see Schlenker (2012) for a Gricean account of such cases.

<sup>12</sup>There is evidence that the redundancy condition for conjunctions is sometimes sensitive to linear order (e.g., Horn, 1972; van der Sandt, 1992; Schlenker, 2008; Fox, 2008). We do not discuss this here; see Katzir and Singh (2014) and Mayr and Romoli (2014) for recent discussion.



### 3.3.2. Complication: amelioration with scalar items

There are cases in which Hurford disjunctions improve, such as (24a) and (24b). Such cases, already noted by Hurford (1974) and further studied by Gazdar (1979) and Chierchia, Fox, and Spector (2012), typically involve disjuncts that differ from each other in the identity of a scalar item ('or' vs. 'and' in (24a); 'some' vs. 'all' in (24b)).

- (24) a. John ate (cake or ice-cream) or he ate both (cake and ice-cream)  
 b. John gave some of his students an A or he gave all of his students an A

Chierchia et al. characterize the pattern as follows: (a) HC is valid (that is, no entailment may hold between disjuncts); and (b), a grammatical *exh* operator is available, the judicious placement of which can break entailment.<sup>13</sup>

We take Chierchia et al.'s characterization of the disjunction pattern to be correct; we differ from Chierchia et al. only in attempting to derive HC – specifically, as a needlessly inferior answer – rather than stipulating it as a separate principle. Superficially, however, acceptable Hurford disjunctions such as those in (24) seem to argue against the answer condition even if a grammatical *exh* operator is granted: the complex disjunction seems pointlessly worse than the equivalent weaker disjunct, and yet the disjunction is acceptable.<sup>14</sup> Upon closer inspection, equivalence with the weaker disjunct depends on certain architectural assumptions that have been discussed in the literature. In particular, Meyer (2013) observes that if we assume in addition to *exh* the availability of a grammatical knowledge operator, sentences such as those in (24) are not, in fact, equivalent to their seemingly weaker disjuncts.<sup>15</sup>

## 4. Locality

The question condition and the answer condition are conditions on appropriate speech acts. Thus, they must apply globally. Similarly, we understand Spector's (2014) constraint against trivial alter-

<sup>13</sup> An important piece of evidence for the possibility of exhaustifying a single disjunct comes from (i), developed by Fox and Spector (2009); see also Chierchia et al. (2012) and Bergen et al. (2014).

i. Peter either solved the first and the second problem or he solved all of the problems  
 Reading: Peter either solved only the first and second problems, or he solved them all

<sup>14</sup> When the first disjunct is parsed without *exh* the second disjunct adds nothing, and when the first disjunct is parsed with *exh* the matrix disjunction is equivalent to the prejacent of *exh* contained in the first disjunct, and thus the structure is again needlessly complex.

<sup>15</sup> A different approach argues that complexity comparisons are made locally in embedded positions, with the consequence that the root cannot be compared with sub-constituents of the disjuncts (Katzir and Singh, 2014). For now, we hope it suffices that there are defensible approaches for dealing with the observation that embedded exhaustification can sometimes rescue a sentence that would otherwise be banned as needlessly complex, even when the resulting sentence is more complex than a minimal variant without *exh*.

natives (cf. (5)) as a global condition. A challenging finding for such proposals is that the oddness detected in atomic sentences persists when the relevant sentences are embedded. Consider the following scenario, from Magri (2011):

- (25) In this department, every professor gives the same grade to all of his students
- a. # This year, every professor who assigned an A to some of his students got a prize from the Dean
  - b. This year, every professor who assigned an A to all of his students got a prize from the Dean

Magri contrasts (25), in which the ‘all’ answer is felicitous and the ‘some’ answer is odd, with the almost identical (18), where it was the ‘some’ answer that was felicitous and the ‘all’ answer that was odd. He proposes that exhaustification, which he argues to take place at every scope position, strengthens the restrictor in (25a) to something like ‘professor  $x$  assigned an A to some but not all of his students’. Given the context provided in (25), this results in an empty restrictor, and Magri suggests that it is this empty restrictor that makes (25) odd.<sup>16</sup> As Spector (2014) notes, however, the oddness pattern of (25) can be replicated even when exhaustification of the restrictor is irrelevant. The answers in (26) illustrate:

- (26) In this department, every professor has exactly ten students and always gives the same grade to all of them.
- a. # This year, every professor who assigned an A to more than two of his students was Italian
  - b. # This year, every professor who assigned an A to some or all of his students was Italian

In both (26a) and (26b), exhaustifying the restrictor is vacuous. Consequently, the restrictor is not empty, and the sentences are predicted by Magri’s theory to be felicitous, contrary to fact. To complete the picture, Spector further notes that, in cases that are more clearly about common knowledge rather than speaker’s opinion, the strongest local alternative patterns with the weaker ones in giving rise to oddness:

- (27) In this country, every father gives the same last name to all of his children
- a. # This year, every father who transmitted a stupid last name to some of his children got a fine

<sup>16</sup>Magri proposes to derive the contrast between (25) and (18) from considerations of relevance: in (25) – but crucially not in (18) – ‘professor  $x$  assigned an A to all of his students’ is equivalent to ‘professor  $x$  assigned an A to some of his students’ and consequently cannot be ignored in computing the embedded implicature. See Magri (2011) for discussion.

- b. # This year, every father who transmitted a stupid last name to all of his children got a fine

To account for the full embedding paradigm, Spector (2014) proposes a local condition, his (30), that bans pointlessly weak expressions – stated with respect to speaker equivalence rather than contextual equivalence – within certain constituents:

- (28) MINIMIZE MEANING CONTRIBUTION!: For any constituent  $X$  containing an occurrence of a lexical item  $\alpha$ , we note  $X(\alpha \rightarrow \beta)$  the result of replacing this occurrence of  $\alpha$  with  $\beta$ . Let  $S$  be a sentence,  $C$  a non-linguistic context, and  $\alpha$  an occurrence of a certain lexical item in  $C$ . Then  $\alpha$  is not licensed in context  $C$  if there is an alternative  $\beta$  of  $\alpha$  such that:
- a.  $\alpha$  and  $\beta$  are speaker-equivalent relative to  $S$  in  $C$
  - b. The smallest constituent  $X$  of  $S$  such that  $\beta$  and  $\alpha$  are speaker-equivalent relative to  $X$  in context  $C$  is such that  $X(\alpha \rightarrow \beta)$  asymmetrically entails  $X$

For Spector, (28) seems like an imperfect fit to his global condition against all-trivial alternative sets: the two principles try to say similar things but in very different ways. The combination of (28) with the global condition is motivated empirically, by the need to account for the meta-contrast between (25) and (18). Above we have proposed to derive Spector's global condition as a by-product of the question condition; the local (28) can perhaps be folded into a localized version of the answer condition. In fact, other predicted violations of the answer condition – such as MAXIMIZE PRESUPPOSITION! effects – have previously been noted to persist under embeddings similar to the ones above (Percus, 2006):

- (29) a. # Every father who has exactly two sons gave all of them a stupid first name.  
 b. Every father who has exactly two sons gave both of them a stupid first name.

Percus (2006) gives an analysis of (29) that – like (28) – involves competition between lexical items in embedded constituents, with items that have stronger presuppositions blocking items with weaker ones under certain conditions that need not concern us here. What is important for the present discussion is that, like with (28) in its original formulation, we do not have a natural place for such competition. Because the sentences in (29) are semantically equivalent, and differ syntactically only at a single terminal, they are equally good as far as the answer condition is concerned. The challenge is to find ways to deal with apparent embedded violations of the answer condition, and unfortunately no obvious solution comes to mind.

How are we to extend the answer condition to make sense of its apparent application in complex sentences such as the ones discussed above? Two technical fixes with antecedent motivation might help (see Singh, 2009). One is to assume that the answer condition compares sentences not for

their semantic strength, but for the relative strength of their Gajewski-LFs (e.g., Gajewski, 2004; Fox, 2000; Fox and Hackl, 2006). These can be derived from the actual LF of the sentence by replacing all non-logical vocabulary with distinct variables. Simplifying for presentation purposes, the Gajewski-LF of (29a) would be something like ‘every  $\alpha$   $\beta$ ’d all of  $\gamma$  a  $\delta$ ’ and that of its alternative (29b) would be ‘every  $\alpha$   $\beta$ ’d both of  $\gamma$  a  $\delta$ .’ For all assignments to the variables  $\alpha$ ,  $\beta$ ,  $\gamma$ , and  $\delta$ , the sentence containing ‘all’ would be entailed by the sentence containing ‘both.’ If the answer condition applied to Gajewski-LFs, the competition could be adjudicated globally.

The other technical fix continues to assume that the competition is between the actual content of the constituents, but that it is adjudicated in the *local contexts* of embedded constituents (see Singh, 2011; Schlenker, 2012). This of course commits one to theories that assume there *are* local contexts. For example, assuming Heim’s (1983) theory of local contexts, for any context  $c$  the local context for ‘ $x$  gave all of them a stupid first name’ and ‘ $x$  gave both of them an A’ in (29) is  $c + x$  is a father +  $x$  has exactly two sons, and in such a context the constituent with ‘all’ is needlessly weak. Thus, applying the answer condition in local contexts could account for such cases.

The difficulty is that neither of these two moves fits well with our approach. The answer condition is a condition on appropriate speech acts. There seems to be no pragmatic motivation for either the extreme blindness of Gajewski-LFs nor of the appeal to local contexts (though see Schlenker, 2009). We must leave a resolution of this tension for future work.

## 5. Discussion

We have proposed a condition on appropriate speech that allows for a unified, pragmatic treatment of oddness: an assertion is good if it provides a good answer to a good question. Oddness effects under embedding remain challenging.

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# Evidentials in attitudes: do's and don'ts

Natalia Korotkova — *University of California, Los Angeles*

**Abstract.** This paper is devoted to evidentials in attitudinal complements. I start with two empirical observations. A. Some logically possible interpretations are systematically not attested for evidentials-in-attitudes. This new observation has no straightforward account in the current literature. B. Languages vary with respect to whether or not evidentials-in-attitudes *shift*, i.e. whether they are speaker-oriented (as in root declaratives) or not. The variation has been previously attributed to the semantic non-uniformity of evidentials. I argue against this view. To account for A, I propose that evidentials are self-ascriptions, which is additionally motivated by their behavior in matrix clauses. To account for B, I propose that evidential shift is an instance of indexical shift driven by a monster operator à la Anand and Nevins (2004), which explains previously unnoticed similarities in restrictions on both kinds of shift. Understanding what happens in attitude reports has often been key to the semantics of many phenomena, e.g. pronouns and modals. Offering the first systematic examination of evidentials-in-attitudes across languages, the paper makes a case for evidentials and broadens our understanding of perspective-sensitivity in general.

**Keywords:** attitude reports, cross-linguistic variation, evidentiality, perspective shift

## 1. Introduction

Consider a root declarative wherein an evidential adverbial reflects the speaker's judgment:

- (1) Tar sands are **evidently** an unmitigated disaster for the environment.<sup>1</sup>

Attitudinal complements are environments wherein evidentials do not have to be speaker-oriented:

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<sup>1</sup>From <http://www.theguardian.com/commentisfree/2010/may/11/alberta-california-tar-sands-oil>.



- (2) What shallow, worthless, selfish lives and yet these are the same false gods that Republicans worship since the Right believes that wealth is **allegedly** a divine gift.<sup>2</sup>
- (3) *Context:* For a number of years now *the Australian* newspaper has engaged in guerrilla warfare with the progressive parties in general. But, with the Australian Greens, ordinary sneaky guerrilla tactics are way too subtle.

*The Australian* believes that the Greens, **apparently**, deserve a nuclear takeout.<sup>3</sup>

The most salient reading of (2) is such that *allegedly* embedded under *believe* reflects the speaker's evidential judgment, but not that of the attitude subject, the Right. Conversely, the most salient reading of (3) is such that *apparently* embedded under *believe* reflects the opinion of the attitude subject, *the Australian*, but not that of the speaker. Following Garrett (2001), I will refer to cases of switch in orientation from the speaker to the attitude subject (as in 3) as *shift*. The range of interpretations of embedded evidentials as well as the mechanism of evidential shift are poorly understood. This paper presents a cross-linguistic investigation that aims to fill in this gap. Section 2 lays out the core data. Section 3 reviews previous approaches. Section 4 provides a formal treatment of evidentials as belief reports with a shiftable indexical. Section 5 concludes.

## 2. Empirical landscape

The literature on evidentiality has mostly been focusing on root clauses, most notably declaratives, while evidentials-in-attitudes are often only discussed passim (with some exceptions: Garrett 2001; Sauerland and Schenner 2007; Schenner 2010; Şener 2011). Below I discuss which interpretations are available across and within languages.

### 2.1. Universals

I discuss the following logically possible parameters of variation for evidentials-in-attitudes (cf. similar discussion in Schenner 2010): (i) **perspective**: whether the evidential operator EV is oriented towards the speaker or attitude subject, and (ii) **scopal interaction with the attitude verb, or projection**: whether EV is in the scope of the attitude predicate or not. These notions are frequently conflated in the literature, e.g. being speaker-oriented is often regarded as an equivalent of projection while being subject-oriented is often regarded as semantic embedding (Koev 2011; Matthewson et al. 2008; Matthewson 2012). There are indeed correlations between perspective and (what looks as) projection. Still the parameters themselves are *conceptually* distinct.<sup>4</sup>

<sup>2</sup>From [http://www.huffingtonpost.com/2012/06/19/charles-hopper-lehman-brothers-suicide\\_n\\_1608791.html](http://www.huffingtonpost.com/2012/06/19/charles-hopper-lehman-brothers-suicide_n_1608791.html).

<sup>3</sup>From <http://www.nudiefish.com/2012/06/im-not-biased-i-just-hate-you.html>.

<sup>4</sup>The reader should bear in mind that whether or not the evidential operator is in the scope of the attitude verb is different from the scope of the evidential operator: evidentials always take scope only in the complement clause.

Let's assume the following toy semantics (to be revisited) for the evidential operator such that it is relativized to an individual, *evidential origo* (term due to Garrett 2001), and a world (cf. Sauerland and Schenner (2007)'s semantics for Bulgarian reportative):

- (4)  $\llbracket \mathbf{EV} \rrbracket = \lambda w. \lambda x. \lambda p. \mathbf{EV}(w, x, p) = 1$  iff  $x$  in  $w$  acquired  $p$  in a particular way that is lexically specified by the evidential marker (direct perception, inference, hearsay, etc)

Let  $x^*$  be the speaker,  $w^*$  the world of evaluation,  $x_{\text{ATT}}$  the attitude subject, and  $W_{\text{ATT}}$  the set of worlds introduced by the attitude predicate, e.g. doxastic alternatives by *think*,  $\text{DOX}_{x_{\text{ATT}}, w^*}$ . In root cases,  $x = x^*$  and  $w = w^*$ . In embedded cases, there can be at least four interpretations:

- (5) Logically possible interpretations (as discussed below, grey cells are not attested)

	$w = w^*$	$w \in W_{\text{ATT}}$
$x = x^*$	not shifted, projected; (6a)	not shifted, not projected; (6b)
$x = x_{\text{ATT}}$	shifted, projected; (6c)	shifted, not projected; (6d)

Consider contexts that clearly distinguish between these interpretations of the sentence below:

- (6) Pollux: 'Castor thinks [that **reportedly** [solar panels are efficient]]'.

$x^* = \text{Pollux}$ ,  $x_{\text{ATT}} = \text{Castor}$ ,  $W_{\text{ATT}} = \text{DOX}_{\text{Castor}, w^*}$ ,  $p = \text{'Solar panels are efficient'}$

$\llbracket (6) \rrbracket = 1$  iff  $\forall w' \in \text{DOX}_{x_{\text{ATT}}, w^*}$ : **reportedly**  $p$  in  $w'$

- Context*: I, Pollux, heard from many people that they are, Castor knows it for sure.  
 $(6) \approx$  Castor thinks that — and I heard it — solar panels are efficient.  
 $\llbracket (6) \rrbracket = 1$  iff  $\forall w' \in \text{DOX}_{\text{Castor}, w^*} : p$  in  $w' \wedge x^*$  heard  $p$  in  $w^*$   
 $= 1$  iff solar panels are efficient in  $w' \wedge$  I (Pollux) heard in  $w^*$  that solar panels are efficient
- Context*: But I was not told so. I only infer it based on how many neighbors install them.  
 $(6) \approx$  Castor thinks that I heard that solar panels are efficient.  
 $\llbracket (6) \rrbracket = 1$  iff  $\forall w' \in \text{DOX}_{\text{Castor}, w^*} : p$  in  $w' \wedge x^*$  heard  $p$  in  $w'$   
 $= 1$  iff solar panels are efficient in  $w' \wedge$  I (Pollux) heard in  $w'$  that solar panels are efficient
- Context*: I know that Castor was told it many times by neighbors. He has forgotten about it and thinks that panels should be efficient because he generally believes in green energy.  
 $(6) \approx$  Castor thinks that solar panels are efficient (and he heard it).  
 $\llbracket (6) \rrbracket = 1$  iff  $\forall w' \in \text{DOX}_{\text{Castor}, w^*} : p$  in  $w' \wedge x_{\text{ATT}}$  heard  $p$  in  $w^*$   
 $= 1$  iff solar panels are efficient in  $w' \wedge$  Castor heard in  $w^*$  that solar panels are efficient
- Context*: Castor, based on what he thinks his neighbors said, believes in solar panels' efficiency. He's, in fact, confused about it — his neighbors aren't really into clean energy.  
 $(6) \approx$  Castor thinks that, as he heard, solar panels are efficient.  
 $\llbracket (6) \rrbracket = 1$  iff  $\forall w' \in \text{DOX}_{\text{Castor}, w^*} : p$  in  $w' \wedge x_{\text{ATT}}$  heard  $p$  in  $w'$   
 $= 1$  iff solar panels are efficient in  $w' \wedge$  Castor heard in  $w'$  that solar panels are efficient

All of the interpretations above are *a priori* conceivable but not all of them are attested: grey cells in the chart in (5) contain interpretations that are not available, (6b) and (6c). Consider (7):<sup>5</sup>

- (7) Georgian (Kartvelian); evidential past ambiguous between visual inferential and hearsay  
*Context 1*, cf. (6a): I've never met Natasha, who is a friend of a friend. Said friend told me that Natasha knows Georgian.

*Context 2*, cf. (6b): I've never met Natasha, who is a friend of Maria's, and generally know very little of her. Maria is sure she told me that Natasha knows Georgian.

*maria pikrobs [rom natasha-s codnia kartul-i]*  
 Maria.NOM think.3SG.S.PRES COMP Natasha-DAT 3SG.S.EV.PST Georgian-NOM

- (i) *Context 1*: 'Maria thinks that—and I was told it—Natasha knows Georgian'.  
 (ii) #*Context 2*: 'Maria thinks that I was told that Natasha knows Georgian'.

As the example above shows, Georgian evidential past cannot be used in a scenario wherein someone other than the speaker ascribes to the speaker having a certain kind of evidence about *p*: the evidential cannot be speaker-oriented and be evaluated with respect to the attitude subject's doxastic alternatives (the same also holds for Bulgarian and Turkish). The opposite situation is not attested either: the evidential cannot be subject-oriented and be evaluated in the actual world. Illustrated with a Korean example below; the same holds for Bulgarian, Japanese and Turkish.

- (8) Korean; direct perception marker *te* (adapted from Lee (2013): ex. 22)

*Context 1*, cf. (6c): Chelswu went outside during the rain yesterday. He somehow has forgotten it and thinks he only knows about the rain from his neighbors.

*Context 2*, cf. (6d): Chelswu, who spent all day sick, thinks he went outside and saw the rain.

*Chelswu-nun [pi-ka ecey o-te-la-ko] malha-yess-e.*  
 Chelswu-TOP rain-NOM yesterday fall-**DIR**-DECL-COMP say-PST-DECL

- (i) #*Context 1*: 'Chelswu said that—and he has perceived it—it was raining yesterday.'  
 (ii) *Context 2*: 'Chelswu said that, as he has perceived, it was raining yesterday.'

Some interpretations are systematically absent. It might seem that in the attested interpretations the two variables *x* and *w* co-vary: either both of them are interpreted with respect to the matrix clause (6a; 7i) or both of them are interpreted with respect to the embedded clause (6d; 8ii). Mismatch interpretations as in (6b; 7ii) and (6c; 8i) are not allowed even though nothing in (4) prohibits it. Sauerland and Schenner (2007) stipulate this fact for the Bulgarian reportative. I argue that this seeming co-variation is due to the subjectivity of evidentials: the evidential origo is the one and only authority over their information source, see section 4 for the full entry. In both of the unattested cases, someone attributes having evidence to another individual: speaker to attitude subject (6c; 8i) or attitude subject to speaker (6b; 7ii). In both cases, said individual does not think

<sup>5</sup>Unless indicated otherwise, data come from my work with consultants.

they have this kind of evidence, which is exactly the reason evidentials are ruled out.<sup>6</sup>

## 2.2. Variation

Languages vary in which interpretation they allow. Above I've shown that perspective has an impact on the worlds the evidential is evaluated with respect to. In what follows, I will use *shift* as a shortcut for the interpretation where the individual argument shifts and the evidential is then interpreted with respect to that individual's relevant alternatives set.

### 2.2.1. No shift

In some languages, evidentials-in-attitudes are obligatorily speaker-oriented. This is the case in Bulgarian (South Slavic) as reported in (Sauerland and Schenner 2007; Koev 2011), and Georgian:

#### (9) Georgian

*Context 1:* Maria and Nana are supervising monks' work on translation. I've heard about it from Nana. Later, Maria also tells me about it.

*Context 2:* The priest is supervising monks' work and tells Maria about it. She then tells me but I actually know it directly as I was helping the monks.

*maria-ma mitxra rom ber-eb-s biblia kartul-ad*  
 Maria-ERG tell.me.AOR COMP monk-PL-DAT Bible.NOM Georgian-ADV  
*gadautargmniat*  
 translate.3PL.S.3SG.O.EV.PST

- (i) *non-shifted, context 1:* 'Maria told me that—and I was told that already—the monks translated the Bible into Georgian.'
- (ii) *# shifted, context 2:* 'Maria told me that, as she was told, the monks translated the Bible into Georgian.'

Context 1 forces the non-shifted interpretation: the speaker has hearsay information about the scope proposition, while Maria knows it directly.<sup>7</sup> The sentence can be used in this scenario.

<sup>6</sup>This is a property specific to evidentials rather than something universal to the expressions of evidence (contra McCready 2011). Expressions such as *be told*, seemingly expressing similar semantics as e.g. hearsay evidentials, are perfectly acceptable in mismatch scenarios: *Castor thinks that I was told that solar panels are efficient. However, nobody told me such a thing* (cf. 6b) or *Castor thinks—and he was told it—that solar panels are efficient. He himself, however, does not remember being told so and bases his judgment on how popular they are among his neighbors* (cf. 6c). The consequence for the theory is that semantics of evidentiality should be modelled in a way that predicts these restrictions.

<sup>7</sup>Note that Maria cannot be the source of information so it is a genuine speaker-oriented reading rather than an evidential concord reading wherein evidential just repeats the content of the attitude verb (Schenner 2010).

Context 2 forces the shifted reading: the speaker knows for sure about translation, while the attitude subject, Maria, has hearsay information about it. The sentence cannot be used in this context, which indicates that evidential past has to be interpreted with respect to the speaker.

### 2.2.2. Optional shift

In some other languages, embedded evidentials can be interpreted either with respect to the speaker or the attitude subject. This is the case in German (Schenner 2010, confirmed with consultants); Bulgarian (Roumyana Pancheva, p.c.); and Turkish (Şener 2011):

- (10) Turkish: direct evidential *di* (Şener (2011): ex.98a,99a; confirmed with consultants)  
*Context 1:* Berna told Seda that Ayşe has red hair and Seda believes her. Seda says: 'Ayşe has red hair'. I (speaker) saw Ayşe's red hair with my own eyes.  
*Context 2:* Seda saw Ayşe's hair, and tells me: 'Ayşe has red hair'. I didn't see Ayşe myself.  
 Seda [Ayşe'nin saç-ı kızıl-**di**] de-di.  
 Seda Ayşe-GEN hair-POSS red-**DIR** say-PST-DIR  
 (i) *non-shifted, context 1:* 'Seda said that—and I've seen it—Ayşe has red hair'.  
 (ii) *shifted, context 2:* 'Seda said that, as she has seen, Ayşe has red hair'.

Context 1 forces the non-shifted reading: the speaker has seen Ayşe's red hair and therefore has direct evidence for what Seda said, while Seda, attitude subject, has only hearsay evidence. Context 2, on the other hand, forces the shifted interpretation: the speaker has only heard about Ayşe's red hair, while Seda has seen it. The sentence can be used in both, indicating that direct evidential *di* optionally shifts. Another evidential, *miş*, behaves likewise.

### 2.2.3. Obligatory shift

Finally, there are languages where evidentials in attitude reports shift obligatorily. This is the case in Japanese; Korean (Lee 2013); Standard Tibetan (Tibeto-Burman; Garrett 2001); St'át'imcets (Salish; Matthewson et al. 2008); Zazaki (Iranian; Gajewski 2005).

- (11) Korean: immediate perception marker *te* (based on Lee 2013: ex.7c)  
 Yenghi-nun [Chelswu-ka khaley-lul mek-**te**-la-ko] malha-yess-ta  
 Yenghi-TOP Chelswu-NOM curry-ACC eat-**DIR**-DECL-COMP say-PST-DECL  
 a. non-shifted: #'Yenghi said that—and I have perceived it—Chelswu ate the curry'. Infelicity of the follow-up 1 confirms absence of this reading: #But Yenghi did not see or otherwise observe Chelswu eating the curry. She heard about it from his neighbor.

- b. shifted: 'Yenghi said that, *as she has perceived*, Chelswu ate the curry'. Felicity of the follow-up 2 confirms presence of this reading: But I did not see or otherwise observe it.

In this example, different follow-ups probe whether the evidential shifts or not. If it can be speaker-oriented, then the attitude subject, Yenghi, does not have to have perceptual evidence for Chelswu's curry-consumption. However, explicitly indicating that Yenghi did not see or otherwise perceive it results in infelicity, as shown in (11a). If *te* can shift, then it is the speaker who does not have to endorse the evidential claim. As shown in (11b), this continuation is felicitous.

### 2.3. Interim summary

In this section, I showed that out of logically possible interpretations only some are available to evidentials across languages. Perspective of the evidential has an impact on which worlds it is evaluated with respect to: (i) speaker-oriented evidentials have to be evaluated in the actual world, which creates an effect of projection, and (ii) subject-oriented evidentials are evaluated with respect to subject's alternative set, which creates an effect of them being in the scope of attitude verb. On top of these constraints, there are also language-specific restrictions. Languages fall into three classes with respect to which perspective evidentials may take:

- (12) A. **No evidential shift:** Georgian, Bulgarian\*  
 B. **Optional evidential shift:** German, Turkish, Bulgarian\*  
 C. **Obligatory evidential shift:** Korean, Japanese, St'át'imcets, Tibetan, Zazaki  
 \* for some speakers

In the next section I discuss how these restrictions are handled by the current theories.

### 3. Previous approaches

I made two empirical observations: (A) some interpretations are systematically absent, and (B) there is cross-linguistic variation in perspectival orientation of evidentials. A is neither discussed nor fully predicted. B is often used as one of the diagnostics used to justify the existence of two semantic classes of evidentials: (i) **modal**: those that operate at the propositional level (Garrett 2001; McCready and Ogata 2007; Matthewson et al. 2008; Lee 2013), and (ii) **illocutionary**: those that contribute content that is not part of the main assertion (Faller 2002; Murray 2010; Koev 2011). Modal evidentials are expected to scopally interact with attitude verbs and shift, while illocutionary evidentials are expected to be non-embeddable semantically and remain speaker-oriented.

One problem with this view is that there is no independent empirical support for the modal vs. illocutionary distinction above: other tests used in the literature do not in fact distinguish between the

two classes (Matthewson 2012), e.g. evidentials across the board do not scopally interact with negation. And if evidential shift is the *only* diagnostic, the modal-illocutionary divide might not be the right way to cut the evidential pie (section 4). Another problem is that for languages with optional evidential shift, we have to postulate systematic lexical ambiguity, e.g. under this view Turkish has a modal *miş*, obligatorily shifted, and an illocutionary *miş*, obligatorily speaker-oriented. I discuss further issues below.

**Modal approaches.** Sentences with evidentials carry an *Evidential Requirement (ER)*: they are only felicitous if the proposition expressed by the sentence was acquired in a particular way, e.g. direct perception or hearsay. Most modal approaches model ER as a presupposition (Izvorski 1997; Matthewson et al. 2008; Matthewson 2012; Lee 2013; cf. also von Stechow and Gillies 2010 on *must*). Verbs like ‘think’ and ‘say’ “plug” presuppositions. Sentence *Mary thinks that the president of the world is Canadian* does not entail that there is a unique world’s president and does not commit the speaker to this view. The expectation is that ER will also be “plugged” in such environments, which under the modal view means that evidentials will be subject-oriented. However, there are languages where evidentials are always speaker-oriented, even under ‘say’ and ‘think’, and evidentials in some of these languages (Bulgarian) have received a modal analysis.

At the same time, modal approaches take for granted that modals-in-attitudes always shift, which is motivated by the following examples:

- (13) Scylla thought [that Odysseus’ ship **might** pass Charybdis].
- a. non-shifted, speaker-oriented: # ... but Scylla was sure it would pass.
  - b. shifted, subject-oriented: ... but I was sure it would pass.

To account for (13), modals are analyzed as relativized to an individual: agent of a particular event (Hacquard 2010) or judge (Stephenson 2007). Under both approaches, the variable in the modal has to be bound locally, which predicts (13b) and bans (13a). Subject-orientedness of evidentials-in-attitudes is presumably modelled in the same way as that of modals (it is not explicitly discussed in the literature).<sup>8</sup> However, the landscape of modality is not exhausted by modal auxiliaries in Germanic and Romance. Consider the behavior of *possible* in attributive position:

- (14) *Context*: Meaghan and I are lost in the backcountry. We managed to get stranded on a ledge from which we can proceed no further.

Meaghan said that a cliff was overhanging a **possible** escape route.

- a. non-shifted, speaker-oriented: ... but she thinks that this route that I pointed to will eventually turn into a dead-end.

<sup>8</sup>These approaches partially capture subjectivity in the sense that among subject-oriented interpretations, only such as in (6d) but not as in (6c) will be allowed. However, they also rule out speaker-oriented interpretations altogether since evidentials will be forced to shift in embedded clauses.

- b. shifted, subject-oriented: ... but I think that the route she pointed to will eventually turn into a dead-end.

English modal adjectives do not have to shift. The moral? We know little about the behavior of modals-in-attitudes. The difference between (13) and (14) is likely due to syntax. But automatically assuming that speaker-oriented and subject-oriented evidentials have a different syntax will be preliminary at best. Therefore, we cannot outsource evidential shift to Hacquard's or Stephenson's mechanism. More research is needed.

**Illocutionary approaches.** Koev (2011) argues that Bulgarian evidentials-in-attitudes are obligatorily speaker-oriented (in his dialect) by virtue of being not-at-issue. However, appositive relative clauses—classically analyzed as contributing not-at-issue content—need not be speaker-oriented (Harris and Potts 2009; Schlenker 2013):

(15) *Context:* My aunt is extremely skeptical of doctors in general.

She says that dentists, **who are only in it for the money anyway**, are not to be trusted at all. (Harris and Potts 2009: Appendix A, ex.3a)

Provided the alleged parallelism between evidentials and other types of not-at-issue content (see also Murray 2010), we expect evidentials to undergo optional shift but, as I've shown, the expectation is not fulfilled.

To sum up, current theories fall short at explaining universals and variation in evidential shift and make wrong predictions. In the next section, I develop an alternative account that does not make reference to the modal vs. illocutionary distinction.

#### 4. Proposal

To recapitulate, there are two main sets of facts that I aim to account for. First, some of the logically possible interpretations are not attested for evidentials-in-attitudes: namely, ones where having information source is ascribed to the evidential origo by a third party. Second, there is cross-linguistic variation in who can be the evidential origo in attitudes: in some languages, it has to the speaker, while in some others, it can or must be the attitude subject.

Before I proceed, two background assumptions need to be made (Anand 2006; Anand and Nevins 2004). (i) Attitude predicates quantify over indices (rather than (centered) worlds).<sup>9</sup> (ii) An index is an object of type *k*, same as context, and includes information about the circumstance of a speech act such as e.g. speaker and world. This will become important when I discuss evidential shift in 4.2.2.<sup>10</sup> In matrix cases, index and context are the same.

<sup>9</sup>In a similar system in (Schlenker 2003; Sudo 2012) attitude predicates directly manipulate contexts.

<sup>10</sup>Anand and Nevins (2004) provide conceptual arguments from attitudes 'de se' as to why index includes more



$$(16) \quad i_k = c^* = \langle author, hearer, \dots, world \rangle$$

This gives the following semantics for an attitude predicate such as ‘think’ and a sentence with it:

$$(17) \quad \begin{aligned} \text{a. } \llbracket \text{think} \rrbracket^{c,i,g} &= \lambda \phi_{\langle k,t \rangle} . \lambda x_e . \forall i' \text{ compatible with what } x \text{ thinks at } i, \llbracket \phi \rrbracket^{c,i',g} \\ \text{b. } \llbracket \text{Meaghan thinks that I am a space alien} \rrbracket^{c,i,g} \\ &= \forall i' \text{ compatible with what Meaghan thinks at } i, \llbracket \text{I am a space alien} \rrbracket^{c,i',g} \\ &= 1 \text{ iff } \text{AUTHOR}(c^*) \text{ is a space alien at } i' = 1 \text{ iff the speaker is a space alien at } i' \end{aligned}$$

Intensional operators such as ‘think’ manipulate the index parameter. The context parameter, on the other hand, remains intact in the scope of attitude predicates and expressions such as *I*, which are sensitive to context, do not change their reference, as in (17b). The context parameter can only be manipulated by *monsters*, to be discussed later in section 4.2.

#### 4.1. Universals: subjectivity

I argue that evidentials, together with e.g. epistemic modals and taste predicates, belong to the class of *subjective* expressions whose truth is relativized to some individual and therefore cannot be evaluated externally. The formal implementation is as follows. I analyze evidentials as self-ascriptions of the property of acquiring the scope proposition in a particular way lexically specified by the evidential. I also add one more individual coordinate to the context: *origo*, responsible for whose information source is reflected by the evidential. We need both *author* and *origo* because they are sensitive to different operators, see 4.2.2 below.

Just like other perspective-sensitive phenomena, evidentials obey the speaker default:

$$(18) \quad \text{ORIGO}(i) = \text{AUTHOR}(i)$$

Consider the lexical entry for the reportative use of the non-shifting Georgian evidential past below:

$$(19) \quad \llbracket \text{EV.PST}_{\text{REP}} \rrbracket^{c,i,g} = \lambda p . p \wedge \forall \langle x', w' \rangle \in \text{DOX}_{\text{Origo}_c, w_c} : \text{HEAR}(x', w')(p)$$

(19) says that the evidential asserts (a) its scope proposition<sup>11</sup> and (b) that in all world-individual pairs compatible with what the evidential *origo*  $\text{Origo}_c$  believes in the world of evaluation  $w_c$ ,

than just time and world: obligatorily ‘de se’ expressions such as PRO can be analyzed as making reference to the individual coordinates, which immediately accounts for lack of ‘de re’ interpretations.

<sup>11</sup>It has been argued (see e.g. Faller 2002; Murray 2010) that evidentials differ in whether they assert their scope proposition (direct evidentials) or its modalized version (indirect evidentials), or merely present it (reportatives). For my current purposes, strength of evidential statements is irrelevant so I ignore this issue.

individual  $x'$  that the origo identifies as themselves in  $w'$  heard  $p$ . This is a departure from a more standard treatment of evidential requirement as not-at-issue (see section 3).

This analysis does double duty. First, (19) takes care of the first grey cell in (5) and the non-attested reading in (6b). It straightforwardly accounts for the fact that evidentials-in-attitudes cannot be used in scenarios when having information source for  $p$  is ascribed to the origo by a third party: evidentials are only felicitous just in case the origo believes of themselves that they have a particular information source for  $p$  (to put it differently, origo is a *de se* individual). Here is a derivation for (7), whose translation is repeated below:

- (20) a. Maria thinks that [ EV.PST<sub>REP</sub> [Natasha knows Georgian]]  
       = self-ascribed: 'Maria thinks that—and *I was told it*—Natasha knows Georgian'.  
       ≠ non-self-ascribed: # 'Maria thinks that *I was told that* Natasha knows Georgian'.  
       b.  $\forall i'$  compatible with what Maria thinks at  $i$ ,  $\llbracket \text{EV.PST}_{\text{REP}} [\text{N. knows G.}] \rrbracket^{c,i',g}$   
       = 1 iff N. knows G. at  $i' \wedge \forall \langle x', w' \rangle \in \text{DOX}_{\text{Origo}_c, w_c} : \text{HEAR}(x', w') (\text{N. knows G.})$   
       = 1 iff N. knows G. at  $i' \wedge$  I believe at  $i$  that I heard that N. knows G.

Second, the semantics in (19) has another empirical advantage: it immediately accounts for the fact that ER cannot be challenged or denied in the subsequent discourse. For instance, sentences with hearsay evidentials cannot be replied to with 'No, you were not told so'. This property of *non-challengeability* has been attributed to the not-at-issue status of ER (e.g. Murray 2010). However, (not-)at-issueness does not have to correlate with (non-)challengeability: first-person belief reports (e.g. *I am sure there is life on Venus*) are not challengeable yet clearly at-issue. At the same time, subjective expressions are non-challengeable by definition. Under my analysis, it falls out naturally since origo is the one and only authority over their epistemic state. *Premises* for having a belief can be challenged, just like premises for an evidential statement (Faller 2007; Matthewson 2012), but not the very fact of holding some belief. For instance, if my addressee believes my information source is not trustworthy, they can challenge said source and thus cast doubt on the validity of my claim, but that does not challenge holding some belief unless I decide to revise it later.

Previous approaches do not connect lack of some interpretations in embedded clauses and non-challengeability in matrix cases. The approach I advocate derives both properties from the same source, subjectivity, and also does not postulate any additional dimension of meaning that is not obviously motivated empirically (cf. discussion in Schlenker 2013).<sup>12</sup>

<sup>12</sup>Further empirical support for subjectivity of evidentials comes from the fact that evidentials across the board are judged true in Gettier scenarios. Unfortunately, there is no space here for a more thorough discussion.

## 4.2. Variation: shifted indexicality

The analysis above is incomplete without an account of the cross-linguistic variation in evidential shift. To this end, I propose that *origo* is a shiftable indexical. The emerging typology of languages vis-a-vis evidential shift (12) closely resembles the typology of languages vis-a-vis shift of indexical pronouns such as *I*:

- (21) A. **No pronominal shift:** English; French; Russian; ...
- B. **Optional pronominal shift:** Aghem, Amharic (Schlenker 2003, secondhand data); Catalan Sign language (Quer 2005); Japanese (Sudo 2012); Korean (Park 2014); Kurmanji (Koev 2013); Mishar Tatar (Podobryaev 2014), Navajo (Speas 1999); Nez Perce (Deal 2014); Slave (Rice 1986); Tamil (Sundaresan 2012); Turkish (Özyildiz 2013); Zazaki (Anand and Nevins 2004)
- C. **Obligatory pronominal shift:** Balkar (Koval 2014); Matses (Munro et al. 2012); Uyghur (Shklovsky and Sudo 2014)

Configurations with the shifted *I* somewhat resemble the English *Meaghan thought*: “*I<sub>M.,\*speaker</sub> should fight the patriarchy*”, except that in English it is only possible in quotation. In languages in (21B, 21C), indexical shift also occurs in bona fide embedded clauses, as evidenced by e.g. availability of cross-clausal dependencies (see (Munro et al. 2012) for an overview of diagnostics).

Just like pronominal shift, evidential shift is confined to attitudinal complements and is not sensitive to the perspectival center introduced by experiencer PPs or across sentence boundary:<sup>13</sup>

- (22) Turkish
- babam-la konuş-tu-m*  
father-with speak-PST-1SG  
'I spoke to my father'.
- a. *saat iki-de gel-eceğ-im* [Pronouns]  
time two-LOC come-FUT-1SG  
(i) non-shifted: 'I'm coming at 2'; (ii) #shifted: 'He's coming at 2'.
- b. *hastalan-mış* [Evidentials]  
get.sick-EV.REP.3SG  
(i) non-shifted: 'He is sick, *I was told*'; (ii), #shifted: 'He is sick, *my father was told*'.

In the example above, neither the shiftable pronoun nor the evidential can refer to *babamla* 'father' introduced in the previous sentence.

<sup>13</sup>Supplements, on the other hand, can shift in such environments (Harris and Potts 2009), which is another argument that casts doubt on the analyses treating evidentials on a par with them, see section 3.

#### 4.2.1. Pronominal indexical shift in a nutshell

Two major families of approaches to pronominal indexical shift differ, in particular, in the locus of cross-linguistic variation. For Schlenker (2003) and von Stechow (2002) (modulo differences in the formal implementation), *I* in e.g. English can only be bound globally by the matrix context while the Amharic *I* can be in addition bound locally, which results in shifting to the author of the reported context. I will call it the binding approach. An alternative analysis (Anand and Nevins 2004; Shklovsky and Sudo 2014) maintains uniform binding conditions and attributes the variation to the presence or absence of a context-shifting operator  $\mathbb{M}$ , the monster, in the lexicon of a given language: English does not have it while Amharic does, which results in shifting. The monster takes the context parameter of its sister and overwrites it with the index parameter:

$$(23) \quad \llbracket \mathbb{M} \phi_{k,t} \rrbracket^{c,i,g} = \llbracket \phi \rrbracket^{i,i,g}$$

Given that the index parameter is the one affected by intensional operators (see (17a)), indexical elements in  $\phi$  such that it is in the scope of an attitude verb change their reference whenever the monster is present in the same clause. The empirical advantage of the operator approach comes from restrictions associated with indexical shift. The binding approach predicts that sentences with two indexicals are four-way ambiguous. But e.g. Zazaki clausemate indexicals either all shift or do no shift at all:

(24) pseudo-Zazaki: I, Natasha, tell Kavita: “*Meaghan told Kathleen* [<sub>CP</sub> *I admire you*]”.

	I=AUTHOR(c*)=N.	I=AUTHOR(c')=M.
you=HEARER(c*)=Kavita	✓	☹
you=HEARER(c')=Kathleen	☹	✓

This effect, dubbed *Shift-Together*, falls out naturally under the operator approach. When the monster is present, everything in its scope has to shift: [att.verb [<sub>CP</sub>  $\mathbb{M}$  [I admire **you**]]]. For ramifications and other advantages, see Anand (2006); Sudo (2012).

#### 4.2.2. Evidential shift

Sauerland and Schenner (2007) analyze Bulgarian reportative as a non-shiftable indexical that can only be bound by the matrix context. Extended to other languages, this analysis gives a Schlenker/von Stechow view on evidential shift (adopted by Şener (2011) for Turkish). Based on the restrictions on evidential shift and their similarities to restrictions on pronominal shift, I opt for the operator approach. I propose that evidential-shifting languages have the following operator in their lexicon, modelled after context-shifters in (Anand and Nevins 2004; Deal 2014):

$$(25) \quad \llbracket \textcircled{\text{EV}} \phi_{k,t} \rrbracket^{\langle \text{Author}_c, \text{Origo}_c, \dots, w_c \rangle, i, g} = \llbracket \phi \rrbracket^{\langle \text{Author}_c, \text{Origo}_i, \dots, w_c \rangle, i, g}$$

The sole function of monsters is to overwrite context coordinate(s), this is why it was important to ensure that index and context are of the same type. The evidential monster  $\textcircled{\text{EV}}$  takes the *Origo* coordinate of the context parameter *ORIGO*(c) and changes it to the *Origo* coordinate of the index parameter *ORIGO*(i), while everything else remains the same. Given that *ORIGO*(i)=*AUTHOR*(i) (speaker default in (18)), in attitudinal complements this results in the evidential shift to the attitude subject whenever the monster is present:

$$(26) \quad \llbracket \text{think} \textcircled{\text{EV}} \phi_{k,t} \rrbracket^{\langle \text{Author}_c, \text{Origo}_c, \dots, w_c \rangle, i, g} = \lambda x. \forall i' \in \text{DOX}_{x, w_c}: \llbracket \textcircled{\text{EV}} \phi \rrbracket^{\langle \text{Author}_c, \text{Origo}_{i'}, \dots, w_c \rangle, i', g}$$

At the same time, reference of indexical elements sensitive to other context coordinates is intact (see discussion at the end of this section). Other monsters overwrite other coordinates.

In optional-shift languages such as Turkish,  $\textcircled{\text{EV}}$  can be present or absent in the structure. In obligatory-shift languages such as Korean, it is always present. Assuming that evidentials only differ in the type of evidential requirement, they receive a lexical entry similar to one in (19). This gives the following derivation for (11), whose translation is repeated below:

- (27) a. Korean: Yenghi said [TE [Chelswu ate the curry]] = Yenghi said that, *as she perceived*, Chelswu ate the curry.
- b.  $\forall i'$  compatible with what Y. said at  $i$ ,  $\llbracket \textcircled{\text{EV}} \text{TE [Ch. ate the curry]} \rrbracket^{\langle A_c, \text{Origo}_c, \dots, w_c \rangle, i', g}$   
 $= \llbracket \text{TE [Ch. ate the curry]} \rrbracket^{\langle A_c, \text{Origo}_{i'}, \dots, w_c \rangle, i', g}$   
 $= 1$  iff Ch. ate the curry at  $i' \wedge \forall \langle x', w' \rangle \in \text{DOX}_{\text{Origo}_{i'}, w_c}: \text{PERC}(x', w') \text{ (Ch. ate curry)}$   
 $= 1$  iff Ch. ate the curry at  $i' \wedge \text{Y. believes at } i \text{ having perceived that Ch. ate the curry}$

Note that the second grey cell in (5) (and also 6c) is taken care of. The evidential is felicitous so long it is Yenghi and no one but Yenghi who ascribes having perceived  $p$  to herself.

Applied to evidential shift, the operator approach provides similar advantages over the binding approach as when applied to pronominal shift. First, like most pronominal indexicals (except in some Sign Languages under Role Shift, e.g. Quer 2005), evidentials exhibit *Shift-Together*:

## (28) Bulgarian

*Context:* I'm exchanging news with Maria, we're discussing our cohort. I was mostly in touch with Jane and tell Maria that she lives in Japan. She was in touch with Lisa who is in Canada. Later on, Maria's mom joins us. Maria tells her: "Jane lives in Japan and Lisa lives in Canada".

Speaker: direct information about  $p$  = 'Jane lives in Japan', hearsay about  $q$  = 'Lisa lives in Canada'; Maria: hearsay about  $p$ , direct about  $q$

*Maria kaza na majka si che [Dzhein zhivee-l-a v Yaponia] i [Lisa zhivee-l-a v Kanada]*  
 Maria said to mother her that [Jane live-EV-F in Japan] and [Lisa live-EV-F in Canada]

- (i) expected mismatch interpretation: # 'Maria told her mother that, *as she was told*, Jane lives in Japan and—*as I was told*—Lisa lives in Canada'.
- (ii) only the concord interpretation (both non-shifted): The speaker is reporting a speech event (what Maria said) of the form  $p \wedge q$ .

Second, evidential shift is confined to a very particular set of verbs. In Korean, an obligatory-shift language, evidentials are only licensed under 'say' (Lim 2010). In Standard Tibetan, another obligatory-shift language, it occurs under 'say' and predicates that take a complementizer derived from 'say' (Garrett 2001). In Bulgarian, while both 'think' and 'say' license embedded evidentials, only the latter licenses the shifted interpretation. The same is true for pronominal shift, which is almost exclusively licensed under 'say', plus sometimes other communication predicates and 'think' (see (Sundaresan 2012) for an overview). The binding view predicts unconditional shift under all attitude predicates, given that their semantics is uniform. The operator view allows more space for variation, e.g. it is possible to formulate the restriction in terms of selection. I leave the precise formulation of the distribution of monsters for future research.

One might rightfully wonder: why not just say that origo is shifted by the same operator that shifts the author coordinate? In other words, why multiply monsters? The shifting behavior of evidentials and indexicals in languages where both shift (Korean, Turkish) is not uniform. For instance, in Korean evidential shift is obligatory while pronominal shift is optional. Furthermore, there is no interaction between evidential and pronominal shift, which would be expected were both shifts due to the same monster. Despite the obligatory shift of *te*, both shifted (triggered by  $\textcircled{\omega}_{PER}$ , Park 2014) and non-shifted interpretations of the first person pronoun are allowed:

## (29) Korean

*Yenghi-nun [John-i na-lul po-te-la-ko] malha-yess-ta*  
 Yenghi-TOP John-NOM I-ACC see-DIR-DECL-COMP say-PST-DECL

- a. non-shifted: 'Yenghi said that, *as she perceived*, John saw me'.

$\forall i'$  compatible with what Y. said at  $i$ ,  $\llbracket \textcircled{\omega}_{EV} [\text{TE [J. saw me]}] \rrbracket^{(A_c, \textit{Origo}_c, \dots, w_c), i', g}$   
 $= \llbracket [\text{TE [J. saw me]}] \rrbracket^{(A_c, \textit{Origo}_{i'}, \dots, w_c), i', g}$

- $= 1$  iff J. saw AUTH(c) at  $i' \wedge \forall \langle x', w' \rangle \in \text{DOX}_{\text{Origo}_{i'}, w_c} : \text{PERC}(x', w') \text{ (J. saw AUTH(c))}$   
 $= 1$  iff J. saw the speaker at  $i' \wedge \text{Y. believes at } i \text{ having perceived that J. saw the speaker}$   
 b. shifted: 'Yenghi<sub>i</sub> said that, *as she perceived*, John saw her<sub>i</sub>'.  
 $\forall i'$  compatible with what Y. said at  $i$ ,  $\llbracket \textcircled{\text{EV}}_{\text{EV}} \textcircled{\text{PER}}_{\text{PER}} [\text{TE [J. saw me]}] \rrbracket \langle A_c, \text{Origo}_c, \dots, w_c \rangle, i', g$   
 $= \llbracket \textcircled{\text{PER}}_{\text{PER}} [\text{TE [J. saw me]}] \rrbracket \langle A_c, \text{Origo}_{i'}, \dots, w_c \rangle, i', g$   
 $= \llbracket [\text{TE [J. saw me]}] \rrbracket \langle A_{i'}, \text{Origo}_{i'}, \dots, w_c \rangle, i', g$   
 $= 1$  iff J. saw AUTH(i') at  $i' \wedge \forall \langle x', w' \rangle \in \text{DOX}_{\text{Origo}_{i'}, w_c} : \text{PERC}(x', w') \text{ (J. saw AUTH(i'))}$   
 $= 1$  iff J. saw Yenghi at  $i' \wedge \text{Yenghi believes at } i \text{ having perceived that J. saw the Yenghi}$

Indexical expressions are overall not homogenous, e.g. behavior of personal and adverbial indexicals is not uniform. In Korean (Park 2014) and Nez Perce (Deal 2014), they only exhibit *Shift-Together* within one group (*I* plus *you*, *here* plus *now*) but not across groups (*I* plus *here* is four-way ambiguous, unlike in Zazaki). In Hebrew and English Free Indirect Discourse, only adverbial indexicals shift while personal ones stay faithful to the original context of utterance (Sharvit 2008). That said, it is not surprising that evidentials do not pattern together with other indexicals.

### 4.3. Interim summary

This section offers a formal account of evidentials-in-attitudes. I argue that the evidential requirement is a belief report. This captures the subjectivity of evidentials that manifests itself in two ways: (i) lack of interpretations in embedded clauses such that someone ascribes having information source for  $p$  to the origo, (ii) non-challengeability of evidentials, i.e. impossibility to cast doubt on, or deny, origo's having information source for  $p$ . To account for the cross-linguistic variation in evidential shift, I argue that origo is a shiftable indexical that can only be shifted by a dedicated context-overwriting operator  $\textcircled{\text{EV}}_{\text{EV}}$  present in the lexicon of some languages. When faced with restrictions on shift such as the limited set of predicates that license it or *Shift-Together*, the operator approach fares better than the binding analysis, both for evidentials and pronouns.

## 5. Conclusion

The goal of this paper was to tackle the interpretations of evidentials-in-attitudes. It was previously observed that in some languages, evidentials shift, while in some others, they don't. This has been attributed to the semantic variation in evidentials. I argue that shifted evidentiality is a variety of shifted indexicality, thus reducing a case of the apparent semantic variation in evidentials to variation in the lexicon. While there is little empirical support for the semantic non-uniformity of evidentials, *some* machinery to account for pronominal indexical shift is required independently, therefore this approach is better on the grounds of parsimony.

Needless to say, there are many open questions left. One such question is the status of origo. If it is not the author, maybe it is the judge? I purposefully refrained from bringing this up thus far.

Stephenson (2007) uses the judge for taste predicates and epistemics, Pearson (2013) defends a judge-free view on taste predicates, and the jury is still out for the context-dependence of epistemics. This organically leads us to the second question: what is the place of evidentials among other perspective-sensitive phenomena? Finally, what is the connection between shift in attitudes and shift in questions and where does the curious inability of pronominal indexicals to shift in questions stem from? The quest for answers takes me well beyond the confines of this paper.

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## Watch the attitude: Embedding and role-shift in ASL

Helen Koulidobrova-Central Connecticut State University  
Kathryn Davidson-Yale University

**Abstract:** Much of the work on attitude predicates, spawned by Hintikka (1962), treats them as a uniform class – quantifiers over possible worlds. However, recently a number of suggestions have been made that highlight different subclasses. Here we present novel data from American Sign Language (ASL) that support a differentiation made by Anand and Hacquard (2008) concerning the objectivity and subjectivity of their complements, while also bringing into focus a special property of Sign Languages – role shift.

### 1. Introduction

Consider the difference in (1):

- (1) a. John<sub>a</sub> said, “I<sub>a</sub> am busy.”  
b. John<sub>a</sub> said he<sub>a</sub> is busy.

Both (1a) and (1b) can be reports of John uttering the statement “I am busy”; however, in (1a), the use of the 1st person pronoun to refer to John and 1st person verbal morphology agreeing with the subject reports the utterance in the words that John himself used, accomplished through quotation. By contrast, the use of the 3rd person pronoun in (1b) and 3rd person subject agreement signals a report of what John had uttered from the perspective of someone else, the speaker. Unlike quotation, this indirect speech report shows all properties of being fully integrated into the rest of the sentence through clausal embedding. We see then that in English, the person marking on the subject of the attitude report (John) serves as a way to reveal the type of discourse: 1st person marking signals direct discourse (quote), and 3rd person marking indirect discourse (a report). However, recent findings suggest that this diagnostic may not be fully cross-linguistically viable, since in languages like Ewe, Zazaki, Amharic and Slave, the 1st person pronoun instead of the 3rd occurs in reported speech contexts like (1b) (Clements 1975, Rice 1986, Schlenker 2003, Anand & Nevins 2004, Pearson *to appear*, i.a.). Such cases are sometimes said to be “monstrous”, to use an evocative term from Kaplan (1977): monstrous because an indexical expression that is usually (in English) evaluated with respect to the context of speech (1st person = the speaker) is instead evaluated with respect to another context, that of the reported speech (1st person = the subject). Investigations of the source of monstrosity have nearly all focused on the pronoun in question, including in cases of potential monsters in Sign Languages (SLs) as well. In this paper, we will mostly be concerned with American Sign Language (ASL), although we also discuss some extensions of our findings to other European Sign Languages. At the onset, we disclose that we will not be providing yet another theory of monsters in general or of monsters in SLs in particular. Instead, we use the aforementioned observations, whatever their analysis, coupled with novel data, as diagnostics for investigating two types of ways that embedding verbs can behave in English and, we show, in ASL.

- (2) a. JOHN<sub>k</sub> IX<sub>k</sub> SAY IX-1<sub>k</sub> SMART<sup>RS-k</sup>  
     ‘John says ‘I am smart’’  
     b. JOHN<sub>k</sub> SAY IX-3<sub>k</sub> SMART  
     ‘John says he is smart’

In terms of notation, the line over the part of the utterance following SAY indicates a combination of body/eye-gaze/head shift performed by the signer.<sup>2</sup> IX is a pronominal point<sup>3</sup> using the index finger that can be associated with a locus, an area of space associated (abstractly) with John. The descriptive intuition is that the signer ‘becomes John’ in some sense and, thus, utters [IX-1 SMART] (‘I am smart’) on John’s behalf. This is accomplished by the signer’s physical movement and/or break in eye gaze toward the locus associated with John. This is known in the SL literature as Role-Shift (RS).

The first question presented by this data is what exactly the nature of this RS is. Is it a semantic, syntactic, phonological, morphological, or pragmatic phenomenon? At first glance, it is rather tempting to view (2a) and (2b) as cases of direct vs. indirect discourse (as shown in the English translation), with RS marking the former but not the latter. However, as much literature has pointed out, matters are not that simple. When

<sup>1</sup>Following the conventions in Sign Language Linguistics, all ASL glosses are in CAPS. The line above the utterance indicates the spread/duration of the non-manual marking associated with either role-shifted material (RS) or topicalization (t); the letter/number separated with a dash (e.g. -a) indicates the area of signing space dedicated to a particular referent (the Mom) and, thus, the locus of the shift.

<sup>2</sup> The convention as described above, albeit traditional, is problematic in one respect: e.g., *k* in (2) is serving both as notation for locus (where the signer role shifted) and semantics (for co-reference), thus conflating the two. This tradition stems from the early days of Sign Language research (as in, e.g., Lillo-Martin & Klima 1990). Aware of the problem, we proceed here with caution, keeping to the conventions of the literature for simplicity reasons while revealing additional interpretations of anaphoric expressions in the text. See Koulidobrova (in progress) for the focused discussion of the issues involved.

<sup>3</sup> Admittedly, this is an oversimplification. First, *IX* can occur in three types of positions in ASL – pronominal, postnominal, and alone – each of which have been given different analyses in the literature. For example, MacLaughlin (1998) argues that postnominal *IX*, as in (2a) where it follows ‘John,’ is an adverbial, pronominal *IX* is a definite article, and the stand-alone *IX* is a personal pronoun. Additionally, we are also ignoring here (for simplicity purposes) an additional complication: the differentiation between spatial loci and semantic indices, assuming, with much of the literature, that loci serve as morpho-phonological realization of indices. Both of these issues are orthogonal to the arguments in this paper but see Koulidobrova & Lillo-Martin (forthcoming) where the contribution of loci vs. indices to the interpretation of *IX* is discussed and arguments for the demonstrative view of *IX* instead are offered.

other properties of the language are considered, it is clear that (at least) when under RS, the 1st person indexical in IX-1 in (2a) behaves differently than the English ‘I,’ tentatively placing ASL onto the list of languages with ‘logophoric pronouns’ (Lillo-Martin 1995, following the insights from Clements 1975 on Ewe, but see Person 2013). In (some) such languages, the relevant lexical item has been suggested to be a ‘monster’ in being an indexical seemingly dependent on a context that is not the context of utterance, with RS appearing to mark something other than a quote, as has been argued for different sign languages by Zucchi (2004), Quer (2005), Herrmann & Steinbach (2012), and Schlenker (2014). In the literature concerning both of these issues, much rests on the verb introducing/ preceding the RS: whether it is necessarily overt (Lillo-Martin 1995), and whether it necessarily involves an attitude predicate (cf. Quer 2005, Schlenker 2014a-b). What has not, to our knowledge, been discussed in the literature is whether the type of attitude actually matters. In this paper, we document a property of RS, which, to our knowledge, has received no attention in the literature previously – the extent of the spread non-manual markings associated with RS depending on the type of attitude predicate. We demonstrate that this seemingly minor detail adds significantly to the overall picture of clausal embedding, since its effect can be observed in indexical behavior and syntax of the complement. Finally, we discuss what it means for RS to extend throughout an embedding verb as lexicalized non-manual marking, and how this supports the view that in the cases discussed here, RS arises through verb-dependent information stored in the lexicon.

## 2. Methodology

The novel data come from two sources: the initial (pilot) data-set is a set of four one-hour videos from Pyers (2004) recording four Deaf signers completing false-belief tasks with attitude verbs, which served as a springboard for creating more extensive traditional elicitations. The second set contains elicited sentences in contrast (1-4 separate trials) of an original sentence with the 1st and non-1<sup>st</sup> person IX and transformation with extraction (internal and external arguments as well as adjuncts). The sentences were played back to the signer (during a different session) and to other signers and judged both for grammaticality and possible context. A total of nine informants (8 Deaf, 1 Hearing native signer) viewed and judged test items in their respective languages: 5 users of ASL, 1 French SL, 1 Spanish SL, and 2 Catalan SL. The data were transcribed by a trained Deaf ASL transcriber.

## 3. Data

### 3.1 Puzzle 1

The first, previously undocumented, puzzle of RS that we are concerned with in this paper is the extent of its spread. Note that in (3), RS begins after SAY (as in (3a)) but on IMAGINE (as in (3d)). Alternative options are either deemed totally ungrammatical, as in the case of role shift on SAY in (3b), or awkward and unnatural as in the case of role shift starting after IMAGINE in (3c).

- (3) a. MOM SAY <sup>RS-a</sup> IX-1 BUSY

- ‘Mom<sub>k</sub> says I<sub>k</sub> am busy’
- b. \*MOM SAY IX-1 BUSY  
‘Mom<sub>k</sub> says I<sub>k</sub> am busy’
- c. ??MOM IMAGINE IX-1 BUSY  
‘Mom<sub>k</sub> imagines I<sub>k</sub> am busy’
- d. MOM IMAGINE IX-1 BUSY  
‘Mom<sub>k</sub> imagines I<sub>k</sub> am busy’



Figure 1: MOM SAY IX-1 BUSY  
‘Mom<sub>k</sub> says I<sub>k</sub> am busy’



Figure 2: MOM IMAGINE IX-1 BUSY  
‘Mom<sub>k</sub> imagines I<sub>k</sub> am busy’

This same pattern has also been confirmed for LSF and, while not specifically discussed, has appeared in published material on LSC SAY vs. THINK (4).

- (4) a. IX<sub>a</sub> MADRID JOAN<sub>i</sub> THINK IX-1<sub>i</sub> STUDY FINISH HERE MADRID  
‘When he was in Madrid, Joan thought he would finish his studies there in Madrid.’
- b. ANNA<sub>i</sub> 3-SAY-2 IX-1<sub>i</sub> FED-UP LOSE+++  
‘Anna told you that she was fed up with losing so often.’ (Quer 2011)

That is, as (3)-(4) demonstrate, RS descriptively starts *on* IMAGINE and THINK but *after* SAY.

### 3.2 Puzzle 2

- (5) a. MOM SAY  $\overline{\text{IX-1 BUSY}}^{\text{RS-a}}$  = (3a)  
 ‘Mom<sub>k</sub> says I<sub>k/\*1</sub> am busy’  
 b. MOM  $\overline{\text{IMAGINE IX-1 BUSY}}^{\text{RS-a}}$  = (3d)  
 ‘Mom<sub>k</sub> imagines I<sub>k/1</sub> am busy’

In (5a), under role shift the first person indexical IX-1 (‘I’) can only refer to the subject, MOM (‘mom’); in contrast, IX-1 in (5b) can refer to either MOM (when it is evaluated with respect to the context of the speech report – a shifted context) *or* the narrator (when it is evaluated with respect to the context of the utterance). The null embedder in (6), quite common in ASL, patterns with SAY.

- (6) MOM  $\overline{\text{(IX-1) BUSY}}^{\text{RS-a}}$   
 ‘Mom<sub>k</sub> is like I<sub>k/1</sub> am busy’

The aforementioned behavior of IX-1 under IMAGINE is replicated in (7) for the LSC THIS under THINK.

- (7) LAST YEAR  $\overline{\text{JOAN}_i \text{ IX-3 } \overline{\text{THINK IX-1}_i \text{ STUDY FINISH YEAR THIS\#}}^{\text{RS-i}}}$   
 ‘Last year Joan thought that he would finish his studies {this year/then-that year}’  
 [LSC] (Quer 2011)

In their possible interpretations, then, ASL IX-1 and LSC THIS# resemble the Zazaki *εz* and *t̥i* in (7), discussed at length in Anand & Nevins (2004).

- (8) Heseni<sub>i</sub> (m̥i<sub>k</sub>-ra) va kε εz<sub>i/k</sub> dεzletia [Zazaki]  
 Hesen.OBL (I.OBL -to) said that I rich.be-PRES  
 Hesen said that {I am, Hesen is} rich.’ (Anand and Nevins 2004)

To briefly summarize then: we observe two types of differences between the predicates in ASL (and potentially also LSC): IMAGINE and SAY differ with respect to a) the extent of RS, and b) interpretation of the indexical under it. The question is what is behind this asymmetry?

#### 4. Analysis

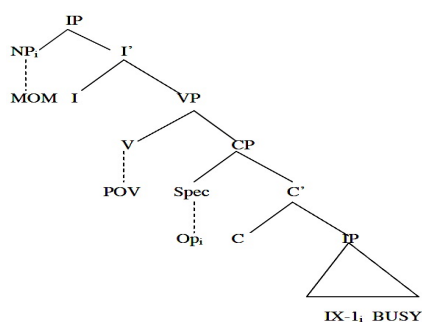
In principle, there are at least three possible solutions to the question above. First, it is possible that what is behind the asymmetry in (5) is due to a property of the RS itself: perhaps, as in accounts by Quer (2005, i.a.), Zucchi (2004), Schlenker (2014), and Davidson (2015), there is something in the syntax or semantics of RS that forces (or blocks) different interpretations of indexicals for exactly the same reason as forcing (or blocking) the presence of the relevant non-manuals on the predicate. An alternative explanation may be found in the syntax of the utterance: perhaps the asymmetry in (5)

results from different types or sizes of complements (cf. Lillo-Martin 1995, et seq., Moulton 2009, Kratzer 2006, Saito 2012, i.a.). Finally, the culprit may be the embedding predicate itself, as in Hintikka (1962), Anand & Hacquard (2009, et seq.), i.a. In what follows, we explore each of these possibilities in turn, beginning with syntax, and demonstrate that a focused inquiry into the nature of the embedding predicate yields the best result.

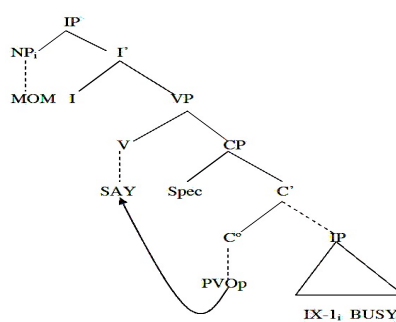
#### 4.1. Role shift

In terms of syntax, to our knowledge, two accounts of RS exist, illustrated in (9) below.

(9) a. Lillo-Martin (1995)<sup>4</sup>



b. Quer (2011) (adpt. Quer 2005)



The first one is Lillo-Martin (1995), the original focus of which is the interpretation of the 1st person indexical (<sub>I</sub>PRONOUN in her terms but IX-1 here) and the null embedding predicate (as in (6)) loosely translated into English as the quotative ‘*be like*.’ Lillo-Martin dubs the latter the Point Of View (POV) predicate and argues for the logophoric status of the former. She follows the analyses of apparently similar phenomena in West African languages like Ewe and Gokana: on that view, POV is either a special complementizer (like Ewe’s ‘*be*’) or an attitude verb that takes as its complement a CP hosting an operator *Op* which forces the co-indexation between the indexical below and the subject of the POV. The CP is thus (role-)shifted into the ‘point of view’ of the relevant individual. POV can be substituted with any other attitude (such as SAY and IMAGINE) without any changes to the syntax and the binding configuration. In this, Lillo-Martin argues, ASL joins the category of languages allowing the 1st person indexical to be interpreted as shifted (see (8)). Let us explore the implications of this account for the data in (5): if POV is a phonologically null verb introducing the role-shifted CP, presumably other types of embedding attitudes will do the same. This means that the non-manuals associated with RS are unexpected on the verb IMAGINE. Additionally, since the embedded indexical is bound by *Op*, a non-shifted

<sup>4</sup> Following Padden (1986), Lillo-Martin (1995), refers to the phenomenon *reference*, rather than *role*, shift, focusing on the semantic effects. Here, we employ the descriptive label deliberately, since, as we have shown, the reference does not actually always shift.

Quer (2005) – the alternative account developed for LSC – views the POV differently. For him, it is a context-shifting operator (Schlenker 2003) overtly realized as RS. Crucially, the POV operator (POVOp, hosted by the  $C^0$ ) always composes with the embedder attitude, so RS markings would be predicted over the embedding predicate. Let us see how this account fares in light of the data in (5). As SAY does in (9b), POVOp – the context-shifting operator – combines with IMAGINE in (5b) (details aside). This means that the indexical must obligatorily shift, which, we know from (5b) does not necessarily occur. Thus, this mechanism appears too coarse. Additionally, the fact that the RS markings do not spread over the embedder in (5a) is now unaccounted for: in (9b), the difference between SAY and IMAGINE with respect to non-manuals over the attitude predicate is not predicted. So we see that no syntactic analysis thus far offers the flexibility required to account for different patterns of both pronominal binding and role shift extent across verbs. Thus, we turn to semantics.

Semantic approaches to RS available to date (Zucchi 2004, Quer 2005, Herrmann and Steinbach 2012, Schlenker 2014) vary in details but have two characteristics in common: RS applies to a full semantic proposition/syntactic clausal IP and changes the context of evaluation of material it scopes above, as in (10) below (from Schlenker 2014).

$$(10) \quad [[RS_i \text{ IP}]]^{c,s,\text{non-manual}} = \lambda x'. \lambda w'. [[IP]]^{<x',w'>,s,w'}$$

This view has two problems in accounting for the pattern of sign language role shift seen above: the issue of the extent of RS over IMAGINE remains unexplained, since the main verb should scope over RS, as does the difference in the interpretation of indexicals: why must indexicals shift under SAY but not IMAGINE?

Davidson (2015) provides a semantic account that follows Lillo-Martin's (1995) intuition that RS signals something like that of English 'be like.' More specifically, she argues that RS is an adverbial modifier, similar to the English 'like this,' that can simply be pronounced simultaneously with the embedding predicate. The account thus predicts RS on the embedding predicate as in (10): the role-shifted material *demonstrates* how the action that is signaled by the verb in the embedded clause was performed by the main

<sup>5</sup> We have ignored here a technical detail of Lillo-Martin's analysis: POV is not (necessarily) the main clause verb but, rather, a part of the first embedded clause containing a null subject (p. 163). This explains why it can co-occur with an overt verb in the matrix clause but does not affect our proposal in any significant manner. To illustrate: keeping faithful to the analysis, we would say that irrespective of the type of the main clause predicate, non-manual markings associated with POV (as the verb of the first embedded clause) will always begin *after* the matrix verb. Nor does this detail in Lillo-Martin's proposal affect predictions regarding the shift in reference: since, on that account, the null subject of the POV is coreferential with the matrix subject, reference to any other individual is unexpected.



subject, from the subject's perspective. On this view then, cases where RS begins after the embedder must be something else – e.g. a traditional quotation as in (1a). However, this path to the analysis of (1a) is also problematic: not all cases with RS starting after the embedded clause can be dismissed as instances of quotation, since through standardly assumed diagnostics some appear to show properties of being indirect discourse. Secondly, this account does not capture the various interpretational possibilities of the embedded indexical with IMAGINE – namely, while Davidson (2015) predicts the embedded IX-1 to refer to the agent of imagining, the source of reference to the speaker remains unaccounted for.

Note that all of the analyses outlined above, despite their differences, face the same problem with respect to the data in (5): they treat (5a) and (5b) on a par. This is the consequence of a hypothesis that RS itself will account for the asymmetry between the IMAGINE and SAY cases – something RS cannot do simply because it occurs in both.

## 4.2. Complement clause

In this section we explore the possibility that the difference between (5a) and (5b) is syntactic in that it reveals a complement of a different size/type.

### 4.2.1. Indirect discourse

Before we spend any time considering the size/type of the clausal complement – and whether the asymmetry in (5) is derivable from it – let us first clarify our reasons for thinking that in cases like (5) we are dealing with fully integrated clausal complements in the first place, and not quotation. Consider an account that treats either the SAY or IMAGINE case as a quotation. First, we might predict that quotation differs from true embedding in that for cases of true clausal embedding, RS necessarily spreads over the embedder because it composes with the predicate, while in the case of quotation/direct speech, it does not because it is part of the quote. This account would be consistent with Quer (2005), where the POVOp composes with the attitude predicate itself, or with Schlenker's (2003) account of the context shifting operator doing the same. For Davidson (2015), this would be expected if the role shift over the predicate were acting as a modifier of the verb. Perhaps this might even be the reason that some cases of what appears to be clausal embedding involve role shift on the verb that embeds declarative (Petronio and Lillo-Martin 2007) and even interrogative clauses (Davidson and Caponigro, to appear), of which we have more to say below.

Another result of a view that the complement of SAY or IMAGINE could be a quotation is the interpretation of the 1st person indexical. Consider (11), where the utterance beginning with '*John says*' is attributed to Bill.

- (11) a. Bill<sub>c</sub>: John<sub>a</sub> says, "I<sub>a,\*b,\*c</sub> am busy." ≈ (1a)  
       b. Bill<sub>c</sub>: John<sub>a</sub> says he<sub>a,b,\*c</sub> is busy." ≈ (1b)

In writing, quotations clearly mark direct discourse and, thus, suggest the interpretation of the indexical in (11a), dismissing potential alternatives. However, in spoken language without quotation scope being marked, the interpretation of the indexical is ambiguous: it can refer either to John<sub>a</sub> or to Bill<sub>c</sub>, depending on when the quotation begins. This option disappears with the 3rd person pronoun in (11b): while it can refer to John<sub>a</sub> or to some other individual in discourse (subscripted *b* here), but reference to the narrator (Bill<sub>c</sub>) is impossible. Let us set the reason for the ambiguity aside for a moment and focus on the observation: only when interlocutors hear an utterance containing quotation might they interpret the 1st indexical as picking out the narrator.

The two consequences outlined above result in the following prediction: if one of the predicates in (5) is actually followed by a quotation, we may expect that it is the predicate over which RS does not spread and which allows the indexical in its scope to have more than one interpretation, perhaps if the quotation starts after the indexical. This, however, is the wrong result: between the two predicates under examination (SAY and IMAGINE), the one over which role shift does not spread is SAY but the predicate that allows multiple interpretations is IMAGINE. Further, as we have discussed elsewhere (Koulidobrova & Davidson, under review), both pass other diagnostics for clausal embedding, namely long-distance extraction, as seen in (12).

- (12) a. RS-a  
 WHO WOMAN SAY YESTERDAY ~~WHO~~ BUSY WHO  
 ‘Who did the woman say yesterday was busy?’

- b. RS-a  
 WHO WOMAN THINK YESTERDAY ~~WHO~~ BUSY WHO  
 ‘Who did the woman think yesterday was busy?’

Thus, we set this possibility aside and return to the puzzle under the assumption that the complement of SAY and IMAGINE in (5) is clausal – i.e. (5a) and (5b) are best described as cases of clausal embedding. This leaves us with two routes for exploration: either the culprit is the complement or the embedding predicate itself. We turn to former possibility next.

#### 4.2.2. Does the size matter?

Overt complementizers are known to be able to reveal the amount of structure in the embedded clause. For instance, Japanese complementizers *no*, *ka*, and *to* head CPs of different sizes (Saito 2010). Bošković (1997) argues that the size of the clausal complement can be detected based on the obligatory presence or absence of the complementizer in topicalized structures (as in (13)): e.g., because ‘*that*’ in cases like (13b) is unavoidable, embedded topicalization always involves a CP.

- (13) a. John, Mary likes  
 b. Peter does not believe *that* John, Mary likes  
 c. \*Peter does not believe John, Mary likes

- (14) a.  $\overline{\text{JOHN}}^t$  MARY LIKE  
           ‘John, Mary likes’  
       b. SEEM YESTERDAY           MARY BACK TOMORROW  
           ‘It seemed yesterday that Mary would be back tomorrow’

Nevertheless, with a modification, the diagnostic remains helpful. Despite the lack of phonological form, there is more subtle evidence of the presence of the additional layer: a subset of verbs, such as FEEL in (15a), allows embedded topicalization while another subset does not (see (15b)), suggesting, according to Bošković (1997), that some verbs (e.g. FEEL) require a CP complement and others (e.g. THINK) a TP.

- (15) a. BILL FEEL [<sub>CP</sub> [<sub>TP</sub> <sup>t</sup>JOHN [<sub>TP</sub> MARY LIKE]]] ≈ (13b)  
 ‘Bill feels that John, Mary likes’  
 b. \*BILL THINK [<sub>TP</sub> [<sub>TP</sub> <sup>t</sup>JOHN MARY LIKE]] ≈ (13c)  
 ‘Bill thinks that John, Mary likes’. (Bošković 1997)

Turning to SAY and IMAGINE, we find that they replicate the asymmetry in (15).

- (16) a. BILL SAY [<sub>CP</sub> [<sub>TP</sub> JOHN MARY LIKE]]  
           ‘Bill imagines that John, Mary likes’  
       b. \*BILL IMAGINE [<sub>TP</sub> [<sub>TP</sub> JOHN MARY LIKE]]  
           ‘Bill thinks that John, Mary likes’.

On Bošković’s diagnostic then, (16) serves as evidence that IMAGINE takes a TP complement. Armed with hope then, and considering the observation regarding IMAGINE in (5), we expect a generalization in (17) to hold.

- (17) RS markings extend over the embedding predicate with a TP complement.

However, as will shortly become evident, (17) does not hold.

In their examination of embedders, Davidson & Caponigro (2015) establish three classes of ASL verbs:

- (18) a. Declarative clause embedders: THINK, REALIZE, SURPRISE, AGREE  
 b. Propositional (extensional) embedders: KNOW, GUESS, REMEMBER, FORGET, FIND-OUT, TELL  
 c. wh-/polar interrogative (intensional) embedders: ASK, WONDER, CURIOUS,

(19) a. MOTHER CURIOUS IF JOHN, MARY LIKE  
'Mother is curious whether John, Mary likes.'  
b. MOTHER a-IX WONDER IF a-IX BUSY<sup>RS</sup>  
'Mother is wondering whether she is busy.'

### 4.3 What's with the attitude?

(20) a. {<sup>OK</sup>The book/<sup>OK</sup>Mary} {said/claimed} that he was happy  
 b. {\*The book/<sup>OK</sup>Mary} {thought/imagined} that he was happy.

(21) a. Holmes {#believed/assumed} that every guest might be the murderer.  
 Intended: Holmes believed each had the possibility to be the murderer.  
 b. John {believes/\*assumes} that the Earth might be flat.

(Anand & Hacquard 2009)

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Table 1. Interaction of ‘*believe*’ and ‘*assume*’ with epistemics (from Anand & Hacquard 2009)

<i>Believe</i>	<i>Assume</i>
Require sentient subjects (as in (19b)).	Do not require sentient subjects (as in (19a)).
License subjective epistemic modals (as in (20b)).	License objective epistemic modals (as in (20a)).
Propose adding the matrix clause to the common ground (are “about” the main clause subject)	Propose adding their complement to the common ground (i.e. proffer their content)

Anand & Hacquard argue that the paradigm in (20)-(21) reflects a subjectivity requirement that certain predicates impose on their complements, captured in the semantics by having *beliefs* be evaluated with respect to an event involving doxastic alternatives held by the subject, the attitude holder. The class of verbs that exhibit this type of behavior includes *believe*, *think*, *wonder*, and *imagine*, among others. In contrast, *claims* (and *assumptions*) are evaluated with respect to alternatives that are active in the common ground after the claim is accepted by all (i.e. not specific to the subject). The verbs that behave this way are *claim*, *assume*, and *mean*, among others. Note that the issue under discussion in Anand & Hacquard (2009) is not embedding per se; rather, it is the characteristics of different types of attitudes stemming from semantics and resulting in various effects on the discourse. In the following sections we will apply these distinctions to the ASL embedding data, taking a first look at semantics, then pragmatics.

#### 4.3.1 Semantic subjectivity requirement

Anand & Hacquard (2009) argue that the different behaviors of *believe*- and *assume*-verbs in Table 1 arise from the difference in what each class of verbs reports on: doxastics (e.g. *believe*) report mental states while profferings (e.g. *claim*, *assume*) report discourse moves – i.e. the attempt to update the common ground. Anand & Hacquard assume the view of modal semantics in Hacquard (2006): modals are relative to an event of evaluation, and the epistemic accessibility relation is licensed by an event with propositional content. Attitudes can be modeled as predicates of events, and these events, in turn, have a set of propositions associated with them –  $\text{CONTENT}(e)$ , or  $\text{CON}(e)$  as below, picks out such a set, which for *believe* contains doxastic propositions (22). Therein lies the interaction with epistemics.

- (22) a.  $f_{\text{epistemic}}(e) = \lambda w'.w'$  is compatible with  $\text{CON}(e)$   
b.  $[[\text{believe}]] = \lambda e.\lambda p.\lambda x.\lambda \text{non-manual.Holder}(x,e) \ \& \ \text{belief}'$

In other words, the content of believing is dependent on the attitude holder. Not so with proffering verbs: their attitude holders serve as discourse participants. Anand & Hacquard argue that since proffering verbs report attempts to make their complements non-controversial, they induce objective stance: the complement of the proffer must be evaluated with respect to the proposed common ground (below,  $\text{Goal}(e)$  is a predicate which returns a conversational goal of event  $e$ , and  $e_{CG-\text{non-manual}}$  is a common ground state which results from the acceptance of a proposition by all of the participants) (23).

$$(23) [[\text{claim } e \text{ } p]] = \text{claim}'(e) \& \forall \text{non-manual compatible with Goal}(e) \\ [\forall w' \in \cap \text{CON}(e_{CG-w'})[p(w')=1]] \quad (\text{Anand \& Hacquard 2009 [32]})$$

Let us now apply (22)-(23) to the ASL cases in (5). For IMAGINE (as in (24a) and like BELIEVE, etc.), the content of the attitude predicate contains a set of propositions for which there is a variety of doxastic relationships that hold for one who is said to have the attitude (here, the mother). For SAY (as in (24b) and like CLAIM, etc.), the content of the attitude predicate is based on a projection of the common ground that would result from adding the embedded proposition (*that mom is busy*) to the common ground.

- (24) a.  $[[\text{MOM IMAGINE IX\_a BUSY}]=1 \text{ iff Holder}(\text{mom},e) \& \text{imagine}'(e,\text{non-manual}) \& \forall w' \in \cap \text{CON}(e)[\text{Busy}(\text{mom})(w')]]$ ,  
 where  $\cap \text{CON}(e) = \text{DOX}(\iota x \text{ Holder}(x,e), \text{World}(e))$   
 b.  $[[\text{MOM SAY IX\_a BUSY}]=1 \text{ iff Holder}(\text{mom},e) \& \text{say}(e,\text{non-manual}) \& \forall w' \in \text{Goal}(e) [\forall w'' \in \cap \text{CON}(e_{CG-w'})[\text{Busy}(m))(w'')]]]$ ,  
 where  $e_{CG}$  = proposed common ground state resulting from accepting  $\text{Busy}(m)$  to CG

We now have the tools to differentiate the two classes of verbs. Although we will have to leave it to future work, we note that this discussion suggests that the ASL predicates are expected to interact with epistemics; testing this prediction is currently under way.<sup>6</sup>

#### 4.3.2. Pragmatics

In terms of discourse structure, Anand and Hacquard suggest that utterances involving doxastic vs. proffering embedding verbs appear to have different pragmatic foci (answer different Questions Under Discussion (QUD), Roberts 1996): with doxastics, what is up for discussion is the truth of the main clause, while with proffering verbs, what is up for discussion is the truth of their complement. Here is the intuition then: if what is up for discussion is the content of the main clause, then we might expect the accompanying RS

<sup>6</sup> Preliminary data suggest that we are on the right track here:

- (i) YESTERDAY MARY THINK/??ASSUME EARTH MAYBE FLAT  
 ‘Yesterday Mary thought/??assumed that the Earth might be flat’

to spread into the main clause as well, to extend *over* the embedding predicate (as in (25a)). If, on the other hand, what is up for discussion is the content of the complement only, this too is marked by RS – starting *after* the attitude predicate (as in (25b)).

- (25) a. MOM SAY <sup>RS-a</sup> BUSY  
 ‘Mom said [mom] busy’  
 → Pragmatic focus = that mom is busy
- b. MOM THINK <sup>RS-a</sup> BUSY  
 ‘Mom thinks [mom] busy’  
 → Pragmatic focus = that mom thinks she is busy

Our reasoning for this hypothesis involves the system of reference tracking in ASL and other sign languages (cf. Schlenker 2011). In particular, in ASL an individual introduced into discourse receives a (typically arbitrary) locus assignment – a dedicated area of signing space used for reference to the individual in question, as in (26) below. This assignment can be accomplished through either the indexical point ‘IX’ (see section 2) or by simply signing the name of the individual in that space.

- (26) ‘Marie<sub>i</sub> teaches ASL. She<sub>i</sub> is skilled.’
- a. MARIE a-IX TEACH ASL. a-IX SKILLED.
- b. a-MARIE TEACH ASL. a-IX SKILLED.

How this assignment is established in the first place remains a matter of some debate in the literature orthogonal to the issues discussed here. What is relevant, however, is the following: assignment of spatial loci (and its later use in anaphoric relations) is not restricted to individuals; propositions too may be assigned loci as well.

In general, the assignment of propositions to loci works in the same way as the assignment of discourse referents to loci, which can be done either with an overt IX or with non-manuals. Non-manually, body shift serves this purpose, for example, with a rightward shift assigning the proposition to the rightward area of signing space, labeled *a* in (27) vs. leftward area labeled in (27) as *b*. Importantly, there is no real ‘role’ here to shift into – the shift in (27b) cannot be immediately captured in terms of (9).

- (27) a. a-GET #a-JOB DISJ/shift b-GO b-GRADUATE-SCHOOL. a-IX I CAN b-IX IMPOSSIBLE  
 ‘Get a job or go to graduate school? The former I can do, but the latter is impossible.’
- b. <sup>-a</sup> MOM BUSY. <sup>-b</sup> DAD SLEEP  
 ‘Mom is busy {and/or} Dad is sleeping’

We suggest then that one reason the role shift extends over the doxastic matrix predicate is that in doxastic contexts, what is up for discussion is the entire proposition (in particular, the truth of the matrix clause); as such, the *whole clause* is likely to be the target for later anaphora and, thus, is assigned a locus. In turn, in proffering contexts, it is the *complement* that is the most likely target of later anaphora, and therefore, a locus is assigned to the complement only. For example, consider a context in which the question under discussion is *Is Mom busy?* One might very well address this QUD by using a proffering verb with the answer *Mom is busy* as its complement, as in (25a). In ASL, if this answer BUSY ‘Mom is busy’ is assigned to a spatial locus, then it can be further discussed, if necessary, through simple pronominal reference by pointing back to that location using the indexical point IX. If, on the other hand, the question under discussion is *Does Mom think she is busy?*, then one might address this QUD through the doxastic example in (25b) – the ASL statement MOM THINK BUSY. Since the mother’s attitude, and not the clausal complement, is what is of concern, interlocutors would most naturally want to assign the whole matrix clause to a spatial locus, not just its complement. While we think this may be on the right track, we acknowledge that there is an element of flexibility predicted by this line of reasoning: in particular, when the context changes, differences in non-manual markings than the ones in (5) may be available. We tentatively suggest that this question could be addressed in an experimental setting by varying contexts in which these two verb types appear (some which later refer to the whole proposition, and some which later refer only to the complement) and investigating whether role shift changes accordingly. We leave this for future research.

It seems then that this path of analysis may capture the difference in (5) – i.e. the solution to the puzzle in section 3.1 concerning the extent of role shift. However, can the aforementioned solution derive the reference options in (5) (the puzzle in section 3.2)? Consider that in both (5a) and (5b), the pronominal in the scope of an attitude predicate is interpreted as the attitude holder – the mother. Further, we now have two propositions, each of which corresponds to some QUD and can serve as an anaphoric expression, interpreted, as expected, relative to the attitude holder. For the proposition ‘IX-1 BUSY’ in (5a), the holder of the attitude (of saying) is MOM; for ‘MOM IMAGINE IX-1 BUSY’ in (5b), the holder of the attitude (of saying) is the signer herself. At any rate, the indexical is interpreted relative to the author/narrator. While this path requires careful examination, at least in broad strokes, it offers the solution to the puzzle in 3.2, concurrently providing independent support, if not the details of analysis, to the claim in Anand & Nevins (2004) that various (types of) predicates dictate shifting possibilities of indexicals. We leave the details for future research.

#### 4.4 Lexical role shift

Although the discussion in this paper has been focused on embedding, the main argument here (following that in Anand & Hacquard 2009) is that the difference between (5a) and (5b) is best captured not with the analysis of embedding but, rather, with careful examination of the embedding predicates – i.e. the lexical semantics of certain verbs and the resulting pragmatics. In fact, this is not the first mention of lexical properties of certain embedding verbs in the literature. One such example was discussed in Petronio &



- (28) a. <sup>wh</sup>WHO BUY COMPUTER  
 ‘Who bought a computer?’
- b. <sup>wh</sup>\*WHO BUY COMPUTER  
 ‘Who bought a computer?’ (Petronio & Lillo-Martin 1997 [74])
- (29) a. <sup>ponder</sup>ANN WONDER <sup>wh</sup>WHO LIKE PHILIP  
 ‘Ann wonders, “Who likes Philip?”’  
 ‘Ann wonders, (so would you tell me) who likes Philip?’
- b. <sup>head nod/ponder</sup>ANN WONDER WHO LIKE PHILIP.  
 ‘Ann wonders who likes Philip.’
- c. <sup>head nod</sup>ANN CURIOUS WHO YOU LIKE.  
 ‘Ann is curious who you like.’ (Petronio & Lillo-Martin 1997 [79])

In (28a), a matrix wh-question receives ‘brow furrowing’ non-manual marking, typically associated with wh-questions in ASL, across the entire utterance. However, if the question is preceded by an attitude predicate, there are two options: *ponder* non-manual marking just on WONDER plus *wh* non-manual marking over the remainder (as if it is a quoted matrix question), and *ponder* non-manual marking over the whole clause, including WONDER, as in the case of indirect discourse/clausal embedding. In the current context, an important property of this kind of reported non-manual marking in embedded clauses in ASL is that it varies from predicate to predicate. For example, the non-manual marking in (29b) is different from (29c), and these in turn are different from the non-manual marking seen with other clausal embedding verbs like KNOW, DON’T KNOW, etc. Caponigro and Davidson (2011) even suggest that the non-manual marking in Question-Answer Clauses / rhetorical questions might be the influence of the embedding predicate (the copula BE) on the embedded question. In any case, there has been a history of discussion regarding embedded clauses in ASL, and they are notable for having a non-manual marking that varies according to the individual predicate.

We suspect that some, if not all, cases of what we have been calling role shift throughout this paper are part of the same family as the non-manual marks on these verbs, especially in the cases where it extends over the matrix verb (as in doxastics). One reason we find this worth considering as a unified phenomenon is that, if it is the case that role shift on doxastics is the same as role shift in other cases of embedded discussed in previous literature, this lends further support for our argument to put the difference in the lexical entry for these verbs. In other words, this non-manual marking is not an overt existence of a separate role shift “operator”, but rather something that comes with each verb as part of its phonology. As the type of the non-manual is entirely verb specific, we take this to necessarily stem from the lexicon, not a similar operator in each case. We do not sacrifice explanatory power by resorting to the lexicon in this case, but instead use it as a source of

## 5. Conclusions

In this paper we have discussed two types of embedding predicates as suggested by Anand and Hacquard (2009): *doxastics* and *profferings*. We show evidence for this same distinction in ASL through two different means: (i) the flexible interpretation of the usually indexical first person singular subject pronoun in doxastics verbs but not proffering verbs and (ii) the spreading of non-manual marking associated with role shift over the matrix predicate in the case of doxastic verbs but not proffering verbs. We presented a series of arguments supporting the hypothesis that this behavior is due to the semantics of the verbs and not the syntax of the clauses or the relationship between the indexical expression and the verb. Finally, we discussed some of the possible reasons that these patterns may arise given the lexical semantics of the verbs, especially from the pragmatic and semantic perspective.

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# Biscuits and provisos: Providing unconditional information by conditional means<sup>1</sup>

Sven Lauer — University of Konstanz

**Abstract.** Independence-based accounts of biscuit conditionals and the proviso problem are attractive due to their parsimony. This paper spells out the semantic and pragmatic background assumptions underlying such accounts, and raises the issue whether they can be adopted for both phenomena jointly. At first blush, the answer is clearly negative, but there is hope for reconciliation, once an independent Gricean factor is taken into account.

**Keywords:** biscuit conditionals, proviso problem, presupposition, independence

## 1. Introduction

The main aim of this paper is integrative. It considers two (near-)identical accounts of two similar phenomena that are very attractive in isolation, and asks whether the two accounts are compatible with each other. At first blush, the answer appears to be clearly negative, but we will see that there is hope for a uniform analysis that maintains the simplicity and elegance of the original accounts, once we pay attention to an additional Gricean factor. The two phenomena involve cases where an expression that otherwise has a conditional implication  $A > p$ , intuitively conveys something stronger, *viz.*,  $p$ .

The first phenomenon is the familiar case of ‘biscuit’ conditionals. (1) is an updated version of Austin’s (1962) classic example. Even though conditional in form, an utterance of the sentence will usually convey that there is pizza in the fridge, regardless of whether the addressee is hungry.

(1) If you are hungry, there is pizza in the fridge.

The second phenomenon is what Geurts (1996) has dubbed the ‘proviso problem’ for certain accounts of presupposition projection. The relevant intuitions are intuitions about *presupposition accommodation*: In a context in which nothing about John’s wetsuit-having is known, (2) will convey that the speaker believes that if John is a scuba diver, he has a wetsuit. Taken at face value, this suggests that a conditional  $A > C$  where  $C$  presupposes  $p$  (written  $A > C_p$ ) as a whole presupposes  $A > p$ . This is what satisfaction theories of presupposition projection (along with some others) predict.

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- (2) If John is a scuba diver, he'll bring his wetsuit on vacation.

But, occasionally (indeed, frequently), when  $A > C_p$  requires accommodation, what is intuitively accommodated is  $p$ . Upon hearing (3), we readily infer that (the speaker believes that) John has a wetsuit, regardless of whether he wants to impress his girlfriend. Geurts calls this phenomenon a problem, as it is not clear how the proponent of a satisfaction theory can explain how this unconditional accommodation comes about.<sup>2</sup>

- (3) If John wants to impress his girlfriend, he will bring his wetsuit on vacation.

Not only do the two phenomena seem very similar, essentially the same account has been proposed for both: The appearance of an unconditional implication has been attributed to a contextual assumption of *independence* between antecedent and consequent, by Merin (2007) and Franke (2007, 2009) for biscuit conditionals and by Merin (2003) and van Rooij (2007) for the proviso problem. These accounts are very attractive, due to their extreme parsimony: Conditionals are taken to uniformly have the same (conditional) asserted content and uniformly project the same (conditional) presuppositions. It is only in virtue of a contingent contextual assumption that the conditional implications sometimes get perceived as unconditional ones. On independence-based accounts, biscuit conditionals and unconditional accommodations are simply cases in which a speaker happens to use a conditional implication to convey unconditional information.

I take it to be rather uncontroversial that these accounts are attractive enough individually that, if they can be made to work, they are preferable to alternatives. That is not to say, of course, that it is uncontroversial that the accounts can be made to work. Among the opponents of independence-based accounts we find, *e.g.*, Scheffler (2013); Ebert et al. (2014), for biscuit conditionals and Singh (2007, 2009); Schlenker (2011) for the proviso problem. But we find equally-recent proponents of (variants of) of such accounts in Sano and Hara (2014); Francez (2015); Csipak (2015) for biscuit conditionals and Lassiter (2012) for the proviso problem. So it is fair to say that the debate whether independence-based accounts are successful has not been settled either way.

This makes the question whether independence-based accounts of the two phenomena are compatible with each other quite pressing. If they are compatible, we likely can shed light on the respective phenomena by considering them jointly. If they are incompatible, as they appear to be at first blush, then the success of an independence-based analysis for one of the two phenomena will count against such an account for the other.

<sup>2</sup>Geurt's problem is not confined to conditionals, but also surfaces with conjunctions that are embedded under operators that cancel entailments but not presuppositions of their prejacent (*e.g.*, negation). To keep the discussion focused, I will confine attention to conditional sentences.

## 2. Conditional independence

Independence-based accounts build on the following intuition: The unconditional entailments and unconditional accommodations surface in particular if the truth of the consequent is felt to be ‘independent’, in the given context, of the truth of the antecedent—whether or not there is pizza in the fridge intuitively does not depend on whether the addressee is hungry. Likewise, whether Bill has a wetsuit intuitively does not depend on whether Bill wants to impress his girlfriend.

Franke and van Rooij, on whose proposals I will focus here, give this idea an epistemic characterization:<sup>3</sup> Two propositions are called *conditionally independent* for an agent iff “learning one proposition to be true or false (where this was not decided before) is not enough evidence to decide whether the other proposition is true or false (where this was not decided before)” (Franke 2009, p. 266). The requisite notion is cashed out formally by fixing a propositional language  $\mathcal{L}$  with connectives  $\wedge, \vee, \neg$  and  $\supset$ , proposition letters  $P = \{p, q, r, \dots\}$ , enriched with a modality  $\Diamond$  that combines only with propositional formulas. The propositional subpart of the language gets a classical semantics relative to a valuation determined by the world, and we write  $w \models S$  if propositional  $S$  is true at  $w$ . Then we define a notion of *support* for information states (4), and characterize conditional independence as in (5). The crucial observation about this notion is in (6).

- (4) For any belief state  $\sigma$  and any propositional formula  $S$ :
- a.  $\sigma \vdash S$  iff for all  $w \in \sigma : w \models S$
  - b.  $\sigma \vdash \Diamond\varphi$  iff there is  $w \in \sigma : w \models \varphi$ .
- (5) **Conditional Independence.** Propositional formulas  $A$  and  $C$  are *conditionally independent* in  $\sigma$  iff

$$\forall X \in \{A, \neg A\} : \forall Y \in \{C, \neg C\} : \text{If } \sigma \vdash \Diamond X \text{ and } \sigma \vdash \Diamond Y \text{ then } \sigma \vdash \Diamond(X \wedge Y)$$

- (6) **Observation** (Franke 2007; van Rooij 2007). Any  $\sigma$  that satisfies (i-iii) ...
- (i)  $A$  and  $C$  are conditionally independent in  $\sigma$ .
  - (ii)  $\sigma \vdash \Diamond A$
  - (iii)  $\sigma \vdash A \supset C$
- ... also satisfies (iv):
- (iv)  $\sigma \vdash C$

<sup>3</sup>All proponents of independence-based accounts ultimately cash out the notion in epistemic terms—but the underlying representational assumptions differ. Merin (2003, 2007); Lassiter (2012) use probabilistic frameworks—and hence probabilistic independence, while Franke and van Rooij use a non-probabilistic representation. With respect to the points made in here, I don’t think the choice makes a difference. A comparison of probabilistic and non-probabilistic independence accounts has to await another occasion.

(6) says that if a belief state  $\sigma$  is compatible with  $A$ , and  $A$  and  $C$  are conditionally independent in  $\sigma$ , then  $\sigma$  will support  $A \supset C$  only if the belief state also supports  $C$ . This, in a nutshell, is how conditional independence is used in Franke’s and van Rooij’s analyses to predict the ‘strengthening’ of conditional implications into unconditional ones: In a context in which the hearer believes that the speaker takes  $A$  and  $C$  to be conditionally independent, learning that the speaker’s belief state supports  $A \supset C$  amounts to learning that the belief state supports  $C$ . This way, by making an utterance that conveys that he believes that  $A \supset C$ , a speaker can convey that he believes  $C$ .

### 3. Modeling utterance interpretation

The short informal sketch of how a conditional implication can be used to provide unconditional information in the previous paragraph is suggestive, but in what follows, I want to be more explicit about the meta-reasoning about (speaker-)information states that it invokes, by spelling out a simplified version of the *dynamic pragmatics* of Lauer (2013). Doing so will be useful in showing more precisely how the accounts work, and what kind of pragmatic and semantic assumptions they make, and will allow us to precisely state the problematic prediction we derive when naïvely combining them.

Distinguish three languages: Firstly, there is an *object language*  $\mathcal{L}_o$ , which is the language spoken by the agents that we are modeling. Secondly, there is an *update language*  $\mathcal{L}_u$  that is used to specify what these agents learn when observing utterances. And finally, there is a *pragmatic language*  $\mathcal{L}_p$ , that we use to describe the pragmatic reasoning of these agents. All three languages are interpreted on (substructures of) the same class of models.<sup>4</sup>

(7) **Models.** A pragmatic model is tuple  $\langle W, V, \sigma, u \rangle$  such that:

- a.  $W$  is a set of possible worlds;
- b.  $V : W \mapsto (P \mapsto \{0, 1\})$  is a world-dependent valuation for some set of propositional letters  $P$ ;
- c.  $\sigma : W \mapsto \wp(W)$  is a function mapping each world  $w$  to the speaker’s belief state in  $w$ .<sup>5</sup>
- d.  $u : W \mapsto \wp(\mathcal{L}_o)$  is a function mapping each world  $w$  to the set of sentences uttered (by the speaker) in  $w$ .

<sup>4</sup>To ease readability, when supplying a world argument to a function, I will write it as subscript, while additional arguments are given in parentheses.

<sup>5</sup>Although, for the sake of perspicuity, I will refer to  $\sigma_w$  as the ‘speaker belief state’, I want to leave open how, exactly, this state should be understood—it could be viewed as the speaker’s belief state proper, or his view of what the common ground is or should become, or some related notion.



### 3.1. The object language $\mathcal{L}_o$

For concreteness and simplicity, I assume that the object language spoken by our agents is the language of classical propositional logic, enriched with a conditional operator  $>$  that receives a strict conditional interpretation on  $\sigma_w$ . I index  $>$  with  $\sigma$  to remind the reader that it is interpreted relative to the speaker belief state.

(8) **Interpretation of  $\mathcal{L}_o$ .** Given a model  $\langle W, \sigma, u \rangle$ :

- a.  $\llbracket p \rrbracket = \{w \in W \mid V_w(p) = 1\}$
- b.  $\llbracket A \wedge B \rrbracket = \llbracket A \rrbracket \cap \llbracket B \rrbracket$
- c.  $\llbracket \neg A \rrbracket = W \setminus \llbracket A \rrbracket$
- d.  $\llbracket A >_\sigma C \rrbracket = \{w \in W \mid \sigma_w \vdash A \supset C\}$

### 3.2. The update language $\mathcal{L}_u$

(9) **Update language.**  $\mathcal{L}_u := \mathcal{L}_o \cup \{\text{utter}(S) \mid S \in \mathcal{L}_o\}$

In a more extended system, we would want to give the utter-predicate a speaker argument (as well as a time argument), but for present purposes, we can assume that there is a single speaker, which we leave implicit.  $\text{utter}(S)$  then represents that this speaker utters  $S$ . Updates from  $\mathcal{L}_u$  add information to **hearer information states**  $I$ , which, like the speaker belief states  $\sigma_w$ , are conceived of as sets of worlds. However, while speaker belief states are fixed statically as part of the model, addressee information states are dynamic and get updated as new utterances are made.<sup>6</sup> An update with  $S \in \mathcal{L}_o$  removes all worlds from an information state at which  $S$  is not true; an update with  $\text{utter}(S)$  removes all worlds at which the speaker does not utter  $S$ .

(10) **Updates.** Given a model  $\langle W, V, \sigma, u \rangle$ , for all information states  $I$  and all  $S \in \mathcal{L}_o$ :

- a.  $I[S] = I \cap \llbracket S \rrbracket$
- b.  $I[\text{utter}(S)] = I \cap \{w \in W \mid S \in u_w\}$

<sup>6</sup>In full generality, of course, we want the speaker belief states to be just as dynamic as addressee belief states—but this is another complication I avoid here as it complicates the system significantly, and is not needed for present purposes. See Lauer (2013) for a more comprehensive system.

### 3.3. The pragmatic language $\mathcal{L}_p$

The pragmatic language  $\mathcal{L}_p$  is richer than both object and update language. Besides allowing us to talk about utterance events (via utter formulas), it allows us to talk about speaker beliefs via a modality  $\Diamond_\sigma$ . Its syntax and semantics are given in (11) and (12).

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|--|---|
| <p>(11) <b>Syntax of <math>\mathcal{L}_p</math>.</b><br/> <math>\mathcal{L}_p</math> is the smallest set st.:</p> <ul style="list-style-type: none"> <li>a. <math>\mathcal{L}_o \subseteq \mathcal{L}_p</math></li> <li>b. <math>\mathcal{L}_u \subseteq \mathcal{L}_p</math></li> <li>c. <math>\{\Diamond_\sigma S \mid S \in \mathcal{L}_o\} \subseteq \mathcal{L}_p</math></li> <li>d. <math>\mathcal{L}_p</math> is closed under <math>\wedge</math></li> <li>e. <math>\mathcal{L}_p</math> is closed under <math>\neg</math></li> </ul> | <p>(12) <b>Satisfaction for <math>\mathcal{L}_p</math>.</b> Given a model <math>\langle W, V, \sigma, u \rangle</math>, <math>w \in W</math>, <math>S \in \mathcal{L}_o</math>, <math>\phi, \psi \in \mathcal{L}_p</math>:</p> <ul style="list-style-type: none"> <li>a. <math>w \models S</math> iff <math>w \in \llbracket S \rrbracket</math></li> <li>b. <math>w \models \text{utter}(S)</math> iff <math>S \in u_w</math></li> <li>c. <math>w \models \Diamond_\sigma S</math> iff <math>\sigma_w \vdash \Diamond S</math></li> <li>d. <math>w \models \phi \wedge \psi</math> iff <math>w \models \phi</math> and <math>w \models \psi</math></li> <li>e. <math>w \models \neg \phi</math> iff <math>w \not\models \phi</math></li> </ul> |
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The remaining propositional connectives can be introduced via the usual equivalencies, and we treat  $\Box_\sigma$  as an abbreviation for  $\neg \Diamond_\sigma \neg$ . We lift the satisfaction relation to a support relation for (hearer) information states in the obvious way:

- (13) **Support for  $\mathcal{L}_p$ .** For any information state  $I$  and any  $\phi \in \mathcal{L}_p$ :

$$I \models \phi \text{ iff for all } w \in I : w \models \phi$$

### 3.4. Communicating contents

To illustrate the basic workings of the system, let us spell out how the contents of sentences are communicated in the present set-up—that is, how does it come about that a hearer who observes the utterance of sentence  $S$  (sometimes) comes to believe that  $S$  is true?

This would be immediately guaranteed if we represented the utterance of  $S \in \mathcal{L}_o$  by updating the hearer information state with  $S$  (recall that  $\mathcal{L}_o$  is a subset of  $\mathcal{L}_u$ ). For clearly, we have for any info state  $I : I[S] \models S$ . This is what is usually assumed in dynamic update semantics à la Veltman (1996) for non-modal sentences. But it is not what is assumed here. The updates performed on hearer information states should be construed as (heavily idealized) information gain by observation. That is, if  $S = \text{it is raining in Chicago}$ , then the update with  $S$  represents what happens when the hearer observes rain in Chicago, not what happens when he observes an utterance of  $S$ . The latter situation is represented as an update with  $\text{utter}(S)$ —and clearly, it is not guaranteed, for arbitrary  $I : I[\text{utter}(S)] \models S$ . Instead, what is guaranteed is only  $I[\text{utter}(S)] \models \text{utter}(S)$ .

But that is as it should be. Generally, hearers do not believe everything they are told. A hearer who

observes an utterance of a sentence  $S$  will come to believe that the truth-conditions of  $S$  obtain only if he thinks the speaker is trustworthy with respect to  $S$ —that is, sincere and well-informed, in the following sense.

- (14) a. **Belief in sincerity with respect to  $S$ :**  $I \models \text{utter}(S) \supset \Box_\sigma S$   
 b. **Belief in well-informedness about  $S$ :**  $I \models \Box_\sigma S \supset S$

If  $I$  satisfies (14a), then  $I[\text{utter}(S)] \models \Box_\sigma S$ . And if  $I$  further satisfies (14b), then  $I[\text{utter}(S)] \models S$ . So the system as defined so far captures the fact that an addressee will only come to believe in the content of the speaker's (declarative) utterances if he takes her to be trustworthy, *i.e.*, sincere and well-informed.

In the following, I will confine attention to information states that satisfy (14a) and (14b), for any object language sentence  $S$ . But it is useful to keep in mind that, even for plain asserted content the update procedure does not guarantee that the speaker comes to believe it. Instead, this is a sort of 'side-effect' that arises in suitable contexts. Of course, this side-effect will often be the main effect intended by the speaker in situations of cooperative information exchange—but this intended effect has to be achieved in an indirect way.

This is relevant because in what is to follow, conditional implications will be 'strengthened' in just this way—as side-effects under certain contextual assumptions. Just as, on the assumption of sincerity and well-informedness, learning that the speaker uttered  $S$  *amounts to* learning that  $S$  is true, so learning that the speaker uttered a sentence with a certain conditional implication will amount to learning that the speaker believes its consequent. This is the heart of independence-based accounts, and hence it would be somewhat misleading to describe them as deriving the unconditional implication from the conditional implication by means of a pragmatic strengthening mechanism.<sup>7</sup> This formulation would suggest that there is a separate mechanism operating on the basis of conventionally-supplied content. But, on the current construal, there is no more of an 'independent pragmatic mechanism' appealed to in independence-based accounts than there is an 'independent pragmatic mechanism' involved in explaining how hearers come to believe in the truth of the content of an utterance that they observe, if they happen to believe the speaker to be sincere and well-informed.

### 3.5. A word on dynamics

The reader will have noticed that all three languages are interpreted point-wise, *i.e.*, sentences of  $\mathcal{L}_o$  and  $\mathcal{L}_p$  determine truth values at worlds, and the updates made via  $\mathcal{L}_u$  are distributive and

<sup>7</sup>This is how Geurts (1996) describes a class of similar (potential) accounts that can be seen as precursors of the independence-based ones.

eliminative.<sup>8</sup> This means that, from a logical perspective, the *dynamics* of the system are not necessary. We could have simply given the static semantics of  $\mathcal{L}_p$  and be done with it. Instead of putting conditions on information states and then talking about what is supported if we update the information state with a particular formula, we could have equivalently spoken about entailment between sets of  $\mathcal{L}_p$  sentences.

From a certain perspective, then, the dynamic notation is just syntactic sugar that lets us talk about entailment in a particular way. But the separation into three languages, and the notions of update and support, are quite useful conceptually.

Firstly, the system makes a clear separation between the function of the different formulas. Formulas of the object language  $\mathcal{L}_o$ , and its interpretation  $\llbracket \cdot \rrbracket$  represent *grammatical facts*, formulas of the update language  $\mathcal{L}_u$  and the associated update procedure specify what new information an addressee receives in a discourse, while the pragmatic language  $\mathcal{L}_p$  and its notion of support, is used to talk about information states of interlocutors. These are three quite distinct kinds of things a theory of semantics and pragmatics should keep apart. And secondly, the system is a *restricted* way of talking about entailment, enforcing a particular shape for pragmatic explanations. We are limited to specifying premises that capture (‘pre-utterance’) conditions, and then add to them only utter-premises to derive desired (‘post-utterance’) effects. Unless and until the system is extended to *necessitate* a dynamic model, I grant that the update-talk is mere conceptual sugar, and not strictly necessary. But it is useful because it makes transparent what is assumed about utterance interpretation.

#### 4. Unconditional implications via conditional independence

To spell out how unconditional implications arise from conditional ones, we extend the pragmatic language  $\mathcal{L}_p$  with formulas saying that two sentences are conditionally independent for the speaker, as in (15). From observation (6) above, (16) immediately follows.

(15)  $w \models CI_\sigma(A, B)$  iff  $A$  and  $B$  are conditionally independent in  $\sigma_w$  in the sense of (5).

(16) **Observation.** For any  $I$ , if ...

(i)  $I \models CI_\sigma(A, C)$  and

(ii)  $I \models \Diamond_\sigma A$  and

(iii)  $I \models A >_\sigma C$

... then:

(iv)  $I \models \Box_\sigma C$

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<sup>8</sup>That is, for all  $I, \varphi \in \mathcal{L}_u : I[\varphi] = \bigcup_{w \in I} \{w\}[\varphi]$  and  $I[\varphi] \subseteq I$ .

#### 4.1. Biscuit interpretation via conditional independence

Franke's account of biscuit uses of conditionals is now almost immediate, if we assume that English **if ... , then ...** is modeled by  $>_{\sigma}$ , *i.e.*, has a strict conditional semantics.<sup>9</sup> All that we need in addition is that the addressee believes that the speaker would utter an (indicative) conditional only if he takes its antecedent to be possible:

$$(17) \quad \textbf{Indicative Sincerity. } I \models \text{utter}(A >_{\sigma} C) \supset \Diamond_{\sigma} A$$

I will simply retain this as a contextual assumption that the addressee makes. One way to motivate it is to assume that indicative conditionals come with a felicity condition, presupposition, or Potts (2005)-style conventional implicature requiring that the antecedent is compatible with  $\sigma$ , and that the speaker is sincere with respect to it. Another is to assume that *subjunctive* conditionals come with the opposite constraint, with (17) arising as an implicature via competition with the subjunctive. Leahy (2011) has recently argued that the former option is correct, but we don't need to decide this issue here.

(18) Let  $I$  be an information state that satisfies  $I \models CI_{\sigma}(A, C)$ , as well as **Indicative sincerity** (17) and **Sincerity about**  $A >_{\sigma} C$  (14a), then:

- (i)  $I[\text{utter}(A >_{\sigma} C)] \models CI_{\sigma}(A, C)$
- (ii)  $I[\text{utter}(A >_{\sigma} C)] \models \Diamond_{\sigma} A$
- (iii)  $I[\text{utter}(A >_{\sigma} C)] \models A >_{\sigma} C$

and hence, by (16):

- (iv)  $I[\text{utter}(A >_{\sigma} C)] \models \Box_{\sigma} C$

That is, on the assumption that the speaker takes  $A$  and  $C$  to be independent (and is sincere), the utterance of a conditional  $A >_{\sigma} C$  will convey that the speaker believes in the truth of  $C$ . As an example, consider (19a), which we can schematically represent as (19b).

- (19) a. If you are hungry, there is pizza in the fridge.
- b. **hungry**  $>_{\sigma}$  **pizza**

In this case, the independence assumption is eminently plausible—learning whether or not the addressee is hungry will usually not influence anyone's belief about whether there is pizza in the (speaker's) fridge. So we can assume  $I \models CI_{\sigma}(\textbf{hungry}, \textbf{pizza})$ . Together with the requisite

<sup>9</sup>Franke (2009) provides a version of the independence condition that obtains the same result for the more popular variably-strict analysis of conditionals.

sincerity assumptions, we derive (20a). If the speaker is furthermore taken to be well-informed about **pizza**, we get the even stronger (20b).

- (20) a.  $I[\text{utter}(\text{hungry} >_{\sigma} \text{pizza})] \models \Box_{\sigma} [\text{pizza}]$   
 b.  $I[\text{utter}(\text{hungry} >_{\sigma} \text{pizza})] \models \text{pizza}$

What goes ‘wrong’ on a hypothetical use of conditional like **If John left on time, he is at home now** is that the assumption of independence is not plausible, hence we have  $I \not\models CI_{\sigma}(\text{left on time, home now})$ . Consequently, making the requisite sincerity assumptions, we only derive  $I[\text{utter}(\text{left on time} >_{\sigma} \text{at home})] \models \text{left on time} >_{\sigma} \text{at home}$ —that is, we get a genuinely conditional interpretation.

#### 4.2. Unconditional accommodation via independence

Integrating van Rooij (2007)’s account of the proviso problem into the current setup is just as straightforward, once we fix appropriate assumptions about presupposition projection and accommodation. I refrain from giving a full account of projection, but simply enrich the object language, allowing proposition letters to be subscripted with other proposition letters (intended to represent lexical presuppositions), and assume a ‘projection function’  $Pres : \mathcal{L}_o \mapsto \mathcal{L}_o$  that specifies for every (possibly complex) formula what its presuppositions are.<sup>10</sup> I make the minimal assumption that  $Pres(p_q) = q$  and further, the crucial assumption from satisfaction semantics that leads to the proviso problem:

- (21) **Projection of conditional presuppositions**  
 $Pres(A >_{\sigma} C) = Pres(A) \wedge (A \supset Pres(C))$

As for accommodation, we need to adopt what Katzir and Singh (2013) dub the ‘speaker-based approach’ of Beaver (1999, 2001).<sup>11</sup> Presupposition accommodation is understood as removing uncertainty about what the speaker might be (pragmatically) presupposing. In the current set-up, this can be captured by adding an operator  $Acc$  to our update language  $\mathcal{L}_u$ , defined as in (22). Again, the result in (23) is immediate.<sup>12</sup>

<sup>10</sup> Assuming that the values of  $Pres$  are formulas rather than, say, propositions is done for expository convenience here. Clearly, this is not the most attractive treatment of presupposition, but it will do for present purposes. In a more complete analysis, we could take  $Pres$  to have sets of possible worlds as values and define it in terms of  $\llbracket \cdot \rrbracket$ —e.g., for a static three-valued analysis of presupposition, we would let  $Pres(\phi) = \{w \in W \mid \llbracket \phi \rrbracket = 0 \text{ or } \llbracket \phi \rrbracket = 1\}$

<sup>11</sup> As Simons (2003) argues in detail, this view of accommodation is closely related to that of Stalnaker (1974, et seq.). For critical discussion of the ‘speaker-based’ approach, see also Beaver and Zeevat (2007); von Stechow (2008).

<sup>12</sup> This is implicit in van Rooij (2007), but it bears emphasizing: It is crucial for the account that accommodation is construed in this way, as a wholesale elimination of potential speaker belief/presupposition states that do not already

- (22) For all  $I, S : I[Acc(S)] = \{w \in I \mid \sigma_w \vdash Pres(S)\}$
- (23) Let  $I$  be an information state that satisfies  $I \models CI_\sigma(A, p)$ , as well as **Indicative sincerity** (17), then:
- (i)  $I[Acc(A >_\sigma C_p)][utter(A >_\sigma C_p)] \models CI_\sigma(A, p)$
  - (ii)  $I[Acc(A >_\sigma C_p)][utter(A >_\sigma C_p)] \models \Diamond_\sigma A$
  - (iii)  $I[Acc(A >_\sigma C_p)][utter(A >_\sigma C_p)] \models A >_\sigma p$
- and hence, by (16):
- (iv)  $I[Acc(A >_\sigma C_p)][utter(A >_\sigma C_p)] \models \Box_\sigma p$

That is, if  $A$  and  $p$  are taken to be conditionally independent for the speaker, interpreting  $A >_\sigma C_p$  (when accommodation takes place) will result in an information state that supports  $\Box_\sigma p$ —i.e., an information state in which the speaker (unconditionally) believes in the presupposition of the consequent. If the speaker is further taken to be well-informed about  $p$ , we will derive the stronger  $I[Acc(A >_\sigma C_p)][utter(A >_\sigma C_p)] \models p$ . And just as before, this result depends on the assumption of independence. Without it, we only get the weaker (23iii), which says that the speaker believes in the conditional presupposition.

#### 4.3. Summary, and an argument for a uniform analysis

Independence-based accounts of biscuit uses of conditionals and of the proviso problem are attractive in their simplicity and parsimony. While I have spelled out a rather involved formal apparatus to make them fully explicit, some version of this apparatus is arguably independently needed for any theory of utterance interpretation (Lauer 2013)<sup>13</sup>—and once it is in place, nothing is required to account for both phenomena but a contextual assumption that is plausible in some contexts (when we observe the unconditional implication), but not in others (when we do not).

Before creating trouble (in Section 5) for adopting independence-based accounts for both phenomena jointly, I want to point out a reason to think that, ultimately, we do want a uniform account of both phenomena. Consider Beaver (1999)’s example in (24).

- (24) If Spaceman Spiff lands on Planet X, he’ll notice that he weighs more than on Earth.

support the presupposition of the sentence. In a dynamic setting, it may seem natural to define accommodation instead as *adding* the presupposition to an information state, by eliminating worlds. But this does not give the right result: Suppose that  $A$  and  $p$  are independent on  $\sigma$ , and further that  $A$  is contingent in  $\sigma$ . Then, unless the update is vacuous,  $\sigma[A \supset p]$  will not support  $p$ —rather,  $A$  and  $p$  will be dependent in  $\sigma[A \supset p]$ !

<sup>13</sup>This is not to say that the various choices made throughout are necessarily the right ones. I consider it an advantage of the system of dynamic pragmatics that it requires us to spell out, in detail, what the underlying assumptions are, and hence where alternative choices could be made.

Beaver ingeniously uses (24) to create trouble for various accounts of presupposition accommodation and the proviso problem (and to argue for a speaker-based approach to accommodation). The crucial feature of (24) is this: Clearly, the sentence does not convey that the presupposition of its consequent is true, *i.e.*, that Spiff weighs more than on earth, regardless of whether he lands on planet X (Beaver: “it seems natural for [(24)] to be uttered under conditions where Spiff is hanging about in space, and completely weight-less”). But it still conveys a bit of unconditional information, namely “that Planet X is the sort of place where one is particularly heavy”, regardless of whether Spiff lands there.

Let us consider what happens, on the present account, when the conditional presupposition predicted by satisfaction accounts (*viz.*, **if Spiff lands on planet X, he’ll weigh more than on earth**) is accommodated. This accommodation will rule out any speaker belief state  $\sigma_w$  that does not support the conditional. Given plausible world-knowledge assumptions (*viz.*, that landing on planet X will not significantly alter Spiff’s mass), this will only be the case if the speaker also believes **if Spiff lands on Planet X, gravity on X will be higher than on earth**. But, since Spiff’s landing on *X* is likely conditionally independent (on  $\sigma_w$ ) from the strength of the gravitational field of *X*, this accommodation will ensure that the speaker’s belief state entails that gravity on *X* is higher than on earth, regardless of whether Spiff lands there. So the independence account, as spelled out here, also predicts that sometimes, what is ‘strengthened’ is not the conditional presupposition itself, but rather a necessary ancillary assumption.

Crucially, we find the same kind of effect with biscuit conditionals. Francez (2015) has recently drawn attention to the phenomenon of so-called *chimerical conditionals*. These are conditionals that give rise to contradicting intuitions about whether they convey conditional or unconditional implications. (25) is an example.

(25) If John entered the museum from the south, there were no guards (where he entered).

On the relevant reading, (25) does not convey that its consequent **there were no guards where [John] entered** is true. But it provides unconditional information, *viz.*, that there were no guards at the south entrance, regardless of whether John entered from the south.

So, both in the case of presupposition accommodation and in the case of asserted conditionals, we find cases where what is ‘strengthened’ is not the conventional (conditional) implication, but rather another contextual assumption that needs to be made for the conditional implication to be true. That suggests that we ultimately want a uniform analysis of both phenomena that also extends to these cases. And independence-based accounts, besides being very parsimonious, seem to do rather well.



## 5. The package-deal problem

Not all is well in paradise, though. It is not at all clear that we can adopt both accounts jointly. Here is why: Both accounts trace the unconditional implication to the same assumption of conditional independence, in the same information state (namely, the speaker's): Whenever  $I \models CI_\sigma(A, X)$  (and the appropriate sincerity assumptions are in place) then (26) and (27) obtain. But then it seems we are forced into the prediction in (28).

$$(26) \quad I[\text{utter}(A >_\sigma X)] \models \Box_\sigma X \quad (27) \quad I[\text{Acc}(A >_\sigma C_X)][\text{utter}(A >_\sigma C_X)] \models \Box_\sigma X$$

(28) **Package-deal prediction.** A sentence  $A > X$  will get a biscuit interpretation in exactly the same contexts in which a sentence  $A > C_X$  gets an unconditional accommodation.

But (28) is patently false. For example, in most contexts, (29a) will convey that Bill has a sister, regardless of whether he is flying to Toronto, while (29b) will not convey this.

- (29) a. If Bill is flying to Toronto, his sister will meet him at the airport.  
b. If Bill is flying to Toronto, he has a sister.

Such counter-examples can be produced at will—in a large majority of the cases where we get an unconditional accommodation, the corresponding conditional assertion will not be construed as a biscuit conditional. Taken at face value, the package-deal prediction shows that an independence-based analysis of both phenomena is not viable: The set of contexts in which conditional presuppositions get ‘strengthened’ is just not the same as the set of contexts in which we observe biscuit readings.

But there is hope. The contexts in which we observe the two phenomena are not unrelated. Indeed, it seems that set of contexts in which we get biscuit interpretations is a subset of the ones in which we observe ‘strengthened’ presuppositions: There do not appear to be counterexamples where, in a particular context, we observe a biscuit reading for a conditional  $A > X$  but where we do not get a ‘strengthened’ accommodation if  $A > X$  is presupposed. This opens up the possibility that, while an independence assumption is at play in both phenomena, this assumption is *necessary and sufficient* for a presupposition to be strengthened, but only *necessary* for biscuit uses<sup>14</sup>—for biscuit uses, another contextual condition is required in addition. This is what I shall propose in the rest of this paper.<sup>15</sup>

<sup>14</sup>Strictly speaking, of course, independence is never necessary: Both asserted conditionals and presupposed conditionals will always give rise to unconditional interpretations if their antecedents are independently taken to be true, as in so-called ‘factual’ uses of conditionals Iatridou (1991).

<sup>15</sup>Other ways to avoid the package-deal prediction are conceivable. One could argue that what is wrong with the way I have set things up here is that presupposition accommodation and the assertion of conditionals target the same

## 6. Towards a solution of the package-deal problem

Let's make the following two plausible assumptions: (i) whenever a speaker utters a conditional  $A > C$ , his utterance makes  $C$  salient as an alternative utterance that she could have made instead; (ii) all else being equal, any speaker prefers an utterance of  $C$  over an utterance of  $A > C$ , because the former is shorter and less complex than the latter.

If we assume both (i) and (ii), then, whenever an addressee observes an utterance of  $A > C$ , he can conclude that everything else is *not* equal—*i.e.*, that the speaker had another preference which is satisfied by an utterance of  $A > C$ , but not by an utterance of  $C$ , and further that this preference is stronger than his preference for a simpler expression. This is just the kind of 'Need a Reason' (NaR) reasoning I describe and formalize in Lauer (2013, Ch. 9) and Lauer (2014). In other words, whenever a speaker utters a conditional  $A > C$ , the hearer must be able to infer a reason why she did not instead utter the (simpler, less complex)  $C$ . Crucially, if no such reason can be inferred, infelicity will result.<sup>16</sup>

If we consider a simple, 'hypothetical' use of a conditional, such as **if John left on time, he is at home now**, it is not difficult to find a reason why the speaker uttered the conditional, rather than its consequent: She did not want to convey the truth of  $C$  (= **John is at home now**), because she does not know it to be (unconditionally) true, while she does know the conditional  $A > C$  to be true.<sup>17</sup> Crucially, for this to be the speaker's reason for preferring the conditional over its consequent,  $A$  and  $C$  have to be taken to be conditionally dependent—for else, an utterance of  $A > C$  would convey the truth of  $C$ .<sup>18</sup>

If  $A$  and  $C$  are independent, there has to be a different reason for the speaker choosing to utter the conditional rather than its consequent. For classical cases of biscuit conditionals, such as **if you are hungry, there is pizza in the fridge**, we can say (following Franke 2009, p. 275ff.) that the speaker uses the conditional in order to provide his audience with a *cue* for the interpretation of the consequent—it, somehow, indicates which potential decision problem of the hearer the consequent is relevant to (see also Francez (2015, Section 4.3) for an articulation of this idea). This is not the only reason for uttering a conditional that conveys the truth of its consequent. Another is to

belief state  $\sigma$ —perhaps accommodation should target the speaker's presuppositional state, while asserted conditionals target his belief state proper. Or maybe it could be argued that different but related notions of independence are at play in the two phenomena. There good arguments that neither option will solve the problem in a satisfying manner, which for reasons of space, I have to omit here.

<sup>16</sup>More or less the same idea is behind the ANSWERHOOD CONDITION of Katzir and Singh (this volume) requiring that a speaker not make a 'needlessly inferior' utterance from a set of options.

<sup>17</sup>This reasoning is essentially Nadathur's (2014) take on what von Stechow (2001) calls 'conditional strengthening'—a weaker version of Geis and Zwicky's (1971) 'conditional perfection'. Besides in von Stechow and the work he builds on (especially van der Auwera 1997 and Horn 2000), we find very similar ideas in Franke (2009)'s discussion of conditional perfection.

<sup>18</sup>In fact, ignorance is only one of a range of possible reasons—*e.g.*, the speaker might know that  $C$  is unconditionally true, but may not wish to reveal that. Again, for this to be the operative reason for choosing the conditional, the addressee must take it to be possible that  $A$  and  $C$  are conditionally dependent for the speaker.

structure the discourse, as in Franke's **if we now turn to the last point of order, fund cuts have been tremendous** or to mark a property of the speech act by use of a self-referential antecedent, as in **if I am being frank, you look awful** (see Csipak (2015), for discussion of the intricacies of latter case). I will call this motley collection of reasons for employing a conditional 'biscuit reasons'.

Here, then, is what I think is going on in cases like (29), where (29a) results in an unconditional accommodation in most contexts, while (29b) does not receive a biscuit interpretation. Suppose (29b) is uttered in a context in which there is a (default) assumption that **Bill is flying to Toronto** and **he has a sister** are conditionally independent. Hence the conditional should give rise to a biscuit interpretation. What goes wrong, I conjecture, is that there *is no plausible 'biscuit reason'* for using the conditional, in most contexts. On pain of infelicity, the hearer is hence forced to revisit his (default) assumption of independence, and conclude that antecedent and consequent are dependent (for the speaker) after all.

- (29) a. If Bill is flying to Toronto, his sister will meet him at the airport.  
b. If Bill is flying to Toronto, he has a sister.

Now suppose (29a) is uttered in the same context. In this case, there is no reason for revisiting the (default) assumption of conditional independence. The use of the conditional, instead of its consequent, is straightforwardly justified because the speaker does not know that Bill's sister will meet him at the (Toronto) airport, regardless of whether Bill is flying to Toronto. Consequently, the unconditional accommodation will straightforwardly arise for (29a). Quite generally, when a sentence  $A > C_X$ , in context, happens to convey that  $X$  is (unconditionally) true, this does not raise the question why the speaker did not simply presuppose  $X$  instead. By contrast, when a speaker utters  $A > X$  in a context in which the utterance happens to convey that  $X$  is (unconditionally) true, the question why the speaker did not just utter  $X$  instead does arise, and if it does not have a plausible answer, this will lead the hearer to revisit his assumptions about the context.<sup>19</sup>

<sup>19</sup>I think that the reasoning sketched in this section might also shed light on the question why strengthened presuppositions are absent in cases like (ia) (after Geurts 1996), which presumably competes pragmatically with (ib).

- (i) a. Walter knows that if Bill is flying to Toronto, he has a sister.  
b. Walter knows that Bill has a sister.

Sentences like (ia) *can* get a strengthened precondition—if a 'biscuit reason' is plausible, as in (ii). This suggests that sentences that contain a constituent denoting the presupposed conditionals pattern with biscuit conditionals, rather than with conditionals with a presupposing consequent.

- (ii) Walter knows that if he is hungry, there is pizza in the fridge.

## 7. Conclusion and outlook

In order to integrate the proposal from the previous section into a formal system such as the one set out in the earlier parts of this paper, we require the apparatus of an ‘optimization-based’ theory of implicature (such as those in Franke 2009 or Lauer 2013, Ch. 9) to derive NaR implicatures more generally, and in addition, the following two ingredients: Firstly, the system needs to allow us to talk about non-monotonic belief revision, so as to model what goes on when a hearer rejects a prior default-assumption of conditional independence. And secondly, we need a more articulated theory of ‘biscuit reasons’ for preferring the utterance of a conditional over an utterance of its consequent. The remarks made by Franke and others are suggestive, but we need a better understanding of how conditional antecedents can serve as ‘cues’ for the interpretation of their consequents, etc., and the conditions under which speakers feel the need to give such cues.

In introducing his sketch of this idea, Franke (2009, p. 274) says: “What is left to be explained is why a conditional with an unconditional reading should be used at all in conversation, given that its discourse effect, as far as information is concerned, is that of a simple assertion of the consequent.” If what I have said before is correct, this is not an idle question, but one that has empirical bite: An articulated account of the reasons that motivate speakers to utter biscuit conditionals will be a crucial ingredient in establishing that independence-based accounts of both the proviso problem and biscuit conditionals are viable and desirable, by showing that they can correctly predict in which contexts the two phenomena come apart.

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# A single-event analysis for German eventive *mit*-modifiers<sup>1</sup>

Julia LUKASSEK — *Universität Tübingen*

**Abstract.** German adverbial modifiers headed by the preposition *mit* ‘with’ can have eventive internal arguments. The combinatorics of these modifiers with their verbal target raises the question whether the modifying and the modified event description are to be considered as referring to one or to two events. I argue that eventive *mit*-modifiers and their targets refer to one event, but they conceptualize this event in two ways. Furthermore, the interpretation of the modified verbal projection depends on the position at which the modifier is integrated. More precisely, eventive *mit*-modifiers can target either the event kind contributed by the matrix predicate or the full-fledged event particular. This is implemented in an analysis in terms of accommodation of a dual aspect event within the framework of Type Composition Logic.

## 1. Introduction

Current research on adverbials evolves around two central questions. One concerns a discussion about the flexibility of adverbial modifiers in the combinatorics with their target arguments, cf. Maienborn (2001), Buscher (2013) or Engelberg (2003). The other question is whether adverbials have syntactic base positions, cf. Cinque (1999), Haider (2000) and Frey (2003). German prepositional phrases headed by *mit* ‘with’ and equipped with an event denoting internal argument, e.g. *mit einem Plädoyer* ‘with a summation’ in (1), are a case in point for both perspectives. In this paper, I will show that they exhibit different combinatoric properties depending on the position at which they are integrated into the verbal projection. The puzzle posed by eventive *mit*-modifiers (EMMs) is the relation that holds between the two event descriptions involved in EMM-constructions: the modifying event and the target, which is typically an abstract verb like German *beenden* ‘to end’, *eröffnen* ‘to open’ or *verbinden* ‘connect’.<sup>2</sup>

- (1)      Der Anwalt beendete die Verhandlung mit einem Plädoyer.  
            The lawyer ended      the trial                      with a              summation.

At first glance, EMMs share some properties with instrumentals. Both modifier types are realized by a prepositional phrase headed by *mit* in German. Thus, *mit* can either combine with a physical object or with an event, cf. (2a). Additionally, both modifiers participate in the so-called instrument alternation pattern as discussed by Levin (1993), i.e. the internal argument of the *mit*-PP can appear in the subject position of an argument structural variant of the matrix verb, cf. the alternated variants of (2a) in (2b).

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<sup>2</sup>I use the judgments \* = ‘ungrammatical’; # = ‘conceptually odd’; ?? = ‘deviant, but not completely out’.

- (2) a. Paul verband die Pulloverteile mit blauen Fäden / mit wenigen Stichen.  
 Paul connected the pullover-parts with blue threads / with few stitches.
- b. Blaue Fäden / wenige Stiche verbanden die Pulloverteile.  
 Blue threads / few stitches connected the pullover-parts.

Nevertheless, EMMs cannot be considered an instrument, as instruments are participants and an eventive internal argument of *mit* does not meet the sortal prerequisites for participant-hood.

In order to answer the question about the relation between matrix and modifier event, I will proceed as follows: In section 2, I will briefly present the outlines of a two-event account as well as a single-event account for EMMs and discuss their advantages and disadvantages. Section 3 extends the data set that has to be covered by an adequate analysis of EMMs. Most importantly, I will show that EMMs have two syntactic base positions with covarying interpretations. In section 4, I will propose a formal analysis of EMMs in terms of dual aspect entities, a concept that has been prominently advocated for polysemous nouns by Asher (2011). Section 5 concludes the analysis.

## 2. A first approach to the meaning of eventive *mit*

### 2.1. Two-event account: EMMs as causes

In a two-event account, each event description in (3) denotes a different event, i.e. the summation and the opening of the trial are two events dissociated w.r.t. their spatiotemporal extension and their participants, cf. Maienborn's (2007) definition of events as particular spatiotemporal entities with functionally integrated participants. The relation holding between those two events has to be specified. Rapp (1997) suggests causality as the pertinent relation between EMMs and their targets, where the modifier event specifies the cause of the matrix event. Under an event-based account of causality, cause and effect are temporally dissociated entities, cf. Shibatani (1975). However, we can see from the entailments in (3) that the temporal and the spatial extension of the matrix event and the modifier event are identical. The duration of the summation is twenty minutes and the opening of the trial takes up the same twenty minutes. Parallel entailments hold for the spatial domain, cf. (3c) and (3d).

- (3) Der Anwalt eröffnete im Gerichtssaal mit dem Plädoyer zwanzig Minuten lang  
 The lawyer opened in the courtroom with the summation for twenty minutes  
 die Verhandlung.  
 the trial.
- a. → The summation lasted 20 minutes.  
 b. → The opening of the trial lasted 20 minutes.  
 c. → The summation took place in the courtroom.  
 d. → The opening took place in the courtroom.



Furthermore, a causal account of EMMs predicts that the modifiers can be paraphrased by a genuinely causal prepositional phrase like a *wegen*-PP in (4a). However, the paraphrase of (1) in (4a) does not preserve the initial meaning. Rather, the modal clause headed by *indem* in (4b) yields an appropriate paraphrase.

- (4) a. Der Anwalt beendete die Verhandlung wegen eines Plädoyers.  
 The lawyer ended the trial because of a summation.  
 b. Der Anwalt beendete die Verhandlung, indem er ein Plädoyer hielt.  
 The lawyer ended the trial, subj<sub>modal</sub> he a summation held.

These observations indicate that a two-event analysis of EMMs cannot be on the right track. Instead, a look at the proposals on *indem* ‘by’ might help to understand the combinatorics of EMMs.

## 2.2. Single-event account: the Anscombe-thesis

Under a single-event account, modifier and target event denote the same event, they merely describe it in a different manner. In the philosophical literature following Anscombe (1957), the single-event account of eventive modifiers like English *by* or German *indem* has been summarized in the Anscombe-thesis.

- (5) **Anscombe-thesis:** If someone  $\phi$ s by  $\pi$ ing, and F is the act which makes it the case that she  $\phi$ s, and P is the act which makes it the case that she  $\pi$ s, then F is P.  
 (Bennett, 1994, 29)

Both matrix and modifier event refer to the same act and this act is described in two different ways. Though this intuition is undoubtedly on the right track, event identity in a strict sense entails an unwanted consequence: If an event is understood as a particular spatiotemporal entity with functionally integrated participants, event identity requires both identity of the spatiotemporal extension and of the participants. We have already seen in (3) that the spatiotemporal extensions of the modifier event and the target event are identical. However, in (6), for instance, the matrix and the modifier event can have partially different participants. Whereas the matrix event involves Lea and Paul as participants, the modifier event additionally involves a feather.

- (6) Lea annoyed Paul by tickling him with a feather.

Nevertheless, the basic intuition of the Anscombe-thesis that – in a coarse-grained, spatiotemporal sense – both event descriptions refer to the same event is to be implemented in a linguistic account

of EMMs. A concept that is particularly suitable to capture identity on different levels of fine-grainedness is provided by dual aspect entities in the sense of Asher (2011). Dual aspect entities have a dual nature inasmuch as they express two different and sortally independent, but equally valid conceptualizations of one and the same entity. For instance, the noun *book* is a dual aspect object, as it can be conceptualized both as a physical and as an informational object. Entities of this type have been argued to occur in two different linguistic domains. On the one hand, they figure as lexical typing of nouns like *book*, i.e. *book* is of type  $\text{PHYS} \bullet \text{INFO}$ ; on the other hand, they can emerge compositionally from a specific linguistic configuration. For example, Asher (2011) argues that *as* in *John as a judge is corrupt* introduces a dual aspect type. Here, the conjunction *as* adds an aspect to the typing of the target argument *John* and by doing so, it generates the dual aspect type  $\text{HUMAN} \bullet \text{JUDGE}$ .

Bücking (2014) implements the concept of dual aspect entities for *by/indem*-modifiers. In this account, the connective accommodates a dual aspect event consisting of the modifier event and the matrix event as its constituent aspects. More precisely, a sentence like (6) contains an event that is conceptualized as both an annoying and a tickling of Paul. In order to account for diverse locality effects, Bücking (2014) makes use of a special property of dual aspect entities within Asher's framework: Dual aspect entities are furnished with a morphism that takes one aspect of a complex entity and maps it to the dual aspect entity. This is encoded via the object elaboration relation 'o-elab(x,y)', where x elaborates on the sort of object that y is. In Bücking (2014), this feature is used to account for the fact that the referential argument of the overall VP has to denote a single aspect event that elaborates on a dual aspect event.

His proposal for a lexical entry of *by/indem* is shown in (7a). It takes two first-order predicates *P* (the modifier event description) and *Q* (the matrix event description) as arguments, as well as an individual *x* for the subject of the VP and an event *e* typed according to the matrix predicate. It introduces an additional existentially quantified variable *e'* that is typed as a dual aspect event with the head types of *P* and *Q* as its constituent aspects. *By/indem*'s meaning contribution is to connect these two event variables via the object-elaboration relation, i.e. *e* of matrix predicate type elaborates on the sort of object *e'* is, namely an event of dual aspect type. The truth conditions for (6) based on this semantics of *by/indem* and disregarding the instrumental within the modifier are given in (7b).

- (7) a.  $\llbracket \text{by/indem} \rrbracket = \lambda P \lambda Q \lambda x \lambda e : \text{TY}^+(Q) \exists e' : \text{TY}^+(P) \bullet \text{TY}^+(Q). P(e') \wedge$   
     highest thematic arg.'(*e'*) = highest thematic arg.'(*e*)  $\wedge$  o-elab'(*e, e'*)  $\wedge Q(x)(e)$   
     (Bücking, 2014, 8, (28))  
     b.  $\exists e' : \text{TICKLE} \bullet \text{ANNOY} \exists e : \text{ANNOY}. \text{tickle}'(e', l, p) \wedge \text{o-elab}'(e, e') \wedge \text{annoy}'(e, l, p)$

The analysis captures the Anscombe-thesis via the complex dual aspect event *e'*, an existentially bound variable that has the modifier type and the matrix type as its aspects. At the same time, the meaning representation is furnished with an additional event variable of the matrix event aspect,

which elaborates on this complex type. This variable is compositionally active. My analysis will build on Bücking's (2014) account of *by/indem*. However, it will be necessary to adapt the account in order to capture the data presented in section 3.

### 3. The combinatorics of eventive *mit*

#### 3.1. EMMs as dual aspect events

If EMMs in fact introduce dual aspect events, EMM-constructions should mirror the behavior that dual aspect nouns display w.r.t. their linguistic environment. Asher (2011) reports two effects that are specific for the interaction of dual aspect nouns with their environment. First, entities of dual aspect type can only be individuated by one of their constituent aspects at a time. This gives rise to so-called quantificational puzzles. The aspect quantified over is chosen by the predicational context in which the dual aspect entity appears. This is illustrated by the scenario and the predicational data in (8). The noun *book* is of dual aspect type. In the given scenario, one can coherently say (8a) referring to the informational aspect of the noun by the predicate *read* and counting the informational instances of *book* in the scenario. Similarly, one can predicate over the physical aspect of the noun by *dust off* and count the physical instances, cf. (8b). However, using the wide container *like* in (8c) that could theoretically predicate over both physical and informational entities still forces us to choose one of the aspects, as it is not possible to count pairs of physical and informational objects.

- (8) Nils has a bookshelf with five copies of the bible and an edition of Grass's 'Danzig Trilogy'-novels.
- a. Nils read<sub>info</sub> all the books on his shelf. That is, he read four books.
  - b. Nils dusted off<sub>phys</sub> all the books on his shelf. That is, he dusted off six books.
  - c. Nils likes<sub>info/phys</sub> all the books on his shelf. #That is, he likes eight books.

Notably, VPs modified by an EMM give rise to a parallel effect in the event domain. Consider the sentence in (9), where we have one ending of a game that is carried out by two moves. The sentence can be continued with a reference to the matrix aspect, i.e. to the ending of the game. This amounts to one event, cf. (9a). Likewise, reference to the modifier aspect is possible, as can be seen by the continuation in (9b) that counts the move events. However, it is impossible to refer to both aspects at the same time. This is shown by the oddness of (9c), where the anaphor *diese* is combined with three events.

- (9) Lea beendete das Spiel mit zwei Spielzügen.  
 Lea ended the game with two moves.
- a. Dieses Ereignis hat Nils verärgert.  
 This event AUX<sub>perf</sub> Nils annoyed

- b. Diese zwei Ereignisse haben Nils verärgert.  
 These two events AUX<sub>perf</sub> Nils annoyed.
- c. # Diese drei Ereignisse haben Nils verärgert.  
 These three events AUX<sub>perf</sub> Nils annoyed.

Second, entities of dual aspect type allow for co-predication, i.e. predications over each of the aspects can be linked by a conjunction. This is exemplified by the sentence in (10) where a predicate over physical objects is coordinated with a predicate over informational entities and both can conjointly predicate over the dual aspect noun *book*.

- (10) Nils dusted off<sub>phys</sub> and read<sub>info</sub> his books during his summer holidays.

Dual aspect eventualities show a similar behavior. Event anaphora that refer back to an event modified by an EMM can be connected by a conjunction, cf. (11). The anaphoric pronouns *das* and *es* take up the same event in the previous sentence, namely – as a default – the one denoted by the main predicate of the preceding sentence, which is the complex event of opening the show by balancing on the tightrope. Two different properties are predicated over the referent of these anaphora: one of the predicates targets the matrix aspect (*festive*) and the other one the modifier aspect (*centimeter by centimeter*).

- (11) Die Artistin hat die Show mit dem Balancieren über das Hochseil eröffnet. Das  
 The performer AUX<sub>perf</sub> the show with the balancing on the tightrope opened. That  
 war wenig feierlich<sub>open</sub>, da es nur zentimeterweise<sub>balance</sub> geschah.  
 was not very festive as it only centimeter by centimeter happened.

One of the central conceptual properties of dual aspect entities is their ability to combine two aspects that are sortally incompatible with each other. For instance, the two component types of *book* are neither subtypes of each other nor are they compatible w.r.t. to their individuation criteria, see the quantificational puzzles above. In the event domain, this property explains why EMMs and their matrix events can differ in aktionsart. Consider the examples in (12). Whereas the matrix predicate is telic in all the sentences, the internal argument of *mit* can either be telic as well, cf. (12a), or differ from the matrix predicate in being an activity, cf. (12b), or even a state as in (12c).

- (12) a. Nils beendete seine Wanderung mit dem Erreichen des Gipfels.  
 Nils ended his hike with the reaching of the summit.
- b. Nils unterbrach mit seinem Quatschen den Vortrag einer Mitschülerin.  
 Nils interrupted with his chatting the talk of a classmate.
- c. Nils eröffnete die Performance mit dem Stehen auf einem Bein.  
 Nils opened the performance with the standing on one leg.

The data presented in this section have shown that EMM-constructions pattern with dual aspect nouns. They give rise to quantificational puzzles, they support co-predication and the constituent types are sortally independent of each other.

### 3.2. EMMs as modifiers of event kinds and event particulars

There is both syntactic and semantic evidence showing that the interaction of EMMs with their linguistic environment is sensitive to the modifier's position relative to the direct object. EMMs can be integrated into the verbal projection at the V- and VP-level, i.e. below or above the direct object. This kind of sensitivity to the adjunction site has already been observed by Maienborn (2001) for locative modifiers and by Engelberg (2003) for eventive prepositional modifiers headed by *bei* 'while'.

#### 3.2.1. Syntactic evidence

I will use a subset of the syntactic tests established by Frey (2003) to show that EMMs have two base positions relative to the direct object. These diagnostics are focus projection, position relative to existentially interpreted *wh*-phrases and complex prefield construction.<sup>3</sup> Together these tests are used to establish base positions in the middle field.

In basic word order, putting the main accent on the verb-adjacent constituent leads to an interpretation of the sentence with wide focus, i.e. the focus feature borne by the stressed constituent is projected to the sentence level. If wide focus is present, the whole sentence belongs to the focussed information and it can function as an answer to a general question like *what's new?* For EMMs, this is illustrated in (13), where capital letters mark the syllable bearing the main sentence accent. Both the sentence with the EMM in verb-adjacent position, as in (13a), and the sentence with the direct object adjacent to the verb, as in (13b), are appropriate answers to such a general question. This means that both relative orders of direct object and EMM are basic.

- (13) Was ist            geschehen? – Ich habe       gehört, dass ...  
       What AUX<sub>perf</sub> happened? – I   AUX<sub>perf</sub> heard that ...
- a.     ... Lea eine Show mit   einem BalanCIERakt eröffnet hat.  
       ... Lea a    show with a       balancing act   opened AUX<sub>perf</sub>.
- b.     ... Lea mit   einem Balancierakt eine SHOW eröffnet hat.  
       ... Lea with a       balancing act the   show   opened AUX<sub>perf</sub>.

<sup>3</sup>Due to the specific properties of event denoting nominals and the sortal properties of the direct objects of the matrix predicates, the remaining tests proposed by Frey (2003) are not applicable.

In German, existentially interpreted *wh*-phrases resist any sort of syntactic movement. Hence, their position identifies base positions of constituents. In (14a), the direct object precedes the EMM. Replacing the direct object by a *wh*-pronoun yields a grammatical result. As the *wh*-pronoun has to be base-generated in this position, the EMM must be base-generated below it. Otherwise, it would be necessary to assume downward scrambling for the EMM, which would conflict with the constraint forcing moved constituents to bind their traces. However, the syntactic order in (14b) must also be basic. Here, the direct object is next to the verb and the higher EMM is replaced by a *wh*-pronoun. As scrambling of the direct object below the EMM is not possible, the superficial relative order between direct object and EMM has to be base generated as well.

- (14) a. Paul hat was mit einer Rede eröffnet.  
           Paul AUX<sub>perf</sub> wh<sub>Akk</sub> with a speech opened.  
       b. Paul hat mit was einen Festakt eröffnet.  
           Paul AUX<sub>perf</sub> with wh<sub>Dat</sub> a ceremony opened.

Any number of constituents from the VP of German sentences can be moved to the prefield together with the main predicate. There is, however, one constraint on this movement: the moved part of the VP must not include traces of preceding scrambling operations. The reason for this constraint is the above-mentioned necessity for moved constituents to bind their traces. (15) illustrates that both the EMM and the direct object can constitute a complex prefield with the main verb. In particular, the direct object in (15a) must have been above the EMM prior to the topicalization of the modifier and the matrix verb. Likewise, the EMM in (15b) must have been located above the direct object in the deep structure.

- (15) a. Mit dem Plädoyer beendet hat der Anwalt die Verhandlung.  
           With the summation ended AUX<sub>perf</sub> the lawyer the trial.  
       b. Die Verhandlung beendet hat der Anwalt mit dem Plädoyer.  
           The trial ended AUX<sub>perf</sub> the lawyer with the summation.

These observations provide converging evidence that EMMs can be base generated both as V- and as VP-adjuncts. However, the data presented in the next section indicate that the two base positions are accompanied by different interpretations.

### 3.2.2. Semantic evidence

Maienborn et al. (2014) show that modifiers targeting V have access to the conceptual information their anchor argument provides. By virtue of this, the modifier and its anchor form an ad hoc concept. Modifiers that adjoin higher than V lack this power. I will now present a range of evidence showing that EMMs have an analogous effect on their target.

Maienborn (2005) demonstrates that perceptual reports are sensitive to the abstractness of their infinitival complement. Only VPs denoting an event can appear as complements of perception verbs, as these verbs select for an entity that is accessible to perception. As can be seen in (16a), the abstract verb *unterbrechen* ‘interrupt’ is an unsuitable complement for a perception verb, whereas the concrete *sprinten* ‘sprint’ in (16b) denotes a perceptible entity and can figure as infinitival complement of a perception verb.

- (16) a. \*Lea sah Paul ein Finale unterbrechen.  
           Lea saw Paul a finale interrupt.  
       b. Lea sah Paul sprinten.  
           Lea saw Paul sprint.

Bücking (2014) argues that *by/indem* requires an abstractness gradient from the matrix event to the modifier event, i.e. the matrix predicate has to be more abstract than the event embedded under *by/indem*, cf. (17). EMMs have a similar constraint, cf. (18). This is reflected in the fact that EMM-constructions always involve an abstract verb as their target argument.

- (17) Ben {kept a promise by dancing / #danced by keeping a promise.} (Bücking, 2014, (36))  
 (18) a. Paul unterbrach mit dem Sprint über das Spielfeld das Finale.  
           Paul interrupted with the sprint over the playing field the finale.  
       b. #Paul sprintete mit dem Unterbrechen des Finales über das Spielfeld.  
           Paul sprinted with the interrupting of the finale over the playing field.

Pursuing the idea that EMMs accommodate dual aspect events, we may expect that EMMs render their matrix predicate more concrete, as they add a concrete aspect to the typing of their target argument. The combination of an abstract verb with a more concrete EMM should make the non-perceptible abstract matrix predicate a suitable infinitival complement of perception verbs. However, this is only expected if the modifier accesses the conceptual information of its target and re-types the referential argument. The data in (19) show that the acceptability of abstract verbs in perceptual contexts increases only, if the EMM is located close to the verb, i.e. below the direct object, cf. (19a), but not if it is above the direct object, cf. (19b).

- (19) a. Lea sah Paul ein Finale mit einem Sprint unterbrechen.  
           Lea saw Paul a finale with a sprint interrupt.  
       b. ??Lea sah Paul mit einem Sprint ein Finale unterbrechen.  
           Lea saw Paul with a sprint a finale interrupt.

These data suggest two different interpretations depending on the integration site of the EMM. Below the direct object, the modifier is integrated at the word boundary and accesses the conceptual

information provided by the matrix verb. By adding a concrete aspect to the conceptual information of the matrix verb, the EMM renders its target more concrete. However, above the direct object, the EMM has no such effect.

Event anaphora like those discussed in the previous section supply analogous evidence. An event description can be taken up by the anaphoric expression *das geschah...* ‘this happened...’ in the subsequent context. By default, the event referred to by this anaphor is the matrix event of the preceding sentence. Independently of the position of the modifier, the matrix aspect of an event modified by an EMM is always discourse transparent, cf. (20). By contrast, the modifier aspect can only be accessed easily if it is located next to the matrix verb, cf. (21a). Above the direct object, the access to the EMM-aspect is significantly harder, cf. (21b).

- (20) a. Die Artistin hat die Show mit dem Balancieren über das Hochseil  
The performer AUX<sub>perf</sub> the show with the balancing on the tightrope  
eröffnet. Das geschah auf feierliche Weise.  
opened. That happened in festive manner.
- b. Die Artistin hat mit dem Balancieren über das Hochseil die Show  
The performer AUX<sub>perf</sub> with the balancing on the tightrope the show  
eröffnet. Das geschah auf feierliche Weise.  
opened. That happened in festive manner.
- (21) a. Die Artistin hat die Show mit dem Balancieren über das Hochseil  
The performer AUX<sub>perf</sub> the show with the balancing on the tightrope  
eröffnet. Das geschah zentimeterweise.  
opened. That happened centimeter by centimeter.
- b. Die Artistin hat mit dem Balancieren über das Hochseil die Show  
The performer AUX<sub>perf</sub> with the balancing on the tightrope the show  
eröffnet. ?? Das geschah zentimeterweise.  
opened. That happened centimeter by centimeter.

If the EMM targets V as in (21a), the balancing-aspect is accessible to the event anaphora, which indicates that this aspect is part of the event type denoted by the matrix verb. By contrast, if the EMM is adjoined at VP level as in (21b), the matrix event keeps its initial typing and thus the target of the anaphor is incompatible with the property predicated over the anaphoric pronoun.<sup>4</sup>

Causal relations are another source of evidence for two adjunction sites of EMMs. In order to establish a causal relation between two events, these events must be conceptually plausible candidates for a causal relationship. If this condition is not met, a causal conjunction of two events is pragmatically anomalous. This is illustrated by the examples in (22). An accident is a plausible

<sup>4</sup>In (21b), bridging to less accessible event referents is possible, i.e. the EMM-event can be taken up by the anaphor. However, as this is a strongly dispreferred referent, (21b) remains odd.



cause for being in hospital. By contrast, Lea's ending of a skiing trip and her being in hospital do not stand in an obvious direct causal relation to each other.

- (22) a. Lea liegt im Krankenhaus, weil sie einen Unfall hatte.  
           Lea lies in the hospital because she an accident had.  
       b. # Lea liegt im Krankenhaus, weil sie einen Skiurlaub beendet hat.  
           Lea lies in the hospital because she a skiing trip ended *AUX<sub>perf</sub>*.

If the EMM accesses the conceptual information introduced by the matrix event, it should be able to render an implausible causal relation plausible, as long as the modifier event is a suitable cause in the relevant situation. In fact, the data in (23) show that an EMM has this effect only in case it is below the direct object. That is, the implausible causal relation in (22b) is rendered plausible only by a modifier targeting V, cf. (23a), but not by a modifier adjoined to VP, cf. (23b).

- (23) a. Lea liegt im Krankenhaus, weil sie einen Skiurlaub mit einem Unfall  
           Lea lies in the hospital because she a skiing trip with an accident  
           beendet hat.  
           ended *AUX<sub>perf</sub>*.  
       b. # Lea liegt im Krankenhaus, weil sie mit einem Unfall einen Skiurlaub  
           Lea lies in the hospital because she with an accident a skiing trip  
           beendet hat.  
           ended *AUX<sub>perf</sub>*.

In (23a), the modifier event is an integral part of the matrix event, as the EMM adds a second aspect to the type of the projected event information. If this aspect is suitable as a cause of the event of Lea being in hospital, the causal relation becomes more plausible. In (23b), the modifier cannot manipulate the information relevant for the causal relation and the incoherence remains.

The last type of evidence comes from intensional contexts. The existence presupposition of definite DPs is preserved, for instance, under sentence negation. In (24), the definite article of the DP *the sofa* introduces an existence presupposition and this presupposition is resistant to negation.

- (24) a. Nils strickt (nicht) auf dem Sofa.  
           Nils knits (not) on the Sofa.  
       b. >> There is a sofa.

Interestingly, the existence presupposition of the definite article within EMMs is projected only in case the modifier is above the direct object, cf. (25b). By contrast, the presupposition disappears when the EMM targets V, cf (25a).

- (25) a. Es ist nicht wahr, dass Paul das Konzert mit dem Spielen der  
 It is not true that Paul the concert with the playing of the  
 Mondscheinsonate beendet hat.  
 moonlight sonata ended AUX<sub>perf</sub>.
- b. Es ist nicht wahr, dass Paul mit dem Spielen der Mondscheinsonate das  
 It is not true that Paul with the playing of the moonlight sonata the  
 Konzert beendet hat.  
 concert ended AUX<sub>perf</sub>.

(25a) is compatible with a context where Paul did not play the moonlight sonata at all during the concert under discussion, i.e. the presupposition of existence introduced by the DP *the playing of the moonlight sonata* is cancelled. Sentence negation thus scopes over the EMM (among other constituents). By contrast in (25b), the presupposition of existence introduced by the definite article within the EMM persists. The sentence is only compatible with a context where Paul did, in fact, play the moonlight sonata at some point during the concert. What is in the scope of the sentence negation is the claim that this happened at the end of the concert.

A similar effect arises when EMMs are embedded under the opaque verb *glauben* ‘believe’. Usually, the existence presupposition introduced by definite DPs is preserved in such contexts, but for EMMs the projection of the presupposition again depends on the position at which their meaning is integrated into the overall VP-meaning. If EMMs appear below the direct object as in (26a), the presupposition does not percolate to the sentence level. However, if the EMM is located above the direct object as in (26b), the presupposition stays intact.

- (26) a. Lea glaubt, dass Bayern München die Saison mit dem Siegen über Real  
 Lea believes that Bayern Munich the season with the winning over Real  
 Madrid eröffnet hat.  
 Madrid opened AUX<sub>perf</sub>.
- b. Lea glaubt, dass Bayern München mit dem Siegen über Real Madrid die  
 Lea believes that Bayern Munich with the winning over Real Madrid the  
 Saison eröffnet hat.  
 season opened AUX<sub>perf</sub>.

(26a) can be true in a context where Bayern Munich actually did not win the game against Real Madrid. The object of Lea’s belief is then the opening of the season qua winning the game against Real Madrid. Hence, the existence presupposition is not projected to the sentence level and the EMM is in the scope of the intensional operator. By contrast, (26b) requires a context where Bayern Munich did, in fact, win the game against Real Madrid, but it is uncertain whether this was the opening of the season. The presupposition of existence introduced by the definite article within the EMM is projected to the sentence level.

We have seen converging evidence for two different adjunction sites of EMMs. Yet, the question about the reasons for the differences in interpretation is unanswered so far. A constant pattern in the data presented in this section is the observation that an EMM accesses the conceptual information introduced by the verb if the modifier is adjacent to the matrix verb. This is manifested in the fact that abstract matrix verbs behave like concrete predicates when modified by a V-level EMM. By contrast, these effects do not arise if the EMM is adjoined at the VP-level. These observations can be explained by the dichotomy of event kind vs. event particular modification. At the V-level, the EMM is integrated into the verbal concept at the word boundary and is therefore involved in the constitution of the event kind. For instance, *mit einem Unfall beenden* in (23a) is a specific kind of ending-event that is built *ad hoc*, cf. Maienborn et al. (2014) for a parallel modifier-target-configuration in adjectival passives. It is interpreted as a complex event kind that can be realized with different participants. At the VP-level, on the other hand, the EMM modifies a full-fledged event particular constituted by the matrix event and furnished with participants. The EMM adds another predication over this particular, without manipulating the abstract concept of the target argument. In other words, in the V-modification case the referential variable of the overall VP is re-typed in terms of a complex type that has the matrix event type and the modifier event type as its constituent aspects; in the VP-modification case the referential variable of the overall VP keeps its initial typing and the modifier adds an event variable of dual aspect type to the meaning. This event variable is related to the referential VP-variable by an object-elaboration relation.

The distinction between modifiers targeting event kinds and event particulars accounts for the peculiar scope behavior within intensional contexts. EMMs in verb-adjacent position are part of the verbal cluster. They are integrated into the verbal meaning prior to event type closure. In this configuration, EMMs form a tight unit with their matrix predicate and they lose their independence, as they become an integral part of the verbal complex. By virtue of this, they contribute a property that specifies the event kind projected by the matrix verb, i.e. they introduce an aspect of the matrix predicate. This accounts for the peculiar behavior EMMs exhibit in intensional contexts. As integral parts of the event kind, they are in the scope of sentence-level operators.

To sum up, there are both syntactic and semantic reasons to assume two different integration sites for EMMs. We have seen that EMMs come either as modifiers of event kinds or as modifiers of event particulars. This is mirrored by two different syntactic base positions. EMMs that target the event kind are base generated at the word boundary, i.e. as V-adjuncts, whereas EMMs that modify event particulars are VP-adjuncts. These insights will feed into a formal account of the semantics of EMMs in the next section.

## 4. Compositional meaning constitution

### 4.1. Some remarks on Type Composition Logic

Type Composition Logic (TCL) by Asher (2011) is a formal semantic apparatus based on the standard  $\lambda$ -calculus. It is furnished with a fine-grained type system which is built to account for

differentiated type restrictions that a predicate imposes on its argument. These type restrictions are understood in terms of type presuppositions that have to be justified by the argument in the course of composition. Type information is percolated via a  $\lambda$ -bound variable  $\pi$ , the type parameter functioning as an additional argument of every predication. Type information is concatenated via the connective  $*$ . TCL comprises type-driven functional application as well as alternative mechanisms for a meaning adjustment, in case the argument is not of the presupposed type. Crucially, these mechanisms only come into play if the predicate is lexically equipped for the repair of a type conflict. For an example of the integration of the  $\pi$ -parameter consider (27). As a result of adding the parameter, a DP as generalized quantifier is not of type  $\langle\langle e, t \rangle, t\rangle$  in TCL, but of type  $\langle\langle e \langle \pi, t \rangle \rangle, \langle \pi, t \rangle\rangle$ .<sup>5</sup> The DP *the show* takes a first-order property  $P$  and a type parameter  $\pi$  and maps it to 1, iff there is exactly one  $s$  such that  $s$  is a show and of type event and  $P$  holds of  $s$ .

$$(27) \quad \llbracket \text{the show} \rrbracket \\ \lambda P \lambda \pi \exists! s. \text{show}'(s, \pi * \text{ARG}_1^{\text{show}} : \text{EVT}) \wedge P(\pi)(s)$$

#### 4.2. Compositional integration of eventive *mit*

The lexical entry for eventive *mit* is presented in (28a). The preposition combines a generalized quantifier  $\Phi$  with a property  $P$  and its referential variable  $e$  which can be either an event kind or an event particular. It is furnished with an argument vector  $\overleftarrow{e}$  that percolates  $\lambda$ -bound variables of the argument  $P$ , so that they can be satisfied after the integration of the modifier. Eventive *mit* contributes to the meaning constitution in four ways. First,  $e$  is determined to be the referential variable of the overall VP, i.e. this variable is compositionally active. Second, an existentially quantified variable  $e'$  is introduced into the meaning constitution. This additional variable is of dual aspect type; its constituent types are the fine-grained types of the internal and the external argument of the preposition. These fine-grained types are selected by the type functor  $\text{TY}^+$ . Third, eventive *mit* contains an object elaboration relation holding between  $x$  (which is the future internal argument) and  $e'$ , which is the dual aspect entity. Fourth, *mit* contributes an underspecified relation  $R$  that holds between the referential variable  $e$  and the existentially quantified variable  $e'$ . The specification of this relation depends on the adjunction site, cf. the condition in (28b): If the EMM modifies an event kind,  $R$  is specified to the identity relation. This accounts for the fact that the referential variable of VPs that are modified at the V-level are of complex type. If the EMM modifies an event particular,  $R$  is specified to another object elaboration holding between  $e$  and  $e'$ . In this syntactic configuration, the referential variable of the VP keeps its original typing. However, it is an aspect of a complex type and this is expressed by the specification of  $R$  in terms of an object elaboration.

<sup>5</sup>This is, in fact, a slight simplification w.r.t. the original DP-type in Asher (2011), as it disregards the polymorphism of the type requirement posed on the individual argument. In order to account for subtyping of functional types, the precise type of a DP is  $\langle\langle \exists x \sqsubseteq e.x \langle \pi, t \rangle \rangle, \langle \pi, t \rangle\rangle$ . As I will not touch the question of functional subtyping in any way, I will stick to the simpler DP-type variant for ease of presentation.

- (28) a.  $\llbracket \text{mit} \rrbracket = \lambda \Phi \lambda P \lambda \overleftarrow{e} \lambda \pi \exists e'. P(\pi * \text{ARG}_1^P : \text{TY}^+(P) \sqsubseteq \text{EVT} \sqcup \text{EVT-KIND})(e) \wedge$   
 $\Phi(\pi * \text{ARG}_1^\phi : \text{TY}^+(\Phi) \sqsubseteq \text{EVT})$   
 $(\lambda x \lambda \pi'. \text{o-elab}'(x, e', \pi' * \text{ARG}_2^{\text{o-elab}} : \text{TY}^+(\Phi) \bullet \text{TY}^+(P) \sqsubseteq \text{EVT} \sqcup \text{EVT-KIND})) \wedge R(e, e', \pi)$
- b. Condition on the application of *mit*:  
 $(e \sqsubseteq \text{EVT-KIND}) \rightarrow (R = \text{identity})$   
 $(e \sqsubseteq \text{EVT}) \rightarrow (R = \text{o-elab})$

The second ingredient needed to model the two readings of EMMs is event type closure, cf. Maienborn et al. (2014). Event type closure applies at the boundary of the verbal complex. It takes an event kind  $e_k$  and returns an event particular  $e_1$  that instantiates the event kind. Crucially, the type of the event particular is the same as the type of the event kind it instantiates.

- (29) Event type closure:  $\lambda P \lambda \overleftarrow{e}_1 \lambda \pi_1 \exists e_k. P(\pi_1)(e_k) \wedge \text{inst}'(e_k, e_1, \pi_1 * \text{ARG}_2^{\text{inst}} : \text{TY}^+(P))$

The compositional meaning constitution for (30) is presented step by step in (31). The lexical entry for *mit* first combines with its internal argument *the balancing on the tightrope*, cf. (31a). In the next step (31b), the event kind denoting *end* is integrated as an external argument<sup>6</sup>. The result is subject to event type closure, cf. (31c). Then, the direct object (31d) and the subject (31e) are integrated. Existential closure of the referential argument and binding the type presuppositions result in (31f).

- (30) Lea hat die Show mit dem Balancieren über das Hochseil beendet.  
 Lea AUX<sub>perf</sub> the show with the balancing on the tightrope ended.
- (31) a.  $\llbracket \text{mit the balancing on the tightrope} \rrbracket =$   
 $\lambda P \lambda \overleftarrow{e} \lambda \pi \exists e'. P(\pi * \text{ARG}_1^P : \text{TY}^+(P) \sqsubseteq \text{EVT} \sqcup \text{EVT-KIND})(e) \wedge$   
 $\exists ! b. \text{BoT}'(b, \pi * \text{ARG}_1^{\text{BoT}} : \text{BALANCE}) \wedge$   
 $\text{o-elab}'(b, e', \pi * \text{ARG}_2^{\text{o-elab}} : \text{BALANCE} \bullet \text{TY}^+(P) \sqsubseteq \text{EVT} \sqcup \text{EVT-KIND}) \wedge R(e, e', \pi)$
- b.  $\llbracket \text{mit the balancing on the tightrope end} \rrbracket =$   
 $\lambda \Psi \lambda e \lambda \pi \exists e'. \Psi(\pi * \text{ARG}_1^{\text{end}} : \text{BALANCE} \bullet \text{END} \sqsubseteq \text{EVT} \sqcup \text{EVT-KIND})(\lambda x \lambda \pi_3. \text{end}'(e, x, \pi_3)) \wedge$   
 $\exists ! b. \text{BoT}'(b, \pi * \text{ARG}_1^{\text{BoT}} : \text{BALANCE}) \wedge$   
 $\text{o-elab}'(b, e', \pi * \text{ARG}_2^{\text{o-elab}} : \text{BALANCE} \bullet \text{END} \sqsubseteq \text{EVT} \sqcup \text{EVT-KIND}) \wedge \text{identity}'(e, e', \pi)$
- c. Event type closure:  
 $\lambda \Psi \lambda e_1 \lambda \pi_1 \exists e' \exists e_k. \Psi(\pi_1 * \text{ARG}_1^{\text{end}} : \text{BALANCE} \bullet \text{END} \sqsubseteq \text{EVT} \sqcup \text{EVT-KIND})$   
 $(\lambda x \lambda \pi_3. \text{end}'(e_k, x, \pi_3)) \wedge \exists ! b. \text{BoT}'(b, \pi_1 * \text{ARG}_1^{\text{BoT}} : \text{BALANCE}) \wedge$   
 $\text{o-elab}'(b, e', \pi_1 * \text{ARG}_2^{\text{o-elab}} : \text{BALANCE} \bullet \text{END} \sqsubseteq \text{EVT} \sqcup \text{EVT-KIND}) \wedge \text{identity}'(e_k, e', \pi_1) \wedge$   
 $\text{inst}'(e_k, e_1, \pi_1 * \text{ARG}_2^{\text{inst}} : \text{BALANCE} \bullet \text{END} \sqsubseteq \text{EVT} \sqcup \text{EVT-KIND})$

<sup>6</sup>Note that I simplify the lexical entry for transitive verbs insofar as I assume a subjectless target VP with only one individual argument left for justification, namely the referential event argument, cf. Kratzer (1996).

- d.  $\llbracket \text{the show mit the balancing on the tightrope end} \rrbracket =$   
 $\lambda e_1 \lambda \pi_1 \exists! s \exists e' \exists e_k. \text{show}'(s, \pi_1) \wedge$   
 $\text{end}'(e_k, s, \pi_1 * \text{ARG}_1^{\text{end}} : \text{BALANCE} \bullet \text{END} \sqsubseteq \text{EVT} \sqcup \text{EVT-KIND}) \wedge$   
 $\exists! b. \text{BoT}'(b, \pi_1 * \text{ARG}_1^{\text{BoT}} : \text{BALANCE}) \wedge$   
 $\text{o-elab}'(b, e', \pi_1 * \text{ARG}_2^{\text{o-elab}} : \text{BALANCE} \bullet \text{END} \sqsubseteq \text{EVT} \sqcup \text{EVT-KIND}) \wedge \text{identity}'(e_k, e', \pi_1) \wedge$   
 $\text{inst}'(e_k, e_1, \pi_1 * \text{ARG}_2^{\text{inst}} : \text{BALANCE} \bullet \text{END} \sqsubseteq \text{EVT} \sqcup \text{EVT-KIND})$
- e.  $\llbracket \text{Lea the show mit the balancing on the tightrope end} \rrbracket =$   
 $\lambda e_1 \lambda \pi_1 \exists! s \exists e' \exists e_k. \text{agent}'(e_1, l, \pi_1) \wedge \text{show}'(s, \pi_1) \wedge$   
 $\text{end}'(e_k, s, \pi_1 * \text{ARG}_1^{\text{end}} : \text{BALANCE} \bullet \text{END} \sqsubseteq \text{EVT} \sqcup \text{EVT-KIND}) \wedge$   
 $\exists! b. \text{BoT}'(b, \pi_1 * \text{ARG}_1^{\text{BoT}} : \text{BALANCE}) \wedge$   
 $\text{o-elab}'(b, e', \pi_1 * \text{ARG}_2^{\text{o-elab}} : \text{BALANCE} \bullet \text{END} \sqsubseteq \text{EVT} \sqcup \text{EVT-KIND}) \wedge \text{identity}'(e_k, e', \pi_1) \wedge$   
 $\text{inst}'(e_k, e_1, \pi_1 * \text{ARG}_2^{\text{inst}} : \text{BALANCE} \bullet \text{END} \sqsubseteq \text{EVT} \sqcup \text{EVT-KIND})$
- f. Existential closure of  $e_1$  and binding of the type presuppositions:  
 $\lambda \pi \exists! s \exists e' : \text{BALANCE} \bullet \text{END} \exists e_k : \text{BALANCE} \bullet \text{END} \exists! b : \text{BALANCE} \exists e : \text{BALANCE} \bullet \text{END}.$   
 $\text{agent}'(e, l, \pi) \wedge \text{show}'(s, \pi) \wedge \text{end}'(e_k, s, \pi) \wedge \text{BoT}'(b, \pi) \wedge \text{o-elab}'(b, e', \pi) \wedge$   
 $\text{identity}'(e_k, e', \pi) \wedge \text{inst}'(e_k, e, \pi)$

The sentence in (30) denotes the event particular  $e$  that is an ending and that instantiates the event kind  $e_k$ .  $e$  and  $e_k$  are both of complex type characterized as a balancing and an ending type event.  $e$  has the agent Lea and there is a show  $s$  such that  $s$  is ended. Additionally, there is a balancing on the tightrope  $b$  that elaborates on the complexly typed event kind  $e'$  identified with  $e_k$ .

In (32), the modifier is integrated at the VP-level. The meaning of *mit* combined with *the balancing on the tightrope* from (31a) is combined with the VP *end the show* that denotes an event particular, cf. (33a). That is, the modifier targets the event variable  $e_1$  that instantiates the event kind  $e_k$  introduced by the verb. In the next step, the subject *Lea* is added, cf. (33b). After existential closure of the referential event variable and binding the presuppositions, we get the truth conditions in (33c).

- (32) Lea hat mit dem Balancieren über das Hochseil die Show beendet.  
 Lea AUX<sub>perf</sub> with the balancing on the tightrope the show ended.

- (33) a.  $\llbracket \text{mit the balancing on the tightrope end the show} \rrbracket =$   
 $\lambda e \lambda \pi \exists! s \exists e' \exists e_k. \text{show}'(s, \pi) \wedge \text{end}'(e_k, s, \pi * \text{ARG}_1^{\text{end}} : \text{END}) \wedge \text{inst}'(e_k, e, \pi * \text{ARG}_2^{\text{inst}} : \text{END})$   
 $\wedge \exists! b. \text{BoT}'(b, \pi * \text{ARG}_1^{\text{BoT}} : \text{BALANCE}) \wedge$   
 $\text{o-elab}'(b, e', \pi * \text{ARG}_2^{\text{o-elab}} : \text{BALANCE} \bullet \text{END} \sqsubseteq \text{EVT} \sqcup \text{EVT-KIND}) \wedge \text{o-elab}'(e, e', \pi)$
- b.  $\llbracket \text{Lea mit the balancing on the tightrope end the show} \rrbracket =$   
 $\lambda e \lambda \pi \exists! s \exists e' \exists e_k. \text{agent}'(e, l, \pi) \wedge \text{show}'(s, \pi) \wedge \text{end}'(e_k, s, \pi * \text{ARG}_1^{\text{end}} : \text{END}) \wedge$   
 $\text{inst}'(e_k, e, \pi * \text{ARG}_2^{\text{inst}} : \text{END}) \wedge \exists! b. \text{BoT}'(b, \pi * \text{ARG}_1^{\text{BoT}} : \text{BALANCE}) \wedge$   
 $\text{o-elab}'(b, e', \pi * \text{ARG}_2^{\text{o-elab}} : \text{BALANCE} \bullet \text{END} \sqsubseteq \text{EVT} \sqcup \text{EVT-KIND}) \wedge \text{o-elab}'(e, e', \pi)$
- c. Existential closure of  $e$  and binding of the type presuppositions:  
 $\lambda \pi_1 \exists! b : \text{BALANCE} \exists! s \exists e' : \text{BALANCE} \bullet \text{END} \exists e_k : \text{END} \exists e_1 : \text{END}. \text{agent}'(l, e_1, \pi_1) \wedge$

$$\text{show}'(s, \pi_1) \wedge \text{end}'(e_k, s, \pi_1) \wedge \text{inst}'(e_k, e_1, \pi_1) \wedge \text{BoT}'(b, \pi_1) \wedge \text{o-elab}'(b, e', \pi_1) \wedge \text{o-elab}'(e_1, e', \pi_1)$$

The sentence in (32) denotes the event particular  $e_1$  that is an ending. It instantiates the event kind  $e_k$  of ending type.  $e_1$  has the agent Lea. Additionally, there is an individual  $e'$  of complex type that is typed as both an ending of the show and a balancing on the tightrope. Both the balancing on the tightrope  $b$  and the ending of the show  $e_1$  elaborate on the type of object that  $e'$  is.

Both the event kind and the event particular reading are generated from the same lexical entry for eventive *mit* and a condition on the syntactic environment to which it applies. In the event kind reading, the EMM is integrated into the event kind constituted by the matrix verb before event type closure applies. As the particular instantiation of the event kind is of the same type as the event kind it instantiates, the event particular and thus the referential argument of the VP is of complex type. In the case of event particular modification, the EMM targets the instantiation of a simple type event kind, i.e. the modified VP denotes a simply typed event particular that elaborates on a complex type introduced by the modifier.

## 5. Conclusion

EMMs constitute a tool to encode more specific and concrete information about the way in which an abstract event occurred. Eventive *mit* and its matrix event description were argued to refer to one event, but to conceptualize this event under two different aspects. This was modeled in terms of an accommodation of a dual aspect entity with two constituent eventive aspects: the modifier and the matrix event. Linguistically, EMM-constructions display the same properties as lexical dual aspect entities: they give rise to quantificational puzzles, support co-predication and allow for constituent types that are sortally incompatible with each other.

I presented syntactic and semantic evidence for the fact that EMMs have two different adjunction positions w.r.t. to the matrix verbal projection: They can be adjoined at the V- and the VP-level. At the V-level, EMMs access the conceptual information provided by the matrix predicate and manipulate the type of the referential argument projected from the matrix verb. In this position, EMMs are event kind modifiers and build a tight unit with their target. Hence, they contribute to the constitution of an ad hoc event kind. At the VP-level, EMMs add a specification of the abstract matrix event to an already full-fledged event description, which is the reason why they do not change the conceptual information contributed by the matrix predicate. That is, EMMs at the VP-level are modifiers of event particulars. In both positions, the meaning constitution proceeds compositionally. Eventive *mit* relates a generalized quantifier to a V- or VP-projection generating an event variable that is typed as dual aspect entity. The present account is, thus, a single-event account that builds on the concept of dual aspect entities: EMMs and their matrix predicates are taken to be two conceptualizations of one event.

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## Adjectives of veracity as vagueness regulators<sup>1</sup>

Melania S. MASIÀ — *Spanish National Research Council (ILLA-CSIC)*

**Abstract.** This paper discusses adjectives of veracity in Spanish (*verdadero* ‘true’ or *auténtico* ‘authentic’), which are intensifiers in prenominal position. I will argue that AVs are sensitive to the vagueness of the predicate and propose an analysis of AVs as domain restrictors that builds on Sassoon (2013).

**Keywords:** adjectives of veracity, vagueness, nominal gradability, prenominal position.

### 1. Introduction

Adjectives of veracity (AVs) such as Spanish *verdadero* ‘true’ or *auténtico* ‘authentic’, in prenominal position, signal that the referent of the subject (in (1), Paloma) is an outstanding exemplar of the category denoted by the noun (*artist*).

- (1) a. Paloma es una auténtica artista.  
Paloma is a authentic artist  
‘Paloma is a real artist.’

The intensification they perform involves some sort of ordering, so these modifiers raise questions regarding nominal gradability — whether (some) nouns have a degree argument or their scalarity is better captured in a non-degree framework — and the contributions of vagueness, typicality, and subjectivity.

In this paper I will argue that AVs are sensitive to the vagueness of the predicate they combine with. In particular, assuming a supervaluation framework (Sassoon 2013), I will propose that AVs are context manipulators that reduce the vagueness of the predicate by restricting the domain in which the noun’s standard is calculated, similarly to the modification of *very* in the adjectival domain. In this way,

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the standard rises and the denotation is shrunk to the best exemplars. Roughly, Paloma would be a true artist if she is an artist among artists.

The paper is organized as follows. In section 2 AVs' distribution and interpretation is characterized. Section 3 discusses two previous analyses based on degree and prototypicality. In section 4, I provide an analysis based on vagueness regulation and discuss the similarities with degree modifiers and possible extensions to adverbial counterparts of AVs. Section 5 concludes.

## 2. Distribution

Like most Romance adjectives, AVs can appear either in prenominal or postnominal position in Spanish, with a difference in meaning. In postnominal position, AVs show their expected, literal senses 'not fake or false', as shown in (2). In (2a), the pain Esther felt was real, not imaginary or pretended, and the same applies to the adventure in (2b). This is also the only meaning available in predicative position.

- (2) a. Esther sintió dolor auténtico. / El dolor era auténtico.  
 Esther felt pain authentic / the pain was authentic  
 'Esther felt real pain.' / 'The pain was real.' (not fake)
- b. Vivieron una aventura verdadera en Zambia. / La aventura es verdadera.  
 lived.3PL a adventure true in Zambia / the adventure is true  
 'They had a true adventure in Zambia.' / 'The adventure is true.' (not false)

In prenominal position, however, the readings are no longer the literal ones. Instead, AVs become intensifiers: they signal that the referent is an outstanding individual in the denotation of the noun. Thus, in (3a), the pain felt by Esther is an intense one, not simple discomfort, and the adventure in (3b) is one that included all the elements expected in an adventure: challenges, exoticism, danger.

- (3) a. Esther sintió auténtico dolor.  
 Esther felt authentic pain  
 'Esther felt real pain.'

- b. Vivieron una verdadera aventura en Zambia.  
 lived.3PL a true adventure in Zambia  
 ‘They had a true adventure in Zambia.’

In addition to their position, interaction with the determiner and the type of noun causes a difference in meaning as well. The intensifier reading of AVs seems to be only possible with an indefinite determiner in the case of relative nouns such as *father* or *identity*, as illustrated in (4). With these nouns and in combination with the definite article, AVs receive a literal interpretation (see (4a); cf. (5), where the AV is an intensifier). In (4a), Carlos is Ana’s actual father, so *verdadero* is interpreted in its literal sense; in contrast, in (4b), Carlos is said to be remarkably fatherly, regardless of whether he actually has a child.

- (4) a. Carlos es el verdadero padre de Ana.  
 Carlos is the true father of Ana  
 ‘Carlos is Ana’s true father.’  
 b. Carlos es un verdadero padre.  
 Carlos is a true father  
 ‘Carlos is a true father.’  
 (5) La verdadera aventura es la que vivieron en Zambia.  
 the true adventure is the that lived.3PL in Zambia  
 ‘The true adventure is the one they had in Zambia.’

AVs combine with abstract nouns such as *pain* in (3a), nouns denoting individuals based on a property such as *father* in (4b), event nouns such as *adventure* in (3b), as well as with some concrete nouns such as *city* in (6). The only restriction is that they not combine with nouns that denote natural kinds or concrete objects, such as the ones in (7).

- (6) Troya era una auténtica ciudad en el sentido clásico del término.<sup>2</sup>  
 Troy was a authentic city in the sense classic of-the term  
 ‘Troy was a real city, in the classic sense of the word.’

<sup>2</sup>[http://www.historialago.com/leg\\_troy\\_01015\\_comoera\\_01.htm](http://www.historialago.com/leg_troy_01015_comoera_01.htm)

- (7) a. ?? Vimos un verdadero pájaro / auténtica agua.  
           saw.3PL a true bird / authentic water  
           ‘We saw a true bird / real water.’  
       b. ?? Tengo una verdadera mesa / una auténtica pistola en mi despacho.  
           have.1SG a true table / a authentic gun in my office  
           ‘I have a true table / a real gun in my office.’

Intensifier AVs occur only in prenominal position and combine with almost any kind of noun, except for those denoting natural categories or concrete objects. Before moving to the analysis, I will first discuss two previous accounts of AVs in the literature and some additional empirical facts.

### 3. Ways of being an outstanding individual

There are different possibilities for characterizing an outstanding individual. In this section I will discuss two proposals in the literature, namely the degree analysis in Morzycki (2009) and the prototypical one in Morzycki (2011).

One way of formalizing the outstanding exemplar would be to understand it as an individual with a high degree of the property denoted by the noun. Morzycki (2009) implements this idea by assuming that some nouns lexicalize a degree argument, in the same fashion that adjectives do (e.g. Kennedy 1997). Gradable nouns would denote a measure function from individuals to their degree of the relevant property. For instance, *idiot* would denote a function from individuals to their degree of idiocy (8).

$$(8) \llbracket idiot \rrbracket = \lambda x. \iota d [x \text{ is } d\text{-idiotic}] \quad (\text{Morzycki 2009})$$

Tests of nominal gradability are based on modification by degree *such*, degree readings of size adjectives (*big*), and so-called adnominal degree morphemes (*real*, *complete*, *utter*) (Bolinger 1972; Morzycki 2009; Constantinescu 2011). Nouns that pass these tests are the most adjective-like ones, such as *idiot* or *courage* (9). With non-gradable nouns, *such* is interpreted in a kind sense, and *big* and *complete* receive their literal readings (big in size, and having all its parts, respectively) (10).

- (9) a. He is such an idiot / a big idiot / a complete idiot.  
 b. Lucía showed such courage / huge courage / utter courage.
- (10) a. # He's such a basketball player / a big basketball player / a complete basketball player.  
 b. # Chicago is such a city / a huge city / an utter city.

Being gradable, however, does not seem to be the feature relevant to being modified by AVs. The distribution of these modifiers contains gradable nouns like the ones in (11) but is not restricted to them, as they combine with nouns such as *city* (see (6), cf. (10b)), *father* (see (4b), cf. (12a)), and *bird* (see (16), cf. (12b)), in some contexts that will be discussed below.

- (11) un auténtico idiota / verdadera valentía  
 a authentic idiot / true courage  
 'a real idiot / true courage'
- (12) a. ?? a big / complete / utter father  
 b. # a big / complete / utter bird

A second option is that the outstanding individual referred to by *AV P* is an individual close to the prototype of the category denoted by the predicate *P*, so that AVs would manipulate scales of typicality (Morzycki 2011). Formally, an individual *x* would be a real *P* iff it is sufficiently similar to the prototype of the category, given by the **prototype** function, in a particular context *c*.

- (13)  $\llbracket \text{real} \rrbracket^c = \lambda P_{\langle e,t \rangle} \lambda x. P(x) \wedge \text{large}_c(\text{similar}_c(x, \text{prototype}(P)))$

In some cases, the individual denoted by *AV P* seems to be a prototypical exemplar, such as for *adventure* in (3b). However, this is not always true: In (14), it is felicitous to say that Paloma is a true artist, even if she is not a prototypical one (a painter who has her studio in an attic in Paris) but someone who crochets beautiful accessories.

- (14) Paloma es una verdadera artista: hace unas flores de ganchillo preciosas.  
 Paloma is a true artist: makes DET flowers of crochet beautiful  
 'Paloma is a true artist — she makes beautiful crochet flowers.'

Moreover, nouns that denote concepts with clear prototypes, such as *bird* or *fruit* (see e.g. Rosch 1973), do not usually combine with AVs (15). And even when they occur together, the phrase fails to point to that prototype: Example (16) is used to discuss the categorization of two types of Jurassic animals as birds, despite the fact that the animals are in fact not prototypical birds.

- (15) \* Vimos una verdadera ave / fruta.

saw.1PL a true bird / fruit

‘We saw a true bird / fruit.’

- (16) El Archaeopteryx y el Archaeornis no son animales intermedios entre estos dos  
The Archaeopteryx and the Archaeornis NEG are animals intermediate between these two  
grupos [reptiles y aves], sino auténticas aves.<sup>3</sup>

groups [reptiles and birds], but real birds.

‘Archaeopteryx and Archaeornis are not transitional animals between these two groups (reptiles and birds), but true birds.’

In addition, AVs have a different behavior from that of real modifiers of typicality such as *(proto)típico*, ‘prototypical’. The latter mainly occurs in postnominal position in Spanish, as shown in (17), and thus receives a restrictive interpretation.<sup>4</sup> As such, the negation of the DP is compatible with the inference that the noun, but not the adjective, is predicated of the individual. This is not the case with AVs, where the attribution of the property denoted by the noun is also negated.

- (17) a. Paloma es una artista (proto)típica.

‘Paloma is a typical artist.’

- b. ?? Paloma es una (proto)típica artista.

‘Paloma is a typical artist’

- (18) a. Paloma no es una artista (proto)típica → Paloma es una artista

‘Paloma is not a typical artist’ → ‘Paloma is an artist’

- b. Paloma no es una verdadera artista → Paloma es una artista

‘Paloma is not a true artist’ → ‘Paloma is an artist’

<sup>3</sup><http://statveritasblog.blogspot.com.es/2010/11/de-reptiles-aves.html>

<sup>4</sup>A restrictive interpretation implies that there are individuals that satisfy N but not A (i). It is generally assumed that, in Romance, pre-head modifiers receive a nonrestrictive interpretation, while post-head modifiers are interpreted restrictively [*Complementary hypothesis*] (see e.g. Alexiadou 2001; cf. e.g. Cinque 2010; Martin 2014).

(i) A modifier M restrictively modifies a head H wrt an individual  $x$  and a situation  $s$  iff

$$M_s(x) \wedge H_s(x) \wedge \exists x' [H_s(x') \wedge \neg M_s(x')]$$

(Martin 2014)

It has been shown that AVs are not restricted to alleged gradable nouns and that their intensification effect is not well captured in terms of prototype readings. However, the idea behind these analyses is right, and AVs require that there be some sort of ordering in the denotation of the modified noun. In the next section, these ideas are recast in a framework that uses supervaluations, and it is argued that an analysis based on domain restriction better explains modification by AVs. First, the empirical generalization will be made more precise.

#### 4. AVs as vagueness regulators

##### 4.1. AVs are sensitive to the vagueness of the predicate

What nouns such as *bird* or *table* from example (7) have in common is that they are discrete, i.e. categorization under them is not graded: something is either a bird or not a bird, or a table or not a table, and the criteria for determining that are objective, relatively constant across contexts, not dependent on opinion. On the other hand, whether something is to be considered an adventure is less easy to delimit and it is usually more subject to contextual or individual variation. In fact, other nouns denoting discrete concepts such as *father* or nationality nouns (*Russian*) can only combine with AVs if they are interpreted in a relative sense: Example (4b) cannot mean that Carlos is an outstanding individual in being a biological father.

The fact that AVs select non-discrete nouns (i.e., those for which there are not objective, completely established categorization criteria) or relative readings of discrete ones has implications in the subjectivity of the NP in which they appear. In particular, predicates that are usually objective, and thus are not allowed in the complement clause of a subjective attitude verb such as *find*, become felicitous in that position if an AV is inserted.

Subjective attitude verbs require that their complement clause express a subjective statement (Sæbø 2009; Bouchard 2012). Examples are English *find*, or Spanish *parecer* ‘seem’ when it takes a small clause complement and a dative argument that corresponds to the experiencer (see Fernández Leborans 1999). Examples in (19) show this contrast with adjectives and nouns, respectively.

- (19) a. Esta tarta me parece rica / ??casera.  
           this cake DAT.1S seem.3S tasty / homemade  
           ‘I find this cake tasty / ??homemade.’  
       b. Esther me parece un cielo / ??profesora / ??rusa.  
           Esther DAT.1S seem.3S a sky / teacher / Russian  
           ‘I find Esther to be a sweetheart / a teacher / Russian.’

Adding an AV makes the nouns in (19b) acceptable under subjective attitude verbs, as shown in (20). This only happens if the AV is in prenominal position, cf. (21).<sup>5</sup>

- (20) Esther me parece un(a) verdadero/a cielo / profesora / rusa.  
       Esther DAT.1S seem.3s a true teacher / Russian  
       ‘I find Esther to be a true teacher / Russian.’  
       (21) ?? Esther me parece una profesora / rusa auténtica.  
           Esther DAT.1S seem.3s a teacher / Russian authentic  
           ‘I find Esther to be a real teacher / Russian.’ (not fake)

Examples (15) and (16) show that AVs only occur with nouns that denote natural categories in some particular contexts, namely when the membership of the individual in the category is being discussed. The same applies to nouns denoting concrete objects, such as *table* from example (7b). Example (22) provides some more evidence.

- (22) a. Ceres fue considerado demasiado pequeño para ser un verdadero planeta.  
           Ceres was considered too small to be a true planet  
           ‘Ceres was considered too small to be a real planet.’  
       b. Tráeme una verdadera mesa, no esa cosa de IKEA que compraste.  
           bring-DAT.1SG a true table, NEG that thing of IKEA that bought.2SG  
           ‘Bring me a true table, not that IKEA thing you bought.’

<sup>5</sup>A second test for subjectivity involves faultless disagreement (see e.g. Lasersohn 2005; Stephenson 2007). Subjective predicates such as predicates of personal taste (*tasty*, *fun*) give rise to disagreement (both speakers seem to be saying something true) rather than contradiction (only one speaker can be right). NPs with AVs behave as subjective predicates (i-ii).

(i) A: Esther es profesora.  
       ‘Esther is a teacher.’

B: No, no lo es (es periodista).  
       ‘No, she isn’t (she’s a journalist).’

(ii) A: Esther es una verdadera profesora.  
       ‘Esther is a true teacher.’

B: No, no lo es (no motiva a sus alumnos).  
       ‘No, she isn’t (she doesn’t inspire her students).’



The relevant factor for combination with AVs is, then, that the cutoff point for the category denoted by the noun is not fixed, i.e. that the noun is vague. AVs would be able to reduce the vagueness of the predicate by shrinking the denotation to the best exemplars of the category — those for which there is no doubt that they belong to it. What we need then is a framework that relates vagueness to an ordering on the individuals in the extension of a predicate. Sassoon (2013) provides such a framework.

#### 4.2. Nominal conceptual gradability

Sassoon (2013) proposes a full vagueness model  $M_c$  whose context structure consists of a set  $C$  of partial contexts  $c$ , a monotonic relation of information extension between contexts, and a set  $T$  of maximal contexts  $t$ . Each predicate  $P$  is associated, in each total context  $t$ , relative to an assignment  $g$ , with a degree function **deg**( $P, t, g$ ) that maps individuals to their degree in the weighted dimensions of the predicate  $P$ .

For each partial context  $c$ , an entity  $x$ 's positive degree in  $P$  can be either unspecified or a real number ( $x$ 's degree in the predicate  $P$ ). A predicate is vague if, in a partial context  $c$ , there are entities in its domain for which the positive degree in the predicate is still unspecified (if it is still not clear whether they belong to the positive or the negative extension of  $P$ , that is, if they are borderline cases). In a total context  $t$ , all predicates are sharp, as all individuals in their domains have a value for **deg** and then belong either to the positive or the negative extension of  $P$ .

The membership standard represents the cutoff point between the positive and negative extensions of the predicate. It is given by a function **Standard** and it is determined based on a relevant set of entities for the predicate in a context, i.e., a domain. **Domain** is a function from a triple consisting of a context  $t$ , and assignment  $g$  and a predicate  $P$ , to a set of entities.

$$(23) \text{Standard}(P, t, g) = S(P, t, g, \text{Domain}(P, t, g))$$

For any entity set  $X \subseteq D$ ,  $S(P, t, g, X)$  is a salient degree of  $P$ ,  $P$ 's central tendency in  $X$

This framework gives nouns the same interpretative pieces as adjectives, such as a standard, a domain from which the standard is calculated, and a dimension set. The difference between nouns and adjectives would lie not on their types of dimensions, but on how these dimensions are integrated. In the case of adjectives, dimensions are bound by logical operations such as conjunction or disjunction. By contrast, dimensions of nouns are integrated through similarity operations like weighted sums. Classification of entities under a noun is based on similarity to the prototype, understood as the ideal values on multiple dimensions. As a consequence of this dimension integration rule, nominal dimensions are not syntactically accessible. This accounts for the conceptual gradability of nouns (prototypicality effects) and their lack of morphological gradability (inability to occur with degree morphemes such as *very* or in degree constructions such as comparatives) (see e.g. Sassoon 2013).

My proposal is that AVs take a vague predicate and manipulate the context. But instead of affecting the global context, AVs only have an effect in the denotation of the noun. So I will propose that AVs restrict the domain in which the standard for the predicate is calculated. By doing so, the standard rises and the positive extension is shrunk to the closest exemplars to the ideal values.

#### 4.3. AVs as domain restrictors

The way I propose AVs reduce the denotation of the noun to the best exemplars of the category is by restricting the domain to entities that are already in the positive extension of  $P$  in the context (24). The new standard for the predicate is thus calculated based on the set of entities that were already in its denotation in the context, i.e. the set of entities whose degrees in the dimensions of  $P$  already exceed the standard.

$$(24) \text{Standard}(\text{true}(P), c, g) = \mathbf{S}(P, c, g, \llbracket P \rrbracket^+)$$

AV  $P$  then denotes the property of exceeding the standard for the predicate  $P$  based on a domain that only includes individuals which already have the property  $P$  in

the same context (25).

$$(25) \llbracket \text{true } P \rrbracket = \lambda x. \mathbf{deg}(x, P, c, g) \succeq \mathbf{Standard}(\text{true}(P), c, g) = \\ = \lambda x. \mathbf{deg}(x, P, c, g) \succeq \mathbf{S}(P, c, g, \llbracket P \rrbracket^+)$$

Then, a sentence with an AV like the one in (14) would be true if the degree of Paloma in the predicate *artist* in context *c* is above the standard for *artist* in *c* taking only into account individuals who were already in the positive extension of *artist*, i.e. if Paloma is an artist among artists (26).

$$(26) \llbracket \text{Paloma is a true artist} \rrbracket = 1 \text{ iff} \\ \mathbf{deg}(\text{Paloma}, \text{artist}, c, g) \succeq \mathbf{S}(\text{artist}, c, g, \llbracket \text{artist} \rrbracket^+)$$

AVs raise the standard so the denotation is restricted to the best exemplars of the predicate, those entities ranking high in its ordered denotation. The intensification derives from the change of standard: individuals in the denotation of AV *P* have higher degrees in the dimensions associated with the noun.

The reason AVs do not combine with nouns denoting natural kinds or concrete objects (cf. (7)) is that these nouns have a fixed standard (usually specified by convention, especially with respect to natural classes such as *bird*), they are not vague, and restricting the domain does not change the cutoff point for the category. As was mentioned in section 4.1, when these nouns are used in a relative, metaphorical sense (i.e., categorization is based in non-objective dimensions), modification by AVs becomes possible again.

- (27) Juan es un verdadero pájaro.  
       Juan is a true bird  
       Lit. ‘Juan is a true bird.’ (he’s wily)

AVs seem to receive a literal interpretation in combination with the definite determiner, see (4a). However, this can be understood as an effect of the interaction of the semantics of AVs with the uniqueness requirement of the definite determiner.

In the denotation of the NP consisting of an AV and a noun there are only the outstanding individuals of the category. The definite determiner returns the unique individual for which the property denoted by *AV P* holds: the most outstanding individual, the only one that deserved to be considered *P* in that context. This applies to *adventure* in (5), where it is said that only what happened in Zambia should be considered an adventure, not any other event that might qualify as an adventure in more vague uses of the noun. The same can be said of (4a). In fact, a biological father is usually the referent of *el verdadero padre*, but it is not necessarily so: (28) can be said to an adoptive father.

- (28) Tú eres mi verdadero padre.  
 You are.2SG my true father  
 ‘You are my true father.’

#### 4.4. Privative adjectives

The basic idea of the analysis presented here is similar to that of Partee (2010) for privative adjectives such as *fake*. Partee (2010) argues that these adjectives do not entail the negation of the noun property, but they are a subtype of subsecutive adjectives that coerce the denotation of the noun to include fake entities.

The core idea is that, in the absence of *fake*, all referents of the predicate are understood to be real. *Fake* coerces the denotation of the noun into a looser interpretation so it includes fake entities. This applies to AVs: unless guns can be fake, it would be redundant to say that a gun is real. Note that, in this readings, these adjectives must occur postnominally in Spanish (30).

- (29) Esta pistola es falsa.  
 This gun is false  
 ‘This gun is fake.’
- (30) una pistola falsa / auténtica  
 a gun false / authentic  
 ‘a fake / real gun’

In our analysis, prenominal AVs also divide up the denotation of the noun into real and fake entities, but without any coercion, so individuals that were in the denotation of the noun in the context are excluded from it.<sup>6</sup>

#### 4.5. Comparison with *very*

The denotation I have presented for AVs parallels that of degree modifier *very*. *Very* manipulates the comparison class so that it is restricted to entities which are already in the denotation of the predicate so that a new (higher) standard is calculated. Specifically, it sets the comparison class argument for the function **standard** for a gradable adjective *G* to those entities that already have the property *G* in the context of utterance (31) (Klein 1980; Kennedy and McNally 2005, a.o.).

$$(31) \llbracket \text{very} \rrbracket^c = \lambda G \lambda x. \exists d [\text{standard}(d)(G)(\lambda y. \llbracket \text{pos}(G)(y) \rrbracket^c) \wedge G(d)(x)]$$

Just like English *very*, Spanish *muy* is a degree modifier of relative adjectives, see (32a). It also coerces non-gradable adjectives and even some particular nouns into gradable readings, as in (32b). The stereotypical readings of the nouns that arise in the last examples are in fact parallel to the effect AVs have in those nouns, cf. (33).

- (32) a. Marina es muy alta / ??muy desconocida.  
           Marina is very tall / very unknown  
           ‘Marina is very tall / ??very unknown.’  
       b. Juan es muy ruso / muy payaso / muy niño.  
           Juan is very Russian / very clown / very child  
           ‘Juan is very Russian / very clownish / very childish.’
- (33) Juan es un auténtico ruso / un auténtico payaso / un auténtico niño.  
       Juan is a authentic Russian / a authentic clown / a authentic child  
       ‘Juan is a real Russian / a real clown / a real baby.’

<sup>6</sup>This difference in the way the denotation of the noun is divided up (a difference in domain) seems to be an effect of the syntactic position of the adjective. It might be worth to investigate if it can be associated with more Romance adjectives that change their meanings in prenominal and postnominal position, such as the equivalents of *complete*, *poor*, or *good*. I leave this for future work.

*Very* and AVs also have in common that they may be iterated, though they cannot precede other degree modifiers, as illustrated in (34) and (35) (for *very*, see e.g. Kennedy and McNally 2005). Although (35b) is slightly odd, there is a big contrast with (35a), which is not acceptable.

- (34) a. \* I was {quite / really} very surprised.  
 b. I was [[very very] surprised].
- (35) a. \* Paloma es una {auténtica / realmente / muy} verdadera artista  
 Paloma is a authentic / really / very true artist  
 ‘Paloma is a {real / really / very} true artist.’  
 b. ? Paloma es una verdadera verdadera artista  
 Paloma is a true true artist  
 ‘Paloma is a true true artist.’

Their behavior with respect to negation is similar. There is an apparent contradiction in asserting that someone is tall but not very tall, as in (36a), with the intended meaning that she has a degree of tallness that lies between the standard for *tall* and the standard for *very tall*. This is even more odd in the case of *verdadero*, see (37a). Negation of *very* does not have this meaning, but it negates the predicate instead, see (36b) (unless *very* is stressed, see Bolinger 1972). The same effect happens when an AV is negated, cf. (37b).

- (36) a. ? Marina es alta pero no muy alta.  
 Marina is tall but NEG very tall  
 ‘Marina is tall but not very tall.’  
 b. Marina no es muy alta.  
 Marina NEG is very tall  
 ‘Marina is not very tall.’ (= she is rather short)
- (37) a. ?? Paloma es una artista, pero no una verdadera artista.  
 Paloma is an artist but NEG a true artist  
 ‘Paloma is an artist, but not a true artist.’  
 b. Paloma no es una verdadera artista.  
 Paloma NEG is a true artist  
 ‘Paloma is not a true artist.’ (= she is not an artist)

Although the facts about negation need to be analyzed in more detail,<sup>7</sup> the similarities between degree modifier *very* and AVs pointed out in this section indicate that the analysis presented here for AVs might be on the right track and might shed some light on the parallelisms between scale structures and intensification in the adjectival and nominal domain.

#### 4.5.1. Adverbs of veracity

Our analysis for AVs could be extended to their adverbial correlates *verdaderamente* ‘truly’, *autenticamente* ‘authentically’, and *realmente* ‘really’. If adverbs of veracity were sensitive to the vagueness of the predicate as well, it would be expected that they only occur with vague predicates, such as relative adjectives like the ones in (38), and not with non-vague predicates, such as total absolute adjectives, see (39) (gradable but not vague, see e.g. Kennedy 2007) or non-gradable adjectives (40). This prediction is borne out if the adjectives in (39) are interpreted in their relative, vague, sense (as in *The glass is very full*).

- (38) a. Marina es verdaderamente alta / guapa.  
           Marina is truly                      tall / beautiful  
           ‘Marina is trully tall / beautiful.’
- (39) a. El vaso está verdaderamente lleno / vacío.  
           the glass is truly                      full / empty  
           ‘The glass is truly full / empty.’  
       b. La ventana está realmente abierta / mojada.  
           the window is really              open / wet  
           ‘The window is really open / wet.’

<sup>7</sup>In particular, the fact that once *x is a P* is asserted, *x is not a true P* is an infelicitous continuation (37a). This patterns with the behavior of imprecision regulators, in the sense that, once the standard of precision is set, it is not easy to lower it. For instance, in (i), once *the townspeople are asleep* is interpreted with some precision, it is odd to make it less precise, i.e. not referring to all the towns people, excluding some citizens who are awake. This would bring AVs closer to slack regulators (cf. Masià 2014 for an imprecision analysis of AVs).

(i) # Although the townspeople are asleep, some of them are awake.

(Lasersohn 1999)

- (40) a. ?? Vanessa está verdaderamente embarazada.  
           Vanessa is truly pregnant  
           ‘Trully, Vanessa is pregnant.’ (not ‘in her last months of pregnancy’)
- b. ? Este problema es realmente geopolítico.  
       this problem is really geopolitical  
       ‘This problem is really geopolitical.’

Both in (38) and (39), adverbs of veracity have a standard boosting effect, similar to that of *very*. The question would be then why these modifiers have this effect in absolute adjectives, but are not able to coerce non-gradable adjectives such as *pregnant* into gradable ones, as *very* does in some cases (*Vanessa is very pregnant.*, but *?This problem is very geopolitical*). I leave this extension of the analysis for future work.<sup>8</sup>

## 5. Conclusion

In this paper I have provided an account of AVs based on domain restriction. Specifically, I have argued that these modifiers only combine with vague predicates and that they have a standard boosting effect similar to that of *very* in the adjectival domain. A higher standard for the noun is calculated based on entities that were already in its denotation.

I have assumed that nouns, like adjectives, have a standard or cutoff point between their positive and negative extensions that depends on a comparison class or domain in a supervaluation fashion, building on Sassoon’s 2013 framework. The similarities between *very* and AVs pointed out show that this might be a fruitful option for a better understanding of the semantic parallels between adjectives and nouns.

The analysis, however, left some issues open, especially regarding the connection between vagueness and subjectivity and how AVs being vagueness regulators turn

<sup>8</sup>Adverbs of veracity modify propositions as well (i) and have been analyzed as involving epistemic modality, in the sense that they express the commitment of the speaker towards the proposition (for an epistemic analysis of AVs, see Constantinescu 2011; cf. McNabb 2013, Masià 2014).

(i) Really, that’s quite good.

(Paradis 2003)



the noun into a subjective predicate. Another issue left for future research was the role of syntactic position in the type of modification an adjective performs in the noun. Other modifiers (e.g. *Completo* ‘complete’, whose adverbial counterpart (*completely*) is also a degree modifier) display a behavior similar to that of AVs with respect to position and could shed light on this topic.

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# On the morphosyntactic representation of dependent quantification: distance distributivity, dependent indefinites, and Skolemization<sup>1</sup>

Dejan Milačić — *McGill University*

Raj Singh — *Carleton University*

Ida Toivonen — *Carleton University*

**Abstract.** It is commonly assumed that distance distributive elements like binominal *each* are operators that may or may not be related to other instances of the word *each* (e.g., floated *each*). We propose instead that binominal *each* is a bound variable in the Skolem term denoted by the indefinite noun phrase that *each* appears adjacent to. We argue that this approach captures various generalizations about the distribution of distance distributive elements within and across languages, and in particular it unifies distance distributivity with dependent indefinites as instances of the more general idea that languages sometimes morphologically mark ‘dependent quantification.’

**Keywords:** distance distributivity; indefinites; typology; choice functions; Skolemization; variables; dependent quantification.

## 1. Introduction

The word *each* can appear as a prenominal quantifier (1a), as a floated quantifier (1b), or as a distance-distributive element (1c), so-called ‘binominal each’ (Safir and Stowell 1988).

- (1) a. PRENOMINAL: Each boy lifted a table.
- b. FLOATED: The boys each lifted a table.
- c. BINOMINAL: The boys lifted a table each.

The sentences in (1) are equivalent; they all assert that for each boy  $x$ , there is a table  $y$  such that  $x$  lifted  $y$ . At some level of logical analysis, then, they are  $\forall\exists$  sentences. How do these sentences come to have a  $\forall\exists$  meaning? This meaning is transparently reflected in the surface structure of (1a), but it is less so in (1b) and (1c). Consider (1c). If *each* is a distributive quantifier that universally quantifies over the set of boys, how does it manage to do this from a distance?

A quite straightforward analysis of (1c) is suggested by Heim et al.’s (1991) analysis of (1b). First consider a minimal variant of (1b) in which *each* has been removed, as in (2) below: the resulting sentence is ambiguous between a collective reading under which *the boys* refers to a

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plural individual, (2a), and a distributive reading under which the set of boys serves as the domain for a universal quantifier, (2b).

(2) The boys lifted a table.

- a. COLLECTIVE/REFERENTIAL READING: The boys collectively lifted a table.
- b. DISTRIBUTIVE/QUANTIFICATIONAL READING: The boys each lifted a table.

Note that the reading in (2b) is paraphrased by (1b). Furthermore, the surface forms of (2) and (1b) are similar, differing only in whether there is an overt *each*. It might thus be worth considering the possibility that (2) under its reading (2b) has the same logical form as (1b). Suppose we assume with Heim et al. (1991) that the reading in (2b) is derived by insertion of a covert distributive operator, *D*, whose meaning is identified with the meaning of floated *each*:  $[[D]] = [[each]]$ .<sup>2</sup> Structurally, it is assumed that *the boys* combines with *D* to create a universal quantifier *the boys D* whose meaning can be paraphrased as *the boys each*. The  $\forall\exists$  LF thus follows with the indefinite object remaining in the scope of the universal quantifier *the boys D* in (2b) and *the boys each* in (1b); the only relevant difference between them is whether the distributor is the covert *D* or its overt variant *each*. Assuming this, the LF for (1c) could be derived if *each* could swap its relative order with the VP, in (1c) *lifted a table*.

The proposal is clearly committed to the idea that floated and binominal *each* are the same lexical item, and that – despite surface appearances – these instances of *each* are different from prenominal *each* (see also Kobuchi-Philip 2006). Note also that under this analysis no new lexical entries are needed to accommodate binominal *each* into the grammar; the stipulations instead would all have to do with the rules that would allow *each* in (1c) to appear in surface form far away from its LF position (transparently realized in (1b)). Under the current analysis this might be due to principles governing overt movement or linearization of structures. There are other ways of avoiding lexical stipulations to accommodate binominal *each*. For example, Champollion (2012) posits floated *each* as the basic entry and derives others via type-shifting operations. Call any approach that aims to reduce binominal *each* to floated *each* a ‘reductionist operator’ account: under such proposals binominal *each* is an operator that is not listed in the lexicon as a separate entry, but is instead the result of the application of some grammatical rule to an already existing entry for floated *each*.

We think there are reasons to doubt that any such reductionist account is viable. As we argue in the next section, reductionist approaches are challenged by distributional evidence that binominal *each* is to be treated as something special, different from floated *each* and different from prenominal *each*. We remind the reader of some of this evidence in the next section. It is perhaps because of such observations that several analyses of (1c) have proposed a special lexical entry for binominal *each*. For example, after presenting empirical evidence against the analyses of Blaheta (2003) and

<sup>2</sup>Simplifying for present purposes, we assume  $[[D]] = \lambda X_e. \lambda P_{et}. \forall x \bullet \Box X : P(x)$  (here we interpret “ $\bullet\Box$ ” as ‘atomic-proper-part-of’).

Zimmermann (2002a), Dotlačil (2012) proposes that binominal *each* is an operator that functions as the determiner of *a table* in (1c), and it introduces a distributivity operator which, in effect, extracts the atoms of the plural subject in compositional interpretation and allows the sentence to assert that each of the boys lifted a table.<sup>3</sup> Call any approach that accounts for (1c) by positing a lexical entry for binominal *each* a *lexical operator* account. The problem for such an approach is not that it cannot explain the peculiar properties of binominal *each* that we highlight in the next section; instead, the problem is that it can explain too much, because the researcher is free to stipulate whatever facts are needed in the lexical entry itself. We will see in particular that there are cross-linguistic expressions of distance distributivity, such as so-called ‘dependent indefinites,’ that involve no distributive element at all but instead are expressed through reduplication. If the account of binominal *each* is to be unified with languages that use such mechanisms, it is difficult to see how lexical stipulations about the inventory of distributive operators could be helpful.

The goal of our paper is to take steps toward resolving this tension between description and explanation. We provide a perspective on binominal *each* which aims to (i) capture the ways in which it is different from prenominal and floated *each*, and (ii) unify it with cross-linguistic expressions of distance distributivity such as dependent indefinites. We will argue that we can make progress toward this goal with the assumption that natural languages sometimes mark dependent quantification, although they vary according to choices that we try to identify. Under our proposal, markers of distance-distributivity like binominal *each* are not operators but are instead bound variables. Together with independently motivated assumptions about existential quantification in natural language, we will suggest that the approach has some welcome consequences that might improve our understanding of the interaction between morphosyntax and quantifier alternations. However, the approach replaces stipulations about semantic entries with stipulations about the overt realization of syntactic forms, and the approach makes predictions that in some cases seem to be at odds with the facts. Nevertheless, we hope the questions that are raised are worth pursuing.

## 2. Is Binominal *each* special?

### 2.1. Distributional evidence that dissociates binominal *each* from floated and prenominal *each*

There are various observations about the distribution of binominal *each*, many of them from the syntactic literature, that we take to be essential to any characterization of distance distributivity. First, Safir and Stowell (1988) noted that, unlike other instances of *each*, binominal *each* (i) cannot occur with an intransitive verb (cf. (3)), (ii) cannot remain in-situ when the object is displaced (cf. (4)), and (iii) must attach to an indefinite noun phrase, i.e., a noun phrase that can be analyzed with existential quantification (cf. (5)).

- (3) Binominal *each* disallowed with intransitive verbs:  
 a. PRENOMINAL: Each boy walked.

<sup>3</sup>The theory is formalized in Plural Compositional DRT (Brasoveanu 2007).

- b. FLOATED: The boys each walked.
- c. BINOMINAL: \*The boys walked each.

(4) Binominal *each* cannot remain in-situ when object is displaced:

- a. PRENOMINAL: How many tables did each boy lift?
- b. FLOATED: How many tables did the boys each lift?
- c. BINOMINAL: \*How many tables did the boys lift each?

(5) Binominal *each* can only attach to an indefinite noun phrase:<sup>4</sup>

- a. PRENOMINAL: Each boy lifted {a table/two tables/the table/no table}.
- b. FLOATED: The boys each lifted {a table/two tables/the table/no table}.
- c. BINOMINAL: The boys lifted {a table/two tables/\*the table/\*no table} each.

From these and other observations, Safir and Stowell (1988) conclude that binominal *each* is syntactically contained inside the NP it appears adjacent to on the surface, and moreover this host must be an indefinite noun phrase.

Binominal *each* also behaves like an anaphor in the sense of the binding theory. In particular, like reflexives, binominal *each* is subject to Condition A (Dotlačil 2012; see also Hudson 1970; Kayne 1981; Burzio 1986):

(6) Binominal *each* must be locally bound:

- a. LOCAL BINDING: Mary said the boys lifted a table each./Mary said John loves himself.
- b. NON-LOCAL BINDING: \*The boys said Mary lifted a table each./\*John said Mary loves himself.<sup>5</sup>

Furthermore, note that binominal *each* doesn't seem to *add* anything to the sentences in which it occurs; for example, the meaning of (1c) is one of the readings of the corresponding sentence without *each* (sentence (2)). We know of no operators in natural language that manipulate the set of readings assigned to a sentence, but this is what binominal *each* seems to be doing.

This seems to be a peculiar combination of properties, and other *eachs* like floated *each* do not share all of them. This makes it less attractive to derive binominal *each* as an instance of floated

<sup>4</sup>This evidence is further supported by the results of a recent offline questionnaire (DiGiovanni et al. 2015).

<sup>5</sup>The first sentence cannot mean that each of the boys said Mary lifted a table, and the second sentence cannot mean that John said Mary loves him.

*each*. At the same time, it does not seem to be an accident that the *eachs* in (1) share the same overt form. For instance, the sentences in which they occur all express distributive universal quantification. In some other languages like Swedish the overt variants of *each* are not identical, but they are clearly related. For example, prenominal *each* is *varje* and binominal *each* is *var*, and there is also a possessive *varsin* that can be used to get at a similar meaning:

(7) Swedish *varje*, *varsin*, *var*:

- a. PRENOMINAL:  
**Varje** flicka drack en öl.  
 each girl drank a beer  
 ‘Each girl drank a beer.’
- b. POSSESSIVE:  
 Barnen läste **varsin** bok.  
 children.the read each.POSS book  
 ‘The children read a book each.’
- c. BINOMINAL:  
 Flickorna drack en öl **var**.  
 girls.the drank a beer each  
 ‘The girls drank a beer each.’

The words *var*, *varje*, *varsin* are closely related in overt form and meaning, and they seem historically related. The German determiner *each* is *jeder* and its distance-distributive element is *jeweils* (Zimmermann 2002b); these also seem related on their surface (we return to *jeweils* in section (2)). These observations might again call for a unified analysis of these different constructions. However, it is not clear how to reconcile this closeness with the cluster of properties identified above as peculiar to binominal *each*. Furthermore, once we turn away from Germanic languages we see a complete divorce between distance distributivity and the inventory of distributive quantifiers in the languages. Such languages continue to use morphological marking on indefinites to enforce a distributive reading of an otherwise ambiguous sentence, but the marker often bears no obvious relation to distributive quantifiers in the language. We now turn to some of this evidence.

## 2.2. Typological evidence that binominal *each* is part of a broader generalization

Many languages express distance distributivity with markers that are unrelated to prenominal and floated *each* but which nevertheless continue to share the cluster of properties identified for binominal *each*. For example, many languages express distance distributivity not by insertion of an apparently distributive lexical item, but by reduplication of the numeral in the indefinite noun phrase. For example, in East Cree (Junker 2000), just as in English, a sentence like *the boys*

*lifted two tables* displays a collective/distributive ambiguity (see (8a)), but unlike English, it disambiguates in favour of the distributive reading by reduplicating the numeral (see (8b); see also Farkas (1997) for Hungarian, Yanovich (2005) for Russian, Balasu (2005) for Telugu, a.o.).

(8) EAST CREE (JUNKER 2000):

- a. COLLECTIVE/DISTRIBUTIVE AMBIGUITY:  
 Peyakw waapiminh chii muweuch anchii awaashach.  
 one apple PAST eat those children  
 ‘The children ate one apple.’
- b. DISTANCE DISTRIBUTIVITY VIA REDUPLICATION:  
**Paah**peyakw waapiminh chii muweuch anchii awaashach.  
 REDUP.one apple PAST eat those children  
 ‘The children ate one apple each.’

What is crucial, again, is that there is a collective/distributive ambiguity which is resolved by adding some morphology to the (necessarily) indefinite noun phrase. English does this with insertion of a lexical item, and East Cree does this by reduplicating the indefinite determiner. In fact, even in languages that express distance-distributivity by insertion of a lexical item, the lexical item often has no surface relation to distributive quantifiers in the language. Instead, what remains essential is that the element needs to appear adjacent to an indefinite noun phrase and that it is interpreted in the scope of a universal quantifier. Consider the Slavic distance-distributive element *po* (Pesetsky 1982; Przepiórkowski 2008), illustrated in (9) with an example from Serbo-Croatian:

- (9) SERBO-CROATIAN *po*:  
 Dječaci su kupili *po* dvije kobasice.  
 boys AUX bought PO two sausages  
 ‘The boys ate two sausages each.’

First, note that *po* is morphologically distinguished from the distributive universal quantificational determiner *každoga*, and Slavic *po* is sometimes syntactically analyzed as a preposition.<sup>6</sup> Second, when Slavic *po* appears in subjects with a downstairs universally quantified object, the universal quantifier *must* outscope the indefinite (see (10); note that the surface string *jabloku* is consistent with a definite and an indefinite interpretation, but *po* disambiguates in favour of the indefinite):<sup>7</sup>

<sup>6</sup>For discussion see e.g., Kuznetsova (2005), Przepiórkowski (2008, 2010), Milačić (2014).

<sup>7</sup>See Przepiórkowski and Patejuk (2013) and Harves (2003) for relevant discussion; example (10) is in Russian, from Harves (2003).



- (10) *Po* ENFORCES A  $\forall\exists$  INTERPRETATION:  
*Po jabloku upalo s      každogo dereva.*  
 PO apple   fell   from every   tree  
 ‘A (different) apple fell from every tree.’

There seems to be no way around a  $\forall\exists$  reading when *po* occurs in a sentence. In fact, the higher universal quantifier need not even be overt. For example, in the Bulgarian example in (11) (from Champollion 2012), the higher quantifier is probably a higher covert universal quantifier over times/situations/events; for example, the intended meaning here is that every morning, there is a set of five miles that Mary runs before breakfast.<sup>8</sup>

- (11) HIGHER  $\forall$  CAN BE COVERT:  
*Mariya byaga po pet mili   predi   zakuska.*  
 Mary   runs   PO five miles before breakfast  
 ‘Mary runs five miles before breakfast (every morning).’

In fact, the German *jeweils* also seems to allow distribution over individuals and – when there is no overt quantifier over individuals – also over times/events/situations (Zimmermann 2002b):

- (12) GERMAN *jeweils* DISTRIBUTES OVER INDIVIDUALS AND TIMES:
- a. INDIVIDUALS:  
*Die Jungen kauften **jeweils** drei   Würstchen.*  
 the boys   bought each   three sausages  
 ‘The boys bought three sausages each.’
  - b. TIMES:  
***Jeweils** ein   Apfel war verrottet.*  
 each   one apple was rotten  
 ‘One apple was rotten each time/in each basket.’

When the higher universal quantifier is covert, as in (11) and (12b), the context provides a domain, but the *force* of the quantifier is universal.

<sup>8</sup>For the purposes of this paper we will not take a stance on what the domain is in these cases. They are abstract, contextually determined entities that are universally quantified over. See Lewis (1975) and Heim (1990) (among others) for arguments that covert universal quantifiers of this kind might be needed for independent reasons.

### 2.3. Summary

We have seen that binominal *each* has distributional restrictions that suggest it should not be assimilated with floated or prenominal *each*. At the same time, cross-linguistically we find that distance-distributive markers need not have any connection to distributive quantifiers in the language (e.g., they can be numerals). Instead, they are required to occur on indefinite noun phrases and they enforce a  $\forall\exists$  interpretation. At the same time, languages differ in the ways in which these constraints are satisfied. For example, some languages mark the indefinite with a new lexical item while others reduplicate the numeral. Languages also differ concerning constraints on the higher universal quantifier: English requires the binder to be a locally c-commanding quantifier over individuals, while Slavic allows covert quantifiers over times. In the next section we propose that these constraints teach us that natural language provides certain morphosyntactic means for expressing *dependent quantification* in ways that we hope to make precise.

### 3. Morphological marking of dependent quantification

What we have cross-linguistically is a class of sentences that receive a  $\forall\exists$  interpretation when  $\exists$  is morphologically marked (e.g., *the boys lifted a table each*), and the sentence without this marking (e.g., *the boys lifted a table*) can also receive a  $\forall\exists$  interpretation as one of its readings. Call the marked sentence  $S^+$  and the unmarked variant  $S^-$  (we will use  $S^-$  to refer to either the sentence or to its distributive reading – we hope no confusion arises). The intuition we would like to pursue is that the equivalence between  $S^+$  and  $S^-$  is formally represented. Specifically, we suggest that  $S^+$  and  $S^-$  are alternative pronunciations of the same LF. Crucially, under our proposal distance distributive elements are *not* overt realizations of the covert distributor  $D$ , nor do they realize any other distributive operator. Instead, we propose that they are the overt realization of a variable that is also present but unpronounced in  $S^-$ . This is a stipulation about the syntax-phonology interface, but we believe it can be made natural – reducing to a local choice – with antecedently motivated assumptions about existential quantification in natural language, and in particular with the assumption that *dependent quantification* can be explicitly represented in the grammar.

Before analyzing  $S^+$  and  $S^-$ , consider more transparent  $\forall\exists$  sentences like (13a) (= (1a)) and its familiar first-order logic representation in (13b) (we assume restricted quantifier notation):

(13)  $\forall\exists$  SENTENCES:

- a. Each boy lifted a table.
- b.  $[\forall x : boy(x)][\exists y : table(y)](lifted(x, y))$

An important property of  $\forall\exists$  quantifier-alternations is that choice of witness for the existential quantifier *depends* on choices made for the universal quantifier: choices of tables will vary with choices of boys. In  $\exists\forall$  alternations there is no such dependence (cf. *there is a table that was*

*lifted by each boy*). The notation in (13b) does not formally represent this dependence between the variables, but the so-called ‘Skolem Normal Form’ of (13b) does: it articulates in the LF itself that there is a function  $f$  such that for each boy  $x$ ,  $f(x)$  is a table associated with individual  $x$  and  $x$  lifted  $f(x)$ ; the sentence is true just in case there is such a function (i.e., just in case there is a Skolem function for the sentence).<sup>9</sup>

(14) SKOLEMIZATION:

$$\exists f[\forall x : \text{boy}(x)[(\text{lifted}(x, f(x, \text{table})))]]$$

It is known that whenever (13b) is satisfiable (14) is too.<sup>10</sup> Thus, there are two quite plausible candidates for the ‘right’ representation of *each boy lifted a table*: (13b) and (14). Is there any reason to pick one representation over the other? There is a large literature on the relative (dis-)advantages of a choice-functional treatment of indefinites (Skolemized or not), including the apparent island-escaping behaviour of indefinites, and the (im-)possibility of branching quantification.<sup>11</sup> We will not enter that important discussion here. However, we hope our discussion here might be relevant to it. Specifically, we believe access to Skolem functions, as in (14), might allow us to unify dependent-indefinites and distance-distributivity as instances of the following generalization:

(15) MORPHOLOGICAL MARKING OF DEPENDENT QUANTIFICATION:

Languages may optionally mark dependent quantification.

Recall from our discussion above that  $\forall\exists$  is the only case of dependent-quantification in first-order logic.<sup>12</sup> It is thus unsurprising that these are precisely the configurations that give rise to this apparent optionality, as evidenced by the optional marking of  $\exists$  in sentences like *the boys lifted a table (each)*. Our proposal is that the distributive reading of *the boys lifted a table* ( $= S^-$ ) and *the boys lifted a table each* ( $= S^+$ ) both have the LF in (14), and that the optional pronunciation is possible because of (15). The higher universal quantifier is generated by *the boys*  $D$  (where

<sup>9</sup>More generally, every first-order formula has a Skolem Normal Form. First, any first-order formula can be converted into a prenex normal form with a string of universal quantifiers followed by a string of existential quantifiers. Skolemization eliminates all existential quantifiers and replaces them with Skolem terms, functions  $f$  which take as input values for the universal quantifier governing the eliminated existential and returning values for the existential that make the proposition true. For example, the Skolem Normal Form for  $\forall x\exists y\forall u\exists w(R(x, y, u, w))$  is  $\exists f\exists g\forall x\forall u(R(x, f(x), u, g(x, u)))$ . When the existential outscopes any universal quantifier, e.g., in a  $\exists\forall$  configuration, the Skolem term returns a constant. For example, the Skolem Normal Form for  $[\exists x : Ax][\forall y : By](R(x, y))$  would be  $\exists f[\forall y : By](R(f(A), y))$ . Here the function is a pure choice-function.

<sup>10</sup>The following statement is equivalent to the Axiom of Choice (e.g., Bell 2009):  $[\forall x \in A][\exists y \in B](R(x, y)) \Rightarrow \exists f : A \rightarrow B[\forall x \in A](R(x, f(x)))$ .

<sup>11</sup>On the connection to exceptional scope, see e.g., Reinhart (1997); Winter (1997); Schwarz (2001, 2004); Chierchia (2001); Schlenker (2006); Matthewson (1999); Kratzer (1998). On the connection to branching quantification, see e.g., Hintikka (1973); Barwise (1979); Sher (1990); Schlenker (2006).

<sup>12</sup>Natural languages of course extend beyond the resources of first-order quantification. See section 4.

$D$  is a distributor, cf. note 2), and the lower indefinite *a table (each)* realizes the Skolem term  $f(x, table)$ .<sup>13</sup> The variable  $x$  can be realized as zero, resulting in  $S^-$ , or it can be realized as *each*, in which case  $S^+$  is produced. Of course if the variable is left unrealized, the sentence  $S^-$  is ambiguous between a collective and a distributive reading; on the collective reading, there is no quantifier-dependence, and the indefinite is thus a pure choice function:  $f(table)$  (see note 9).

More generally, we follow Steedman (2011) in assuming that indefinites like *a table* denote *variable-arity* Skolem terms:  $f(x_1, \dots, x_k, table)$ ,  $0 \leq i \leq k$ . We furthermore assume that  $x_i$  is licensed as an input to  $f$  only if there is a higher universal quantifier  $\forall x_i$  (cf. \**Mary read a book each*). Thus it will always be possible to understand *a table* as denoting  $f(table)$  (corresponding to so-called ‘wide-scope indefinites’), but if there is a higher universal quantifier  $\forall x_i$  it may be possible to understand *a table* as  $f(x_i, table)$ . How many variable arguments can there be in a Skolem term? Formally any number from 0 (a Skolem constant) to the number of higher universal quantifiers is allowed. However, there are reasons to think the higher quantifiers (if any) that may govern variables in the Skolem term are tightly constrained. First, because of the Condition A facts noted in section (2.1), the variable arguments to Skolem terms (in English) must be specified as anaphors in the sense of the binding theory, and thus only *locally* c-commanding quantifiers may govern a variable in a Skolem term. A universal quantifier that is too far up will not be able to do this. For example, there is no distributive reading of *the boys said Mary lifted a table* (this sentence cannot mean that the boys each said Mary lifted a table; there is a single, collective telling event). Second, when there are *two* possible governing quantifiers, it seems that the grammar forces speakers and hearers to pick one. For example, in (16c) below, the sentence cannot mean that each teacher gave each student a possibly different book, even though *the teachers* and *the students* can both bind into *a student each* (cf. (16a), (16b)). The sentence either means that each teacher gave the collection of students a (possibly different) book, or it means that the teachers collectively gave each student a (possibly different) book; only one binder seems to be permitted.

(16) ONLY ONE GOVERNING QUANTIFIER ALLOWED:

- a. The teachers gave Mary a book each.
- b. Mary gave the students a book each.
- c. The teachers gave the students a book each.

For the moment, we therefore tentatively assume that there can be maximally one binder, i.e., that  $0 \leq k \leq 1$ .

In the appendix we provide a more explicit statement about our assumptions concerning the syntax, semantics, and pronunciation of Skolem terms. Here we would like to highlight ways in which the

<sup>13</sup>As noted earlier (note 9), Skolem terms generally have variable arity. The terms can be  $f(table)$ ,  $f(x_1, table)$ ,  $f(x_1, x_2, table)$ , and so on. We will see evidence below that natural languages constrain the arity of these functions. See also the appendix.

approach captures the generalizations discussed in section (2). First, the observation that only indefinites can host binominal *each* follows from the independently motivated assumption that indefinites denote Skolem terms and nothing else does. Second, the binding facts follow from the assumption that English binominal *each* is a bound-variable (NB: the variable must be stipulated to be an anaphor). We might thus expect to find variable-like behaviour in other constructions. For example, we seem to find crossover effects with binominal *each*:

(17) CROSSOVER EFFECTS:

- a. A table was lifted by the boys. (only collective reading allowed)
- b. A table {*\*each*} was lifted by the boys.

Finally, the connection to so-called ‘dependent indefinites’ is clear: given (15), languages may mark dependent quantification, but it seems they have options concerning the way in which this is done.<sup>14</sup> At the moment, the typology suggests that there are two ways of marking this dependence: reduplicating the indefinite (RED) or inserting a new lexical item (LI). Languages also differ in the constraints on the domain of the higher universal quantifier (see Champollion 2012): all languages allow the higher quantifier to quantify over individuals, but some are restricted to distributing only over individuals (I), while some also distribute over times/situations/events (T), while some further allow quantification over worlds (W) (we seem to have an implicational hierarchy: any language that allows distribution over worlds also allows distribution over times, and any language that allows distribution over times also allows distribution over individuals). We can thus state the typology in terms of the two independent choices: how the indefinite is marked vs what may be quantified over. In (18) we present a table showing the possible choices a language can make, together with examples of languages known to us that make one or the other choice.

(18) TYPOLOGY: MARKING  $\exists$  VS CONSTRAINTS ON DOMAIN OF  $\forall$ :

	RED	LI
I	Hungarian (Farkas 1997)	English (Champollion 2012)
T	Telugu (Balasu 2005)	German (Zimmermann 2002b)
W	?	Russian (Pereltsvaig 2008)

To illustrate, we have seen that English is a  $[I, LI]$  language. Given our discussion in section (2) languages like Serbo-Croatian and German are  $[T, LI]$  languages. We fill out the cells of the table with examples of languages that have been documented in detail elsewhere (for reasons of space we avoid fuller discussion, and we refer the reader to the relevant literature). At the moment, we do not know of any  $[W, RED]$  language, but the possibility of such a language is suggested.

<sup>14</sup>Thus, unlike the approach in Brasoveanu and Farkas (2011), which takes quantifier *independence* as central (following Hintikka’s Independence-Friendly Logic), we take quantifier dependence as central, and Skolem functions are a central way of making this dependence explicit. We hope to return in future work to a fuller comparison.

#### 4. Concluding remarks

We have proposed to unify distance distributivity with dependent indefinites as instances of the more general idea that languages can mark dependent quantification. Under our proposal, distance-distributive elements are not operators, but are instead the overt realization of a bound variable in a Skolem term. No new semantic machinery is assumed, but the data here seem to argue for a choice-functional treatment of indefinite noun phrases. In fact, the representation of quantifier-dependence via Skolem functions takes choice to be central to quantification more generally; choices of values for  $\exists$  will vary with choices for values for  $\forall$ .

Many questions are raised. For example, the approach predicts that as far as the grammar is concerned any  $\forall\exists$  configuration should allow for marking of  $\exists$ . Thus, a sentence like (19) should be acceptable:

(19) #/? Every boy read a book each.

Some speakers report the sentence as acceptable (see Szabolcsi 2010 for discussion), which might be taken as support for our proposal. Unfortunately, the sentence seems marked to many speakers, at least compared with the perfect (1c). If these negative judgments are representative, they would need to be explained. Dotlačil (2012) suggests an economy condition on the use of binominal *each*: it may be used only if the sentence without it is not already distributive. In a sentence like (19), overtly realizing *each* seems to serve no function, but it is not clear why this should matter if the LF has a variable inside there anyways. We hope to return to this in future work.

A further question concerns possible extensions to c-commanding quantifiers other than  $\forall$ . The core of our proposal concerns quantifier-dependence: choices of values for existential quantifiers depend on choices of values for other variables. There seems to be no *a priori* reason why this should be limited to  $\forall\exists$  configurations. Again, more data are needed to see the appropriateness of quantifiers other than  $\forall$ , but here we report our judgments on some potentially interesting cases:

(20) {#Many/#most/#no/three} boys read a book each.

Finally, we might also inquire into constraints on which functions  $f$  are admissible (see e.g., Kratzer 1998). For example, there is a strong intuition that  $f$  must be ‘one-to-one,’ and there are suggestions that in Swedish this is mandatory (e.g., Teleman et al. 1999).

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## A. Appendix for binominal *each* in English

### (21) INDEFINITE NOUN PHRASES: SYNTAX-SEMANTICS

- a. The LF representation of an indefinite NP  $a(n) B$  is a variable-arity Skolem Term, with variation assumed here to be limited to either nullary Skolem terms ( $= f(B)$ ) or unary Skolem terms ( $f(x, B)$ ).
- b. A nullary Skolem term  $f(B)$  is a choice-function on  $B$ , and a unary Skolem term  $f(x, B)$  is a function mapping individual  $x$  and set  $B$  to an element of  $B$ .
- c. A choice function is a function such that for any non-empty set  $P$ ,  $f(P) \in P$ .
- d. A unary Skolem term  $f(x, B)$  is licensed only if the constituent  $a(n) B$  is locally c-commanded by an occurrence of  $\forall x$ .

### (22) INDEFINITE NOUN PHRASES: SYNTAX-PHONOLOGY

- a. Constituent  $f(B)$  is pronounced  $a(n) B$ .
- b. Constituent  $f(x, B)$  is pronounced  $a(n) B$  (*each*).
- c. Among the set of phonological rules governing the pronunciation of variables, there is the following context-sensitive rule:  

$$x \rightarrow \{\emptyset, \text{each}\} / f(\_, Z) \text{ (} x \text{ is any variable ranging over individuals and } Z \text{ is any string).}$$

## ***Unless*: an experimental approach**

Perna Nadathur — Stanford University

Daniel Lassiter — Stanford University

**Abstract.** The semantics of *unless* has posed a challenge for compositional theories of semantics, and its role as a restrictor of quantifiers is a source of empirical as well as theoretical controversy. We report on an experiment which tests the predictions of the prominent “exceptive” account of *unless*, in particular with respect to how it differs from *if not*. Our results reveal categorical as well as graded patterns of difference between the two conditionals. These patterns falsify previous accounts and motivate a new theoretical picture in which the compositionality issue does not arise, and presupposition and implicature play a central role.

**Keywords:** conditionals, presupposition, conditional perfection, *unless*, compositionality

### **1. Introduction**

The connective *unless* is often cited as a potential counterexample to semantic compositionality, on the grounds that it contributes a different meaning when embedded under positive quantifiers than it does under negative ones (Higginbotham 1986; Janssen 1997; Szabó 2008). In its most up-to-date form, the problem is that *unless* seems to contribute a biconditional meaning in positive contexts, but only a unidirectional conditional meaning in negative ones (see (1); Leslie 2008). An account of *unless* is consequently of some interest with respect to the status of compositionality: the challenge is to develop a semantics which reflects the perceived strength of *unless* statements (versus *if not*), but also captures the contextual split in (1).

- (1) a. Every student will succeed unless he goofs off.  
*All students who don't goof off succeed, and all students who goof off don't succeed.*
- b. No student will succeed unless he works hard.  
*No student who doesn't work hard succeeds (but hard work doesn't guarantee success).*

The best previous approach to this problem treats *unless* as an exceptive operator on quantifier domains (von Stechow 1992). In its most current form (due to Leslie 2008), the exceptive account handles the compositionality question by exploiting formal differences between positive and negative quantifiers to build the biconditionality/unidirectionality split directly into the semantic form of *unless*. This account makes a number of as-yet unexplored predictions about interpretive differences between *unless* and *if not*. We report here on an experimental test of these predictions using sentences with *every* and *no*. Our results reveal a number of empirical issues for existing exceptive theories: semantic biconditionality is too strong a requirement with *every*, but unidirectionality is too weak to account for certain contexts in which *if not* is acceptable and *unless* is not.

Our results argue for three main conclusions. First, while the perception of a positive/negative split in (1) reflects an empirical reality, this is not a difference in asserted content, and *unless* is not noncompositional. Second, *unless* encodes a prohibition on use in “Across-the-Board” contexts: *q unless p* is infelicitous when *q* holds unconditionally. We argue that this prohibition is presuppositional. Third, the biconditional interpretation is a *conditional perfection* phenomenon (Geis and Zwicky 1971), which affects both *if not* and *unless* and leads to reduced (but non-zero) acceptability in contexts intermediate between biconditional (*q* iff *not p*) and Across-the-Board (*q*). This leads to a new empirical puzzle: the pragmatic inference to conditional perfection is stronger with *unless* than *if not*, but only under the positive quantifier *every* – no difference arises under *no*. We conclude by describing this puzzling phenomenon and suggesting some directions for future work.

## 2. Unless and biconditionality

### 2.1. Exceptionality: previous accounts

Classically, *unless* is equated with the negative material conditional *if not* (e.g. Quine 1959). This produces an incorrect interpretation when embedded under negative quantifiers (Higginbotham 1986).<sup>1</sup> Many alternatives have been suggested: for example, Clark and Clark (1977) claim that *q unless p* is *q only if not p*, while Fillenbaum (1986) proposes *p only if q*. These proposals reflect an intuition that *unless* is stronger than *if not*, as Dancygier (1985) argues explicitly: on her account, *q unless p* asserts *q* while acknowledging *p* as an exception to the rule (see also Geis’s (1973) comparison of *unless* to *except if*). The core idea is that *q unless p* not only reports that *q* is true when *p* is false, but also draws attention to potential uncertainty regarding *q* when *p* holds.

Von Fintel (1992) implements this analysis by treating *unless* as an exceptive operator on quantifier domains (cf. *except for* in “Everyone except for John left”). On this view, an *unless*-statement is a conjunction of two assertions: one making a (quantified) generalization over a domain from which the *unless*-complement is subtracted, and a second stating that this complement represents the unique smallest set on which the generalization fails. Letting *Q* represent the interpretation of the quantifier, *C* its restriction, *M* its nuclear scope, and *R* the *unless*-complement or excepted set:

(2) **Analysis based on von Fintel 1992:**<sup>2</sup>

$$Q[C]M \text{ unless } R := Q[C - R]M \wedge \forall S \subseteq C : Q[C - S]M \rightarrow R \subseteq S$$

(3) Every student will succeed unless he goofs off.

$$\text{ALL}[\text{STUDENT} - \text{GOOF}]\text{SUCC} \wedge \forall S \subseteq \text{STUDENT} : \text{ALL}[\text{STUDENT} - S]\text{SUCC} \rightarrow \text{GOOF} \subseteq S$$

<sup>1</sup>This is a familiar problem with material implication in conditional semantics; see Higginbotham (1986) for details.

<sup>2</sup>Von Fintel’s original proposal is stated for those cases where *Q* is a modal quantifier (adverbial or otherwise). He does not provide an explicit formula interpreting *unless*-statements with a nominal quantifier, so there is some uncertainty as to how to adapt the proposal for these cases. Leslie (2008) shows that allowing the quantifier to take wide scope over a (covert) universal modal quantifier results in the same problem as the classical account. Given these considerations, (2) seems to us to be the most plausible extension of von Fintel’s proposal for the cases at hand.

This gives us the interpretation in (3) for (1a), where STUDENT represents the students, GOOF the individuals who goof off, and SUCC those who succeed. The first conjunct asserts that all students who do not goof off are successful. The second clause (*uniqueness*) produces the effect of the reverse conditional (all *M*s are not *R*s), by stipulating that students who goof off are necessarily excluded from any arbitrary set containing only successful students. This entails that no students who goof off succeed. Von Fintel's exceptive account thus gives us biconditionality for (3).

Von Fintel also predicts biconditionality with *no*. For (4) we have: no student who does not work hard will succeed, and no student who works hard is contained in any set of unsuccessful students. Consequently, working hard is both necessary and sufficient for success.

- (4) No student will succeed unless he works hard.

$$\text{NO}[\text{STUDENT} - \text{WORK}]\text{SUCC} \wedge \forall S \subseteq \text{STUDENT} : \text{NO}[\text{STUDENT} - S]\text{SUCC} \rightarrow \text{WORK} \subseteq S$$

Leslie (2008) claims that this is too strong, and provides a number of supporting examples. To take a parallel case, suppose we are discussing a university course that is notoriously difficult. We know that students taking this class must work very hard to pass, but in some cases even this may not suffice. In this context, (4) seems to be neither invalid nor infelicitous. This suggests that, in (4), working hard should only be necessary for success, and crucially not sufficient. Leslie captures non-sufficiency under the negative quantifier by modifying the second (uniqueness) clause as in (5). Since *no* is symmetric — *No A*s are *B*s  $\equiv$  *No B*s are *A*s — this has the desired result of preserving biconditionality under *every* but eliminating it under *no*, as shown in (6).

- (5) **Leslie's proposal:**<sup>3</sup>

$$Q[C]M \text{ unless } R := Q[C - R]M \wedge Q[\mathbf{C} \cap \mathbf{M}](\neg \mathbf{R})$$

- (6) a. Every student will succeed unless he goofs off.

$$= \text{ALL}[\text{STUDENT} - \text{GOOF}]\text{SUCC} \wedge \text{ALL}[\text{STUDENT} \cap \text{SUCC}](\neg \text{GOOF})$$

*All students who don't goof off succeed, and all students who succeed don't goof off.*

- b. No student will succeed unless he works hard.

$$= \text{NO}[\text{STUDENT} - \text{WORK}]\text{SUCC} \wedge \text{NO}[\text{STUDENT} \cap \text{SUCC}](\neg \text{WORK})$$

*No student who doesn't work hard succeeds, and no student who succeeds doesn't work hard.*

Equivalently: *No student who doesn't work hard succeeds.*

<sup>3</sup>Due to space limitations, some of the details of Leslie's account have been glossed over here. Crucially, Leslie holds that *unless* can restrict nominal quantifiers as well as quantificational adverbs, and this is reflected in (6).

## 2.2. Biconditionality as a pragmatic inference

Although Leslie's modification certainly improves matters for negatively-quantified *unless*-statements, it does not seem to go far enough. Pushing farther on the idea that a biconditional interpretation is not always correct for *unless*, we find naturally-occurring examples such as the following:

- (7) Mantou is always late unless she's already out before we meet, but she's often just less late then.

On both exceptive proposals, the pre-comma clause of (7) requires that all relevant situations are (a) such that Mantou is late if she's not already out, and (b) she is not late if she is out. However, the *but*-clause specifies that at least some of the situations where Mantou is out are ones in which she is still late, albeit less so. On these theories, (7) ought to appear as contradictory as (8).

- (8) #Roses are always red and violets are always blue, but sometimes violets are not blue.

This difference shows that uniqueness is *defeasible*, and thus is not entailed by *unless*. Crucially, though, if the *but*-clause is suppressed there is a strong tendency to interpret (7) biconditionally. This suggests that uniqueness may be a pragmatic inference.

Nadathur (2014a) provides empirical arguments for viewing uniqueness as a conversational implicature. (9a) shows it can be reinforced without redundancy and (9b) shows that it can be questioned without contradiction. Along with defeasibility, these properties are normally associated with implicatures, and are incompatible with any theory treating uniqueness as an entailment.

- (9) a. "Always be yourself, unless you are Fernando Torres. Then, always be someone else."  
(vs: "Always be yourself, unless you are Fernando Torres. #Otherwise, always be yourself.")  
b. "The answer is no unless you ask. If you do ask the answer might be no."  
(vs: "The answer is no unless you ask. #If you don't ask the answer might be yes.")

Nadathur (2014a) also shows that uniqueness — specifically, the *not ... if* direction of biconditionality — can be *backgrounded* without redundancy (ex 10) and does not cause infelicity when it is suspended prior to an *unless*-statement (ex 11). These properties rule out a conventional implicature classification (cf. Potts 2005) and a presuppositional treatment of uniqueness, respectively.

- (10) John won't fail if he studies. He will fail unless he studies.  
(vs: John is a student. John, ?the student, will fail unless he studies.)

- (11) The student might not fail if he studies, but he'll fail unless he studies.  
(vs: ?There might not be a student, but the student will fail unless he studies.)

Descriptively, uniqueness is best classified as a generalized conversational implicature (GCI). As well as being defeasible, reinforceable, and questionable, it seems to arise by *default* when it is not directly blocked, as is characteristic of GCIs á la Levinson 2000). It also bears a striking resemblance to *conditional perfection* (the biconditional interpretation given to certain *if*-conditionals; Geis and Zwicky 1971), which is usually regarded as a GCI (see e.g. van der Auwera 1997).

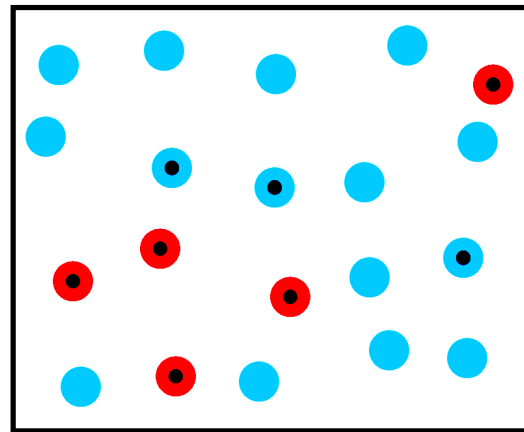
### 3. Marbles and dots: an experimental investigation

We are faced with a puzzling collection of intuitions about *unless*. There is some empirical difference between *unless* and *if not*, and it seems to reside in the stronger tendency of the former toward biconditionality. At the same time, the *not if* direction is apparently cancelable with *unless*, and thus not an entailment; but if it is merely an implicature, it is unclear why it should be stronger with *unless* than *if not*. The puzzle is rendered more complex by the need to account for the divergence between *unless* under *every* and under *no*. Having rejected a semantic uniqueness clause in favour of a pragmatic account, we can no longer rely on Leslie's elegant explanation of the asymmetry.

This section reports on an experiment with two main motivations. First, as section 2 demonstrates, any analysis based only on a small set of intuitions (even from corpus-drawn data) is empirically limited: in particular, such intuitions do not distinguish easily between semantic and pragmatic aspects of interpretation. Second, as the examples in (12) show ( $Q=every$ ), intuitions about appropriate and inappropriate uses of *unless* are robust only in extreme cases, where either  $Q$ -many of the individuals in the excepted set do not have the property picked out by the nuclear scope (biconditional), or  $Q$ -many of them do (Across-the-Board).

- (12) [Context: *Half of the students goofed off.*] Every student passed unless he goofed off.
- Clearly appropriate** if all of the students who did not goof off passed, and all of the students who goofed off did not pass. (Biconditional context; uniqueness satisfied)
  - Clearly inappropriate** if all of the students passed, including all of those who goofed off. (Across-the-Board context; uniqueness not satisfied)
  - Unclear/??** if all of the students who did not goof off passed, and {a few/half/most/...} of the students who goofed off passed. (Intermediate context; uniqueness not satisfied)

The intermediate cases are equally unclear when  $Q=no$ . Collecting naïve judgements on a large (experimental) scale seems to be the only way to clarify these cases. Furthermore, as discussed below, the quantitative details of these cases turn out to be highly informative about the status of exceptionality with *unless* and the nature of the difference between *unless* and *if not*. These details ultimately place significant constraints on the parameters of a revised theoretical account of *unless*.



Is the following claim true or false?

**"Every marble has a dot unless it is blue."**

☐ True ☐ False

Figure 1: Sample test trial

### 3.1. Design

Participants were shown a display of 20 red and blue marbles, and were asked to decide whether a given stimulus statement about the display was true or false (forced-choice; Figure (3.1) is a sample trial). Test stimuli (in (13)-(14)) contained either *unless* or *if not*, embedded under either *every* or *no*. We also varied the proportion of target-colour marbles with dots from among 0, 0.2, 0.4, 0.6, 0.8, and 1. This gave us a total of 24 test conditions.

- (13) a. Every marble has a dot unless it is [target colour].  
b. Every marble has a dot if it is not [target colour].
- (14) a. No marble has a dot unless it is [target colour].  
b. No marble has a dot if it is not [target colour].

To increase display variety, we randomly varied the target colour between red and blue, and the ratio of target:non-target marbles from 5:15, 10:10, and 15:5 (each test condition thus had 6 display variants). To avoid overwhelming participants with false sentences, we set the proportion of dotted non-target marbles in each test condition to satisfy the minimal truth conditions of both *unless* and *if not*, as given by  $Q[C - R]M$  (the first conjunct in (2) and (5)).

We also included a number of fillers. A “sampling” condition asked participants to imagine that a marble was chosen at random, and then judge a sentence of the form “The selected marble has a dot {if it is not/unless it is} [colour].” The display varied as described above.<sup>4</sup> Additional filler statements varied along three parameters: quantifier (*every*, *no*, *none*), whether they mentioned “red,” “blue,” or no colour, and construction type (see (15)-(17)). For the last parameter, we used positive *if*-sentences, single-clause quantified statements, and *there*-existentials. In these filler displays, we also varied the red:blue ratio from amongst 5:15, 10:10, and 15:5, and selected both red and blue dot proportions randomly from amongst 0, 0.2, 0.4, 0.6, 0.8, and 1. Consequently, any given filler statement could occur with any one of 108 possible displays.

- (15) [bare, red, *if*]: The selected marble has a dot if it is red.
- (16) [every, dot, single-clause]: Every marble has a dot.
- (17) [no, blue, *there*]: There are dots on no blue marbles.

### 3.2. Method

Using Amazon’s Mechanical Turk platform, we recruited 160 participants, all of whom were financially compensated. They viewed the experiment in a frame through the Mechanical Turk website. Participants were given detailed instructions together with a sample display and a non-test stimulus, and told to judge whether the stimulus was true or false of the display. They were unable to move from one trial to the next without selecting an answer. At the end of the experiment, participants were asked to enter their native language; this did not affect payment, and no indication was given that it would. The full experiment is available on the second author’s website (<http://web.stanford.edu/~danlass/experiment/marbles/marbles.html>).

Each participant saw 48 trials, in a random order. 24 trials were randomly selected from a set containing the 24 test conditions and 12 “sampling” conditions; the displays for these were selected randomly from the 6 variants for the given condition. 24 trials were randomly selected from the remaining 29 filler types, with one of the 108 display variants randomly generated for each filler. On average, each of our 24 test items was seen by 105 participants (min:80, max:124, median:109).

### 3.3. Results

We excluded data from 5 participants who reported being native speakers of languages other than English. The analysis below includes data from the remaining 155 participants. Figure 2 shows

<sup>4</sup>We included this filler condition out of curiosity about “sampling”-based judgments. The results were statistically indistinguishable from those in the *every* test condition, consistent with theories in which bare conditionals contain a covert *must* (Kratzer 1986). We do not analyze these results further here, however.



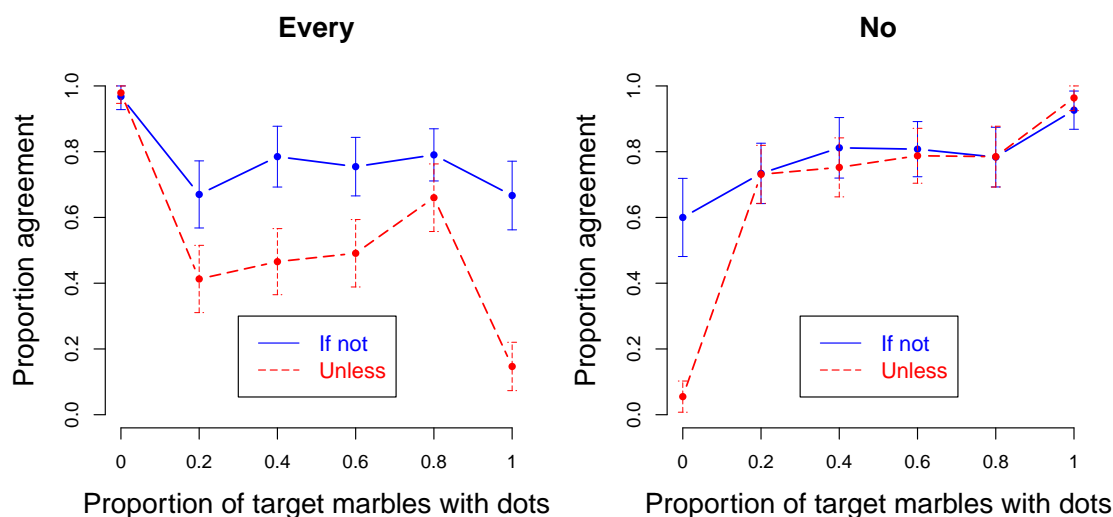


Figure 2: Experimental results, with 97% binomial confidence intervals (see main text).

our results in both quantifier conditions (left=*every*; right=*no*). In each graph, the  $x$ -axis is the proportion of target marbles with dots, and the  $y$ -axis represents the fraction of participants who judged the sentence true. Results from the *if not* condition are in blue with a solid line interpolated between points. Results from the *unless* condition are in red with a dashed line interpolated. Error bars represent 97% binomial confidence intervals, corresponding to the corrected significance criterion ( $\alpha = .03$ ) selected by Monte Carlo simulation to ensure a Type 1 error rate less than 5% despite multiple comparisons (cf. Edwards and Berry 1987). Non-overlapping error bars at a single proportion thus represent statistically significant differences between *if not* and *unless* in a two-sample  $t$ -test,  $p < .05$ . Table 1 gives the corresponding numerical data.

We analyzed the data using a separate linear mixed-effects models for each quantifier, using the lme4 package (Bates et al. 2014) in R (R Core Team 2014). Proportion was coded as a categorical variable, and we included random effects of participant, target colour, and red/blue distribution (5:15, 10:10, 15:5). We included random intercepts only because the maximal models with random slopes did not converge. For each quantifier, we tested for a main effect of conditional type (*if not* vs. *unless*) following the procedure outlined by Levy (2014). Specifically, we converted the categorical proportion variable to a sum-coded numeric variable, and then calculated the likelihood ratio of two models differing only in the inclusion of a fixed main effect of conditional type. Both models included a fixed main effect of proportion and an interaction between proportion and context, in addition to random intercepts as noted above. These tests revealed a highly significant main effect of conditional type for both quantifiers:  $p < .001$ ,  $df=1$  in both cases.

Table 4 summarizes responses to filler stimuli paired with displays which clearly falsified them. Participants very rarely responded “true” in such scenarios (37 of 1549 judgments; 2.4%).

Proportion	<i>if not</i>				<i>unless</i>			
	N	<i>every</i> % agree	N	<i>no</i> % agree	N	<i>every</i> % agree	N	<i>no</i> % agree
0.0	93	96.8 ± 4.0	80	60.0 ± 11.9	95	97.9 ± 3.2	109	5.5 ± 4.7
0.2	100	67.0 ± 10.2	109	73.4 ± 9.2	109	41.3 ± 10.2	119	73.1 ± 8.8
0.4	93	78.5 ± 9.3	85	81.2 ± 9.2	116	46.6 ± 10.0	109	75.2 ± 9.0
0.6	110	75.5 ± 8.9	104	80.8 ± 8.4	112	49.1 ± 10.3	113	78.8 ± 8.4
0.8	124	79.0 ± 7.9	97	78.4 ± 9.1	100	66.0 ± 10.3	93	78.5 ± 9.3
1.0	96	66.7 ± 10.4	95	92.6 ± 5.8	109	14.7 ± 7.4	110	96.4 ± 3.9

Table 1: Endorsement rates in test conditions

<i>every/no marble is [colour]</i>		existential variant		<i>every/no marble has a dot</i>		existential variant	
N	% agree	N	% agree	N	% agree	N	% agree
538	1.8 ± 1.2	456	3.5 ± 1.9	276	2.2 ± 1.9	269	1.8 ± 1.8

Table 2: Endorsement rates for false filler items

### 3.4. Discussion of qualitative patterns and implications for previous theories

This section discusses the predictions of von Fintel’s and Leslie’s theories and compares them to the experimental results. The results are inconsistent with the predictions of both previous theories.

Both formulations of the exceptive account discussed above make unambiguous predictions about the truth-values of the relevant *unless* sentences (examples 18-19). Table 3 shows the predicted distribution of truth-values by theory in each experimental condition.

- (18) Every marble has a dot unless it is blue.  
**von Fintel/Leslie:** TRUE iff *all red marbles have dots and no blue marbles have dots*.
- (19) No marble has a dot unless it is blue.  
**von Fintel:** TRUE iff *no red marbles have dots and all blue marbles have dots*.  
**Leslie:** TRUE iff *no red marbles have dots*.

	von Fintel						Leslie					
	Target dot proportion						Target dot proportion					
<i>every</i>	0.0	0.2	0.4	0.6	0.8	1.0	0.0	0.2	0.4	0.6	0.8	1.0
	T	F	F	F	F	F	T	F	F	F	F	F
<i>no</i>	F	F	F	F	F	T	T	T	T	T	T	T

Table 3: Predictions for *unless* by condition and theory

In general, we assume that sentences in which *if not* restricts a nominal quantifier have the interpretation in (20). The corresponding predictions are given in (21). These predictions are assumed to hold across all theories considered here.

$$(20) \quad Q[C]M \text{ if not } R := Q[C - R]M$$

$$(21) \quad \text{Every/no marble has a dot if it is not blue.} \\ \text{TRUE iff all/no red marbles have dots.}$$

Since the experiment was designed so that the truth-conditions for *if not* sentences were satisfied in all test conditions, this account predicts a response of TRUE in all cases (see Table 4). Results from the *if not* conditions are thus expected to provide a baseline for interpreting *unless* results.

	Target dot proportion					
	0.0	0.2	0.4	0.6	0.8	1.0
<i>every</i>	T	T	T	T	T	T
<i>no</i>	T	T	T	T	T	T

Table 4: Predictions for *if not* by condition

We discuss results for *no* first. Under *no*, participants almost unanimously endorsed stimuli with both *if not* and *unless* at target proportion 1. Recall that the non-target dot proportion in the *no* condition was set at 0: target proportion 1 therefore represents the biconditional context in which no non-target marbles have dots and all target marbles do (satisfying uniqueness). This result is consistent with both von Fintel's and Leslie's accounts.

Endorsement rates dropped off slightly at proportions less than 1 but greater than 0, and appear to have done so identically for *unless* and *if not*. If we allow that the lowered acceptability is due to some pragmatic pressure on both connectives, this result is consistent with Leslie's account, under which *unless* and *if not* are semantically identical under *no* (see Tables 3 and 4). However, it is not consistent with the elaboration of von Fintel's theory, which predicts that the *unless* sentences are always biconditional, and thus false under *no* when the proportion of target marbles with dots is less than 1 (Table 3). Since our participants categorically rejected false items (only .024 acceptance, cf. Table 2), strong endorsement in these conditions falsifies von Fintel's theory.

The remaining data point under *no* is problematic for Leslie's account: *unless* diverges from *if not* sharply at target proportion 0. While a majority of participants (60%) found *No marble has a dot if it is not blue* acceptable in the "Across-the-Board" scenario where no marbles of either colour had dots, endorsement of the corresponding *unless*-sentence approached zero (5.5%) in the same scenario. Indeed, the divergence at 0 was so sharp that it appears to have been entirely responsible for the significant main effect of connective under *no* reported above: endorsement rates for the two connectives were indistinguishable at all other proportions. Confirming this impression, a model comparison procedure identical to the one outlined above, but with proportion 0 removed from the data in all conditions, found no main effect of connective choice under *no* ( $p > .6$ ,  $df=1$ ). Since Leslie predicts identical truth-values for *unless* and *if not* across all target proportions under *no* (see Tables 3 and 4), this divergence is inconsistent with her theory.

Results under *every* were in some respects the mirror image of those under *no*, but there were some

significant differences. Here again we found near-unanimous endorsement in the biconditional context (target proportion 0), just as with *no*. That is, virtually all participants endorsed *Every marble has a dot COND it is blue* for both conditionals when uniqueness/biconditionality was satisfied: all red marbles have dots, and no blue ones do. This result is consistent with both previous semantic accounts. In addition, as under *no*, *if not* and *unless* diverged sharply in the “Across-the-Board” context (target proportion 1; all marbles have dots regardless of colour). A majority of participants (66.7%) accepted *Every marble has a dot if it is not blue* when every marble had a dot regardless of colour, but few (14.7%) accepted *Every marble has a dot unless it is blue* in the same scenario. These data points are consistent with both exceptive accounts, since both predict that *unless* under *every* is true only in biconditional scenarios.

Results in the intermediate range of target proportions (0.2-0.8) were problematic for both previous theories. As in the *no* condition, endorsement rates under *every* were non-maximal at these proportions, but remained much higher than rates for false filler items. However, with *every* there was a reliable difference between *unless* and *if not* also in the intermediate range: *Every marble has a dot if it is not blue* was more likely to be accepted than *Every marble has a dot unless it is blue* when all red marbles have dots and the proportion of blue marbles with dots was .2, .4, .6, or .8. However, it appears that neither is false or otherwise totally unacceptable: endorsement of *every-unless* was reliably above floor in this range (between .41 and .66, all lower CIs above .3), while false filler items were very rarely endorsed (.03 on average). While von Fintel and Leslie are both correct that there is a difference between *every-if not* and *every-unless*, the specific diagnosis of a truth-conditional difference appears to be incorrect: *every-unless* is not simply false in all non-biconditional contexts. In other words, the difference between *unless* and *if not* under *every* appears to involve graded factors affecting felicity, rather than categorical factors involving truth.

In sum, our results argue against a semantically biconditional account of *unless* in either quantifier context. Such an account would incorrectly predict an overwhelming preference for “false” responses in non-biconditional contexts (0-0.8 under *no*, 0.2-1 under *every*). The results also tell against Leslie’s one-directional account of *unless* under *no*, given the divergence between *unless* and *if not* in Across-the-Board contexts. A one-directional theory cannot explain our participants’ near-unanimous rejection of *unless* in these contexts. Finally, the results suggest that there is a non-categorical difference between the two conditionals in intermediate scenarios under *every*. Both previous theories wrongly predict a categorical, truth-conditional difference here.

#### 4. Three puzzles and two proposals

The experimental investigation reported in section 3 suggests that a new account of *unless* is needed. This account should ideally explain each of the following three puzzles:

- (A) The categorical divergence of *if not* and *unless* in Across-the-Board contexts (at target proportion 1 under *every*, and at 0 under *no*).
- (B) The degraded but non-zero acceptability of both types of conditionals in the middle range of

target proportions (and, for *if not*, in the across-the-board contexts as well).

- (C) The reliable but non-categorical divergence between *if not* and *unless* under *every*, and the fact that no such divergence appears under *no*.

In this section we propose solutions to (A) and (B) and sketch some directions for explaining (C).

#### 4.1. Puzzle (A): Categorical divergence in Across-the-Board (AtB) scenarios

When the quantifier ( $Q$ ) is either *every* or *no*, AtB scenarios for statements of the form  $Q[C]M \text{ COND } R$  can be characterized very simply: they are those in which  $Q[C]M$  holds, i.e., the sentence would be true if the conditional clause were omitted. For instance, an AtB scenario for *Every marble has a dot unless it is blue* is one in which every marble has a dot, regardless of colour.

If it were not for Puzzle (A), it would be tempting to suppose that *if not* and *unless* have exactly the same semantic content, and that all differences between them have a pragmatic origin. While there is at least one difference that could in principle be implicated in pragmatic reasoning — *if not* consists of two syntactically separable items, rather than a single word — we do not know of any well-motivated pragmatic mechanisms that would apply only in AtB scenarios and could be expected to create the effect of a categorical divergence. Rather, it seems that *unless* lexically encodes a prohibition against being used in these contexts which is not present in the meaning of *if not*. We will call this requirement the **AtB prohibition**. Two ways of formulating this prohibition are given by the boldfaced portions of (22) and (23) (bracketing for the moment the question of the theoretical status of this conjunct as an entailment, presupposition, CI, etc.).

$$(22) \quad Q[C]M \text{ unless } R \Rightarrow Q[C - R]M \wedge \neg \mathbf{Q[C]M} \quad \textbf{(Option 1)}$$

$$(23) \quad Q[C]M \text{ unless } R \Rightarrow Q[C - R]M \wedge \neg \mathbf{Q[C \cap R]M} \quad \textbf{(Option 2)}$$

Both (22) and (23) accurately predict the results in Puzzle (A), and in fact Options 1 and 2 are logically equivalent when  $Q$  is *every* or *no*. Taking non-universal quantifiers into account, however, Option 2 is clearly preferable: consider example (24) when  $Q$  is *some*. As (24a) shows, Option 1 is a contradiction, but Option 2 is satisfiable when some red marbles have dots and none of the blue ones do. The choice of Option 2 is consistent with results from unpublished experimental work: when at least one red marble had a dot, participants rejected (24) if one or more blue marbles had dots, but reliably endorsed it when no blue marbles did.<sup>5</sup>

- (24) Some marbles have a dot unless they are blue.

<sup>5</sup>Data and preliminary analysis from the unpublished experiment, which employed similar methods but included quantifiers *most*, *few*, and *some*, are reported in Nadathur (2014b). The discussion and proposals in this section are in close alignment with the theoretical account of *unless* developed in Nadathur (2014a,b).

- a.  $\text{SOME}[\text{MARBLE} - \text{BLUE}]\text{DOT} \wedge \neg \text{SOME}[\text{MARBLE}]\text{DOT}$  (Option 1)  
 b.  $\text{SOME}[\text{MARBLE} - \text{BLUE}]\text{DOT} \wedge \neg \text{SOME}[\text{MARBLE} \cap \text{BLUE}]\text{DOT}$  (Option 2)

The AtB prohibition is much weaker than biconditionality. When  $Q$  is *every* or *no*, its only effect is to rule out AtB scenarios: intermediate proportions are predicted to be acceptable.

- (25) Every marble has a dot unless it is blue.  
 $\text{ALL}[\text{MARBLE} - \text{BLUE}]\text{DOT} \wedge \neg \text{ALL}[\text{MARBLE} \cap \text{BLUE}]\text{DOT}$   
*Every red marble has a dot, and some blue marble does not.*
- (26) No marble has a dot unless it is blue.  
 $\text{NO}[\text{MARBLE} - \text{BLUE}]\text{DOT} \wedge \neg \text{NO}[\text{MARBLE} \cap \text{BLUE}]\text{DOT}$   
*No red marble has a dot, and some blue marble does.*

Having concluded that the AtB prohibition is lexically associated with *unless*, we must decide whether it is an entailment, a presupposition, or something else. The empirical endorsement rate of *unless* in AtB contexts was comparable to the endorsement rate of false fillers, but since our experiment did not include control conditions with false presuppositions or conventional implicatures (CIs), we cannot be sure of the source of this pattern. However, independent arguments suggest that the bold clause in (23) is neither an entailment nor a CI: it can be reinforced without redundancy, which argues against an entailment treatment (example 27), and it can be backgrounded, which argues against a CI treatment (ex. 28, cf. Potts 2005).

- (27) Every marble has a dot unless it is blue, and some blue marbles do not have dots.  
 (vs: #Every marble has a dot unless it is blue, and every red marble has a dot.)
- (28) No blue marbles have dots. However, every marble has a dot unless it is blue.  
 (vs: No blue marbles have dots. #The blue marbles, none of which have dots, are my favourites.)

Moreover, efforts to suspend the AtB prohibition explicitly as in (29a) seem to create infelicity, unless they are framed as corrections as in (29b). Like the possibility of backgrounding in (28), this is reminiscent of the behaviour of presuppositions (compare examples 29a-29b with 30a-30b).

- (29) a. #Every blue marble has a dot, and every marble has a dot unless it is blue.  
 b. Every marble has a dot unless it is blue. In fact, every blue marble has a dot, too.
- (30) a. #It's not raining, and Mary doesn't realize that it is raining.  
 b. Mary doesn't realize that it's raining. In fact, it isn't raining.

While we remain somewhat uncertain about this diagnosis — due, in part, to the difficulty of applying standard projection tests to quantified *unless* sentences — we suggest that these data

favour a presuppositional treatment of the AtB prohibition. *Modulo* the presupposition, *unless* is semantically equivalent to *if not* on this proposal:

$$(31) \quad Q[C]M \text{ unless } R \begin{cases} \text{is a presupposition failure if } Q[C \cap R]M; \text{ otherwise,} \\ \text{is true if and only if } Q[C - R]M. \end{cases}$$

Regardless of the precise status of the AtB prohibition, however, it seems evident that this condition must be part of any account of *unless*: it provides a solution to Puzzle (A), and uniquely picks out those points at which *unless* (but not *if not*) empirically receives near-zero agreement ratings.

#### 4.2. Puzzle (B): Biconditionality inferences

Puzzle (B) involves the less-than-unanimous but clearly nonzero acceptance rates for both *unless* and *if not* across the middle range of target dot proportions, and in AtB scenarios for *if not*. We suggest that this pattern can be given a natural pragmatic explanation in terms of *conditional perfection* (Geis and Zwicky 1971). A conditional sentence like (32a) is in many contexts strengthened to a biconditional — that is, to the conjunction of (32a) and (32b). The inference to biconditionality is typically regarded as a GCI (van der Auwera 1997; Horn 2000), where the default inference adds the content of (32b) to the truth-conditional content provided in (32a).

- (32) a. The marble Bill selected has a dot if it is not blue.  
 b.  $\sim$  The marble Bill selected does not have a dot if it is blue.  
 c. (32a) & (32b)  $\equiv$  The marble Bill selected has a dot if and only if it is blue.

We suggest that quantified conditionals with *every* and *no* can also be pragmatically perfected.

- (33) a. Every marble has a dot if it is not blue.  
 b.  $\sim$  Every marble does not have a dot if it is blue.  
 c. (33a) & (33b)  $\equiv$  All and only non-blue marbles have dots.
- (34) a. No marble has a dot if it is not blue.  
 b.  $\sim$  No marble does not have a dot if it is blue.  
 c. (34a) & (34b)  $\equiv$  All and only blue marbles have dots.

Previous work has revealed a tendency for experimental participants in a truth-value judgement task to reject true sentences which are associated with false implicatures. For instance, Doran et al. (2012) investigated truth-value judgments involving true sentences that were associated with

false GCIs. Participants in their baseline condition received instructions most similar to those given to our participants; rejection rates in this condition ranged between 15% and 63% over a large variety of GCI triggers. In terms of our experiment, then, the effect of a default pragmatic inference to biconditionality should be to render *if not* sentences systematically less acceptable in the intermediate target proportion range, as well as in AtB scenarios.

Specifically, suppose that our participants were inclined, with some small probability  $p$ , to reject sentences associated with false conditional perfection inferences. *Modulo* experimental noise, we would then expect to find an endorsement rate of  $1 - p$  in the *every* condition for those stimuli where (33a) is true but (33b) is false. Since the truth-conditions of (33a) were always satisfied in this condition (i.e., all red marbles had dots), we expect high but non-maximal endorsement in the *every-if not* conditions at any target dot proportion greater than 0 (i.e. for any item where some blue marbles have dots). For the *no* condition, we expect an endorsement rate of roughly  $1 - p$  when (34a) is true and (34b) is false: since all stimuli in this condition verified (34a) (no red marbles have dots), this occurs whenever the target dot proportion is strictly below 1 (whenever there is a blue marble without a dot). As far as *if not*-conditionals are concerned, these predictions describe Puzzle (B) precisely: a small but robust tendency for participants to reject *if not* statements in the non-biconditional scenarios.

It is a relatively small step to extend the explanation to Puzzle (B) as it pertains to *unless*. We proposed in (31) above that the semantic meaning of *unless* is identical to that of *if not* when the presupposed AtB prohibition is satisfied. It is thus reasonable to expect that *unless* will be associated with a conditional perfection inference in the same way that *if not* is. This is also supported by the arguments in section 2.2 for treating uniqueness/biconditionality as a pragmatic inference. This derives the observed pattern just as described above for *if not*: outside of AtB scenarios, *unless* is dispreferred under *no* in non-biconditional contexts to a degree which is almost perfectly matched with the dispreference for *if not* under *no*. The AtB scenario is the only clear point of deviation, and this is explained by the additional effect of presupposition failure for *unless*.

*Unless* is also dispreferred under *every* in non-biconditional contexts, excluding again the AtB scenario (where presupposition failure leads to reduced acceptability with *unless*). This effect is consistent with the account from conditional perfection; however, our account so far does not predict the higher rejection rate for *unless* under *every*. This is the subject of Puzzle (C).

#### 4.3. Puzzle (C): Grades of biconditionality?

Puzzle (C) is the most perplexing. It involves the reliable but non-categorical divergence between *if not* and *unless* over the target dot proportions 0.2-0.8 — and, in particular, the fact that this divergence is only observed under *every*, while the connectives are indistinguishable in the intermediate range under *no*. In light of the conclusions above, we see two strategies for explaining Puzzle (C).



First, we might attribute the divergence to a second pragmatic pressure which (i) is triggered only in sentences with *every*, and (ii) interacts additively with the downward pressure exerted by the falsity of the conditional perfection inference in intermediate cases. While this possibility is intriguing, we do not at this time have any speculations about what the nature of such a pressure might be.

A second possibility is that the biconditionality implicature might be somehow “stronger” for *unless* in positive contexts than it is in negative ones. Interestingly, this diagnosis is not too different from the intuition, reported by Leslie (2008) and discussed above, that *unless* feels “more” biconditional under *every* than under *no*. While we have argued that it is a misdiagnosis to treat this intuition as reflecting a truth-conditional difference, a pragmatic approach which (somehow) allows for different strengths of conditional perfection could honour Leslie’s empirical insight.

For the purposes of the current paper, we remain noncommittal about the source of this divergence.<sup>6</sup> We hope that we have nevertheless made important steps toward the resolution of Puzzle (C) in this paper by (i) uncovering it empirically, (ii) showing that it cannot be treated as a straightforward truth-conditional difference, (iii) framing it with respect to the AtB prohibition and conditional perfection, and (iv) suggesting some routes for addressing it in future work. For future work, point (ii) is especially important: given our experimental results, a semantic account is not viable because participants do not respond to intermediate *every-unless* stimuli as they do to false control stimuli. Consequently, a pragmatic approach to Puzzle (C) seems unavoidable.

## 5. Conclusions

Based on the results of our experimental investigation, we have argued for three main points and posed a new empirical question for future work. First, neither von Fintel (1992) nor Leslie (2008) provide the correct semantic account for *unless*: *unless* is not semantically biconditional under either *every* or *no*. Second, *unless* and *if not* diverge categorically in acceptability under both quantifiers. To explain this pattern, we suggested that the only lexically encoded difference between *if not*- and *unless*-sentences is that the latter presupposes an “Across-the-Board prohibition” which proscribes the use of an *unless*-conditional *q unless p* in contexts where the unqualified statement *q* could be used truthfully. Third, we argued that biconditionality generated by conditional perfection implicatures plays a role in the interpretation of both types of conditionals, producing degraded acceptability under both quantifiers in non-biconditional scenarios. Finally, we demonstrated that *if not* and *unless* sentences diverge in intermediate scenarios under *every*, but pattern identically under *no*. While we did not resolve this puzzle fully, we identified several strategies for future investigation, and argued that the most profitable direction for its explication resides in the pragmatics of conditionals rather than the semantics of *unless*.

Our primary aim was to investigate the exceptive account of *unless* experimentally. In addition to showing that neither von Fintel’s nor Leslie’s version makes the right predictions, our data lead

<sup>6</sup>However, Nadathur 2014b provides a detailed pragmatic proposal involving the interaction of downward-entailing contexts and scalar reasoning.

naturally to an alternative set of theoretical proposals, as outlined above. These proposals converge to a large extent with the alternative theory of *unless* offered in Nadathur (2014a). That proposal comprises two main points: first, a biconditional interpretation is pragmatically (not semantically) associated with *unless*, and second, *unless* (and not *if not*) invokes a presupposition which would produce the effect of the AtB prohibition in the empirical cases examined here. Since the claims in this paper were made on the basis of experimental data, we see this convergence as lending support to Nadathur (2014a) – or any alternative proposal in which non-truth-conditional mechanisms are used to accurately predict the patterns described in Puzzles (A)-(C).

These conclusions highlight the importance of utilizing large-scale judgement studies when investigating complex issues in semantics and pragmatics. The difficulty in giving a theoretical account of *unless* has in no small part been driven by the complex and graded cluster of acceptability intuitions associated with it. This work would not have been possible if we had relied exclusively on introspective judgments. However, by collecting a large number of judgments in controlled conditions and analyzing them quantitatively, we were able to distinguish intuitions that are categorical and truth-conditional in nature from those that are graded and contextual/pragmatic in nature (see also Wasow and Arnold 2005; Gibson and Fedorenko 2010, 2013; Scontras and Gibson 2011).

More broadly, our investigation supports the conclusion that the puzzling interaction between *unless* and various quantifiers is explained primarily by pragmatics and presuppositional content, rather than the truth-conditional content. We thus concur strongly with Leslie (2008)'s conclusion, albeit for different reasons: *unless*, while intriguing, poses no threat to compositionality.

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# Subset Comparatives as Comparative Quantifiers<sup>1</sup>

Miriam Nussbaum — Massachusetts Institute of Technology

**Abstract.** This paper is concerned with the meaning of the “subset comparative” construction: *John saw more phonologists than just Mary* seems to assert that John saw more than one phonologist, and presuppose that John saw Mary (the prejacent) and that Mary is a phonologist. Together, the assertion and the two presuppositions entail that John saw other phonologists in addition to Mary. In this paper, I argue that the meaning can be derived by an extension of the analysis originally proposed by Hackl (2000) for comparative quantifiers like *more than three*.

**Keywords:** comparatives, comparative quantifiers, subset comparatives

## 1. Introduction

The “subset comparative” construction, which is illustrated below in (1a), includes the asserted content in (1b) and the two presuppositions in (1c):

- (1)    a.    John saw more phonologists than just Mary.  
      b.    **Assertion:** John saw more than one phonologist.  
      c.    **Presuppositions:**  
            John saw Mary. (prejacent)  
            Mary is a phonologist. (subset presupposition)

These presuppositions project in the usual way: the sentences in (2a)-(2c) all presuppose that Mary is a phonologist that John saw or talked to, and John’s seeing or talking to more than one phonologist is what is denied or called into question.

- (2)    a.    It’s not the case that John saw more phonologists than just Mary.  
      b.    Did John see more phonologists than just Mary?  
      c.    If John had talked to more phonologists than just Mary, he might have heard the news sooner.

These constructions were named “subset comparatives” by Grant (2010), because the denotation of the NP in the than-clause — *Mary* in (1a) — can be analyzed as denoting a subset of the NP

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in the matrix clause (*phonologists*). This is also the case for bare plurals: the subset comparative in (3b) resembles a subcomparative like (3a), except that the two NPs are in a subset relationship rather than being disjoint.

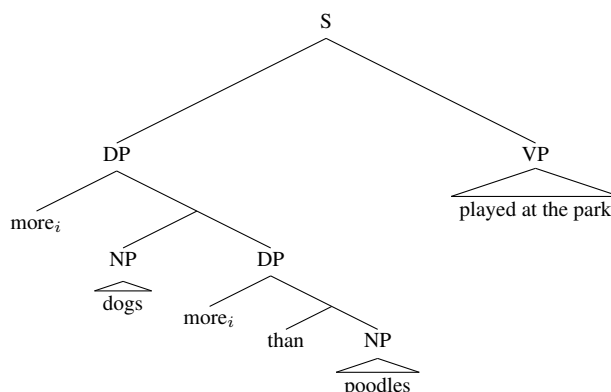
- (3) a. More men than women watched the film.  
b. More computers than just laptops were stolen.

In this paper, I will argue for a clausal analysis of subset comparatives, whereby (1a) has a structure akin to the one proposed by Hackl (2000) for comparative quantifiers like *more than three*. I will be mostly discussing English, but bringing in examples from other languages to illustrate particular issues.

### 1.1. Previous analyses

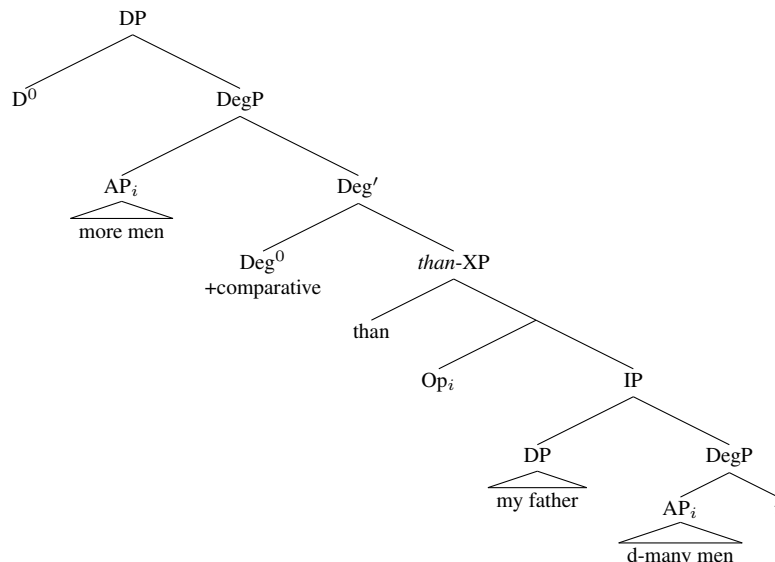
Grant (2010, 2013) gives two analyses for different kinds of subset comparatives, based on whether the DP in the *than*-clause is singular or plural. For bare plurals, she uses the DP-shell analysis that was previously proposed by Izvorski (1995) for DP-internal subcomparatives like *more men than women*; while for subset comparatives with a singular DP in the *than*-clause, she suggests an attributive NP analysis like that of Lechner (2001).

- (4) DP-shell analysis (Izvorski 1995):  
a. More men than women watched the film.  
b. More dogs than (just) poodles played at the park.  
c.



- (5) Attributive NP analysis (Lechner 2001):  
a. A taller man than my father is ~~a d-tall man~~ came to the party.  
b. More men than my father is ~~d-many men~~ came to the party.

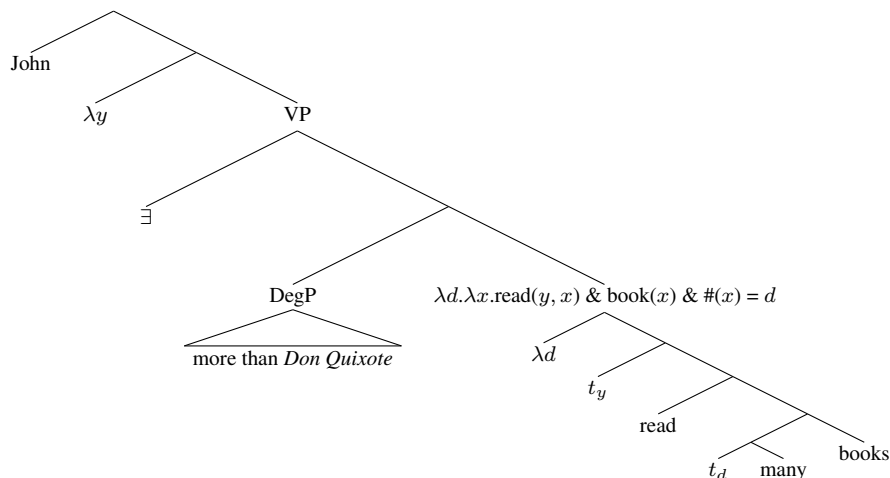
C.



Grant (2013) additionally suggests that the two could be unified under the DP-shell analysis, by coercing individual-denoting expressions like *my father* into type  $\langle e, t \rangle$  predicates.

Aparicio (2014)'s proposal for subset comparatives gives them a direct phrasal analysis, using the phrasal comparative operator of Heim 1985. *More* takes an individual like *Don Quixote* as its first argument, and moves with it to the VP edge, as shown in (6). The silent *many* in the matrix clause is a function that maps individuals to their cardinalities. The predicate *d-many books* acts as a predicate modifier for the main verb, forming the second argument of *more*. Existential closure then applies at the VP level.

- (6) a. John read more books than (just) *Don Quixote*.  
b.



- c.  $\llbracket \text{more} \rrbracket = \lambda y. \lambda g_{\langle d, et \rangle}. \lambda x. \max\{d' : g(d')(x) = 1\} \succ \max\{d'' : g(d'')(y) = 1\}$

- d.  $\llbracket \text{John read more books than } Don\ Quixote \rrbracket =$   
 $\exists x[\max\{d: \text{read}(j, x) \wedge \text{book}(x) \wedge \#(x) = d\} \succ \max\{d': \text{read}(j, DQ) \wedge \text{book}(DQ) \wedge \#(DQ) = d'\}]$

The sentence is true iff there exists a plurality of books John read, whose cardinality is greater than the number  $d$  such that John read *Don Quixote* and *Don Quixote* is a book and the cardinality of *Don Quixote* is  $d$ . If *Don Quixote* is not a book, or if John did not read it, then there is no such number, and presupposition failure results. But if the presupposition that *Don Quixote* is a book that John read is met, then the sentence is true iff John read more than one book.

I will present my own proposal in section 2.2. In section 3, I will compare some of its predictions with those made by the phrasal analyses of Grant (2013) and Aparicio (2014).

## 1.2. A note on *just*

Before proceeding, a few words about the role of *just* in subset comparatives are in order. In previous work on subset comparatives, it has been assumed that *just* does not necessarily have any role of its own in the derivation of the meaning of subset comparatives. The analysis in Aparicio 2014 is based primarily on Spanish, where examples like (7) are fully grammatical without any *just*-like element:

- (7) Juan ha leído más libros que *El Quijote*.  
 J. has read more books than  
 lit. ‘Juan read more books than *Don Quixote*.’ (Aparicio 2014)

There is a considerable amount of cross-linguistic variation in this regard. In some languages, an *only*-like element is obligatory in subset comparatives, as in the German example in (8a). In Irish, on the other hand, this is impossible, as (8b) shows.

- (8) a. Ich habe mehr Leute als \*(nur) den Hans gesehen.  
 I have more people than only the-ACC H. seen  
 ‘I saw more people than just Hans.’  
 b. Chonaic mé níos mó daoine ná Niamh (\*amháin).  
 saw I COMPAR many people than N. only  
 ‘I saw more people than (just) Niamh.’



In English, judgments vary: the sentence in (9) is uniformly judged to be grammatical when *just* is present, but some speakers find it degraded without.<sup>2</sup>

- (9) John read more books than *%*(just) *War and Peace*.

The strongest contrast in judgments comes when considering subset comparatives with bare plurals:

- (10) More dogs than poodles played in the park.

For speakers who accept (9) without *just*, (10) can have a sensible subset reading: in addition to the poodles that are presupposed to have been in the park, there were other kinds of dogs in the park as well. Speakers for whom *just* is obligatory in (9) find (10) infelicitous: the proposition that poodles are not dogs is presupposed, and the sentence asserts that the animals that do “count” as dogs (i.e. the non-poodle dogs) outnumbered the poodles.

The contrast between the judgments reported by Grant and those of speakers who reject (10) on a subset reading suggests that there is a dialect difference here: the former dialect, where subset readings are available without *just*, patterns with Spanish, while the latter patterns with German.

Grant (2013) suggested that all subset comparatives might include *just* or a covert counterpart. In what follows, I will assume that this is in fact the case, and that some languages — German and one dialect of English among them — lack the covert version. In my analysis, *just* will be used in the derivation of the presuppositions of subset comparatives.

## 2. Comparative quantifiers

### 2.1. Properties of comparative quantifiers

The meanings of subset comparatives have certain properties in common with those of comparative quantifiers with numerals, like (11b):

- (11) a. John saw more phonologists than just Mary and Bill.  
b. John saw more than two phonologists.

<sup>2</sup>For these speakers, the sentence only has an implausible reading equivalent to “John read more books than *War and Peace* did.”

Comparative quantifiers also have presuppositions of their own. As pointed out by Hackl (2000), the (a) sentences in (12) and (13) are significantly degraded compared to the (b) sentences:

- (12) a. #More than one student met in the hallway.  
b. At least two students met in the hallway.
- (13) a. #More than three students stood in square formation.  
b. At least four students stood in square formation.

Hackl (2000) proposes an elliptical structure, predicting presupposition failure in the *than*-clause: the *than*-clause refers to a degree  $d'$  such that  $d'=3$  and  $d'$ -many students are standing in square formation, which is impossible because the predicate *standing in square formation* requires four or more participants.

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- Diagram illustrating the hierarchical structure of the sentence "Three students were standing in square formation". The structure is represented by a tree diagram with nodes labeled with lambda terms and the sentence components.
- Root node branches into  $-er$  and  $\lambda d$ .
  - $-er$  branches into  $\lambda d''$ .
  - $\lambda d''$  branches into  $\lambda d''$  and  $d''$ .
  - $\lambda d''$  branches into  $\lambda d''$  and  $d''$ .
  - $d''$  branches into  $\langle d' \text{ -many students} \rangle$ .
  - $d''$  branches into  $\langle \text{were standing in square formation} \rangle$ .
  - $d''$  branches into  $\langle \text{were standing in square formation} \rangle$ .

b.  $\llbracket \text{-er} \rrbracket = \lambda D_{\langle d, t \rangle}. \lambda D'_{\langle d, t \rangle}. \max(D) < \max(D')$

- c.  $\max(\lambda d. d = 3 \ \& \ d\text{-many students were standing in square formation})$   
 $< \max(\lambda d. d\text{-many students were standing in square formation})$

The sorts of paraphrases that comparative quantifiers can have, if the *than*-clause is made overt, illustrate the intuition behind the clausal semantics:

- (15) More than three students came to the party.  
 ‘More students came to the party **than if there had only been three students who came to the party.**’

Subset comparatives also show a version of the MNPG. Moreover, as (17) shows, they can also have counterfactual paraphrases:

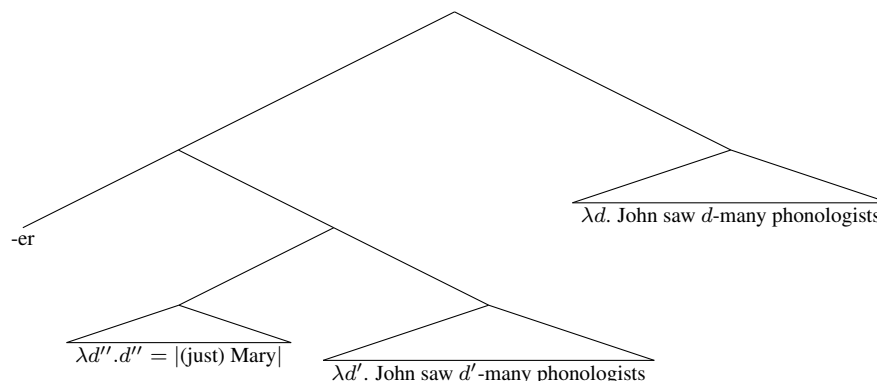
- (16) a. #More people than just Mary met in the hallway.  
 b. #More musketeers than just Athos, Porthos, and Aramis were standing in square formation.
- (17) More phonologists than just Mary came to the party.  
 ‘More phonologists came to the party than if only Mary had come to the party.’

These semantic similarities, along with the fact that sentences with subset comparatives have at-issue entailments equivalent to those of numerical comparative quantifiers, suggest that the meaning of subset comparatives can be properly accounted for by unifying the two.

However, adopting this structure for subset comparatives with no modifications will not work: simply mapping the individual *Mary* into its cardinality and treating it like a numeral will make the truth-conditions come out too weak.

- (18) a. John saw more phonologists than just Mary.

b.



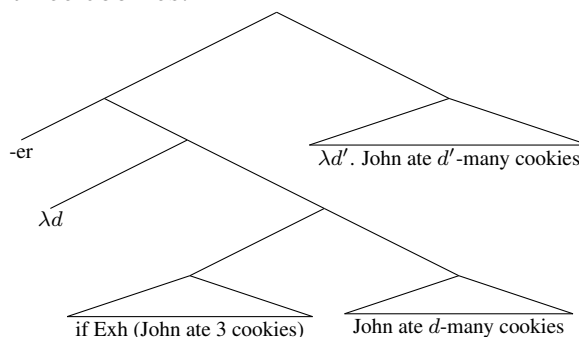
- c.  $\llbracket \text{John saw more phonologists than just Mary} \rrbracket = 1$  iff  $\max(\lambda d'.d' = |\text{Mary}| \ \& \ \text{John saw } d\text{-many phonologists}) < \max(\lambda d. \text{John saw } d\text{-many phonologists})$

These truth-conditions require only that John saw more than one phonologist; the connection between the degree standard and the identity of the individual in the *than*-clause is lost.

## 2.2. The proposal

In order to project the presuppositions that we observe with subset comparatives, the *than*-clause will have to be enriched. Here, I follow Al Khatib (2013), who modifies Hackl (2000)'s comparative-quantifier structure by putting a conditional component (with an exhaustified antecedent) into the *than*-clause.

- (19) a. John ate more than three cookies.  
b.



Here, the number of cookies John ate is asserted to exceed the number  $d$  such that if John only ate three cookies, then John ate  $d$ -many cookies.

In the case of *More than three students stood in square formation*, the degree predicate in the *than*-clause is  $\{d: (\text{Exh}(\mathbf{3 \text{ students stood in square formation}})) \rightarrow d\text{-many students stood in square formation}\}$ , which still results in presupposition failure by making reference (in the antecedent) to the impossible state of affairs that is “only three students standing in square formation”.

In order to adapt this analysis for subset comparatives, I will give this conditional a situation-semantic implementation. Situations are parts of worlds (Kratzer 2007), in which — as in possible worlds — propositions can be true or false. In particular, I will make use of the notion of minimal situations:

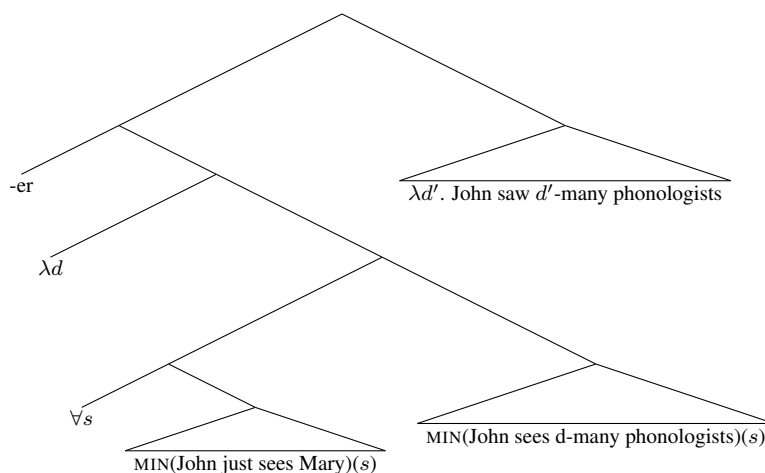
(20) **Definition of a minimal situation** (Kratzer 2007):

A situation is a minimal situation in which a proposition  $p$  is true iff it has no proper parts in which  $p$  is true.

A situation is a minimal situation of John seeing Mary, for instance, if it does not contain anything irrelevant to the truth of the proposition “John saw Mary.” This would be a situation consisting of John seeing Mary, and nothing else.

To see how this works, consider (21), below.

(21) a.



b. **Truth-conditions of (21a):**

$$\max(\lambda d. \forall s[\text{MIN}(\text{John sees Mary})(s) \rightarrow \text{MIN}(\text{John sees } d\text{-many phonologists})(s)]) < \max(\lambda d'. \text{John saw } d'\text{-many phonologists})$$

c. In other words:

The number of phonologists that John saw is greater than the number  $d$  such that a minimal situation of John seeing Mary is a minimal situation of John seeing  $d$ -many phonologists.

The two presuppositions follow from the above semantics:

- (22) a. **Subset presupposition: Mary is a phonologist.** If Mary is not a phonologist, then the degree in the *than*-clause does not exist: a minimal situation of seeing Mary cannot be a minimal situation of seeing  $n$  phonologists, no matter what number  $n$  is. That is, a situation containing a non-phonologist is not a minimal phonologist-seeing situation.
- b. **Prejacent: John saw Mary.** Like in other uses of *just*, the prejacent is presupposed.

The account depends crucially on the situations in both antecedent and consequent being minimal. Minimality is necessary in the antecedent to ensure that the conditional is defined: otherwise, the situations in the antecedent would include every arbitrarily large situation that happened to include John seeing Mary.

The consequent must make reference to minimal situations in order to properly account for the presuppositions that arise when the standard is plural.

- (23) a. John saw more phonologists than just Mary and Bill.
- b. Observed presuppositions:
- (i) **Mary and Bill are both phonologists.**
- (ii) John saw both Mary and Bill.
- c. At-issue entailment: John saw more than two phonologists.

It is the subset presupposition — that Mary and Bill are both phonologists — that will be troublesome in this case. Without the minimal-situation requirement in the consequent, the truth-conditions of (23a) are as below:

- (24)  $\max(\lambda d. \forall s[\text{MIN}(\text{John only sees Mary and Bill})(s) \rightarrow (\text{John sees } d\text{-many phonologists})(s)])$   
 $< \max(\lambda d'. \text{John saw } d'\text{-many phonologists})$

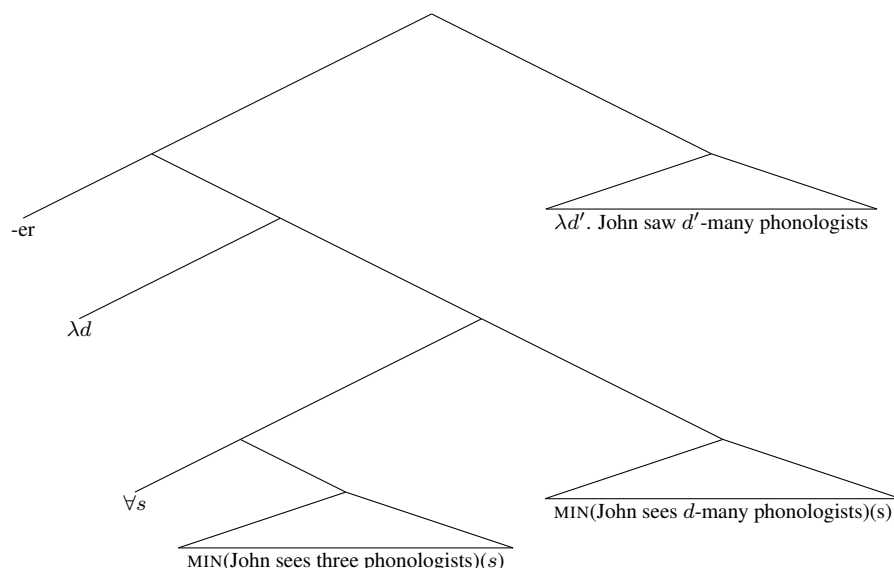
Consider a situation where Mary is a phonologist, but Bill is not; and John saw Mary, Bill, and some other phonologist besides Mary. The at-issue component is true because John saw more than one phonologist, and 1 is the number of phonologists that John sees in every minimal situation where he sees Mary and Bill together. In order to satisfy the subset presupposition, at least one of Mary and Bill must be a phonologist; however, the subset presupposition that we actually observe in (23a) is that they both are. So the subset presupposition that (24) derives is too weak.

If the minimal-situations requirement is present in both antecedent and consequent, on the other hand, we predict presupposition failure in (23a) as we did above with the singular. There is no number  $d$  such that every minimal situation of seeing Mary and Bill is a minimal situation of seeing  $d$  phonologists. In other words, a situation with the non-phonologist Bill in it cannot be a minimal situation of seeing any number  $d$  of phonologists, because seeing him is irrelevant to seeing phonologists.

Looking back at numerals, we can see in (25)-(26) that implementing the comparative in this way can still account for their truth-conditions and presuppositions.

(25) a. John saw more than three phonologists.

b.



c. **Truth-conditions of (25a):**

$\max(\lambda d. \forall s[\text{MIN}(\text{John sees 3 phonologists})(s) \rightarrow \text{MIN}(\text{John sees } d\text{-many phonologists})(s)])$   
 $< \max(\lambda d'. \text{John saw } d'\text{-many phonologists})$

i.e.: The number of phonologists John saw is greater than the number  $d$  such that every minimal situation of John seeing 3 phonologists is a minimal situation of John seeing  $d$ -many phonologists.

(26) Derivation of MNPG presupposition failure:

a. #More than three students stood in square formation.

b.  $\max(\lambda d. \forall s[\text{MIN}(\mathbf{3 \text{ students stand in square formation}})(s) \rightarrow \text{MIN}(d\text{-many students stand in square formation})(s)]) < \max(\lambda d'. d'\text{-many students stood in square formation})$

The impossible state of affairs that is “a minimal situation of 3 students standing in square formation” can still produce the observed MNPG effect on this modified account.

### 3. Evidence that subset comparatives are clausal

An analysis along the lines proposed above will have as a consequence that subset comparatives have the properties of clausal comparatives, rather than phrasal comparatives. In this section, I provide evidence of clausal structure in subset comparative constructions, both in English and in other languages.

#### 3.1. Case and preposition matching

In many languages, including German, the case of a DP in a *than*-clause must match that of the corresponding constituent in the matrix. Subset comparatives are no exception:

- (27) a. Ich habe dir mehr **Leute** als nur **den** **Hans** empfohlen.  
 I have you-DAT more people.ACC than only the-ACC H. recommended  
 ‘I recommended more people than just Hans to you.’  
 b. Ich habe dich mehr **Leuten** als nur **dem** **Hans** empfohlen.  
 I have you-ACC more people-DAT than only the-DAT H. recommended  
 ‘I recommended you to more people than just Hans.’

To the extent that case-matching in general is evidence of a clausal source containing a silent case assigner, the fact that subset comparatives do show case-matching effects can be seen as evidence of clausal structure.

A possibly related phenomenon concerns prepositions in the *than*-clause. In Spanish, for example, the standard can optionally occur with a preposition that matches one in the matrix. As Aparicio (2014) notes, this is a potential problem for a phrasal analysis, since the standard here is a PP rather than a DP. In Irish, the inclusion of the preposition is actually obligatory, as shown in (29).

- (28) Juan se ha deshecho **de** más libros **que (d)el** **Quijote**.  
 J. SE has got.rid of more books than (of)-the Q.  
 ‘Juan got rid of more books than just *Don Quixote*.’ (Aparicio 2014)

- (29) a. Chónaigh Niamh i níos mó cathracha ná **i** [mBaile Átha Cliath].  
 lived N. in COMPAR many cities than in Dublin  
 ‘Niamh has lived in more cities than just Dublin.’



- b. #Chónaigh Niamh i níos mó cathracha ná [Baile Átha Cliath].  
 lived N. in COMPAR many cities than Dublin  
 ('Niamh has lived in more cities than Dublin.')

Without the preposition, a subset reading is impossible: only an implausible clausal reading is available (one where the city of Dublin itself is moving around). The requirement of the matching preposition in Irish (and perhaps the option of including it in Spanish) may be evidence of the presence of a full *than*-clause, the rest of which is elided.

Finnish is another language that shows case-matching effects, as well as providing further evidence for a clausal source on the basis of the standard marker.

### 3.2. A language that marks the phrasal/clausal distinction

In Finnish, the distinction between phrasal and clausal comparatives is marked overtly. The standard can be marked with the partitive case, as in (30a), or with *kuin* 'than' as in (30b).

- (30) a. Liisa on **minua** pitempi.  
 L.NOM is me-PART tall-COMP.NOM  
 'Liisa is taller than me.' (phrasal)  
 b. Liisa on pitempi **kuin minä**.  
 L.NOM is tall-COMP.NOM than I.NOM  
 'Liisa is taller than I am.' (clausal)

In comparatives with *kuin*, the standard matches its matrix correlate in case: nominative in (30b), and allative in (31).

- (31) Matti antoi **Liisalle** enemmän kirjoja **kuin minulle**.  
 M. gave L.-ALLAT more books-PL.PART than me-ALLAT  
 'Matti gave Liisa more books than (he gave) me.'

The choice of standard marker can also affect interpretation, as seen in (32). With *kuin*, the standard is nominative, matching the matrix subject *Matti*, and is interpreted as a subject; if it appears in the partitive construction, the comparative is interpreted as a predicate modifying the object of the verb 'like'.

- (32) a. Matti tykkää pitemmästä tytöstä **kuin minä**.  
 M. likes tall-COMP-ELA girl-ELA than I.NOM  
 ‘Matti likes a taller girl than I do.’  
 b. Matti tykkää **minua** pitemmästä tytöstä.  
 M. likes me-PART tall-COMP-ELA girl-ELA  
 ‘Matti likes a girl who’s taller than me.’

Given these facts about Finnish comparatives, it is interesting to observe that it is the clausal strategy, with the standard marker *kuin*, that is used to form subset comparatives. The standard is marked accusative to match the direct object in (33a); in (33b), it is marked ablative (as is its correlate, ‘more people’), since this is the case that the verb *kysyä* ‘to ask’ takes.<sup>3</sup> Moreover, comparative quantifiers with numerals occur with the clausal standard marker as well, as shown in (34).

- (33) a. Matti näki **enemmän ihmisiä** **kuin vain Liisan**.  
 M. saw more person-PL-PART than only L.-ACC  
 ‘Matti saw more people than just Liisa.’  
 b. Kysyin siitä **useammilta ihmisiltä** **kuin vain Liisalta**.  
 asked.1SG DEM-ELAT more-PL-ABL person-PL-ABL than only L.-ABL  
 ‘I asked more people than just Liisa about it.’
- (34) Kysyin siitä **useammalta kuin kolmelta ihmiseltä**.  
 asked.1SG DEM-ELAT more-ABL than three-ABL person-ABL  
 ‘I asked more than three people about it.’

### 3.3. Multiple remnants

Another hallmark of reduced clausal comparatives is the possibility of multiple remnants in the *than*-clause (Merchant 2009). Subset comparatives in English are capable of hosting multiple remnants, as long as the subset presupposition is met: for instance, (35) presupposes both that *Treasure Island* is a book and that Mary is one of the children.

- (35) John read more books to the children than just *Treasure Island* to Mary.

<sup>3</sup>The choice between the two words for ‘more’ – *enemmän* and *useampi* – depends on what case the relevant DP is in. *Enemmän* is the comparative of *paljon* ‘much/many’; like *paljon*, its distribution is limited to certain direct-object positions (Zimmermann 1999). Elsewhere, the synonymous quantifier *usea* and its comparative *useampi* are used, as in (33b).

To see more clearly that the subset presupposition extends to all remnants, consider the contrast in (36). The problem with (36a) is that an event of reading *Treasure Island* in Boston is not an event of reading a book in New York. The minimally different (36b), on the other hand, is acceptable: here, the locative adjunct in the *than*-clause is one of which the subset presupposition holds.

- (36) a. #John read more books in New York than just *Treasure Island* in Boston.  
 b. John read more books in Massachusetts than just *Treasure Island* in Boston.

In addition, as (37) shows, it is possible for one of these multiple remnants to bind the other:

- (37) *Context: Bill is listening to pairs of CDs. Each pair consists of two recordings of the same piece of music, one by a flutist and one by a violinist. After listening to both versions of each piece, Bill compares the performances. He doesn't know the identities of the musicians. Unbeknownst to him, Sue is the performer – once as a flutist and once as a violinist – on both recordings of the same piece in one of the pairs.*  
 Bill compared more flutists to violinists **than just Sue<sub>i</sub> to herself<sub>i</sub>**.

This points to the existence of a larger elided clause, where *Sue* and *herself* appear in their usual binding configuration. The possibility of subset comparatives with multiple remnants can be accounted for by a clausal analysis, but is problematic for an analysis like that of Aparicio (2014), whereby *than* takes a type *e* argument rather than a full clause.

### 3.4. Disjunction in the *than*-clause<sup>4</sup>

Another potential advantage of a clausal analysis is in accounting for subset comparatives whose standard involves disjunction, as in (38).

- (38) John saw more phonologists than just Mary or Bill.

The clausal analysis based on minimal situations gives the truth-conditions in (39):

- (39)  $\max(\lambda d. \forall s[\text{MIN}(\text{John sees Mary or Bill})(s) \rightarrow \text{MIN}(\text{John sees } d\text{-many phonologists})(s)])$   
 $< \max(\lambda d'. \text{John saw } d'\text{-many phonologists})$

<sup>4</sup>Thanks to Bernhard Schwarz for bringing this issue to my attention.

In other words, (38) is true just in case John saw a number of phonologists greater than the number of phonologists he sees in every minimal situation of seeing Mary or Bill (and the prejacent, that John saw Mary or Bill, is presupposed). A minimal situation of John seeing Mary or Bill either consists only of John seeing Mary, or of John seeing Bill. If the subset presupposition that both Mary and Bill are phonologists is met, then a minimal situation of John seeing Mary or Bill is a minimal situation of John seeing one phonologist. So (38) entails that John saw more than one phonologist, and presupposes that at least one of the phonologists he saw was Mary or Bill.

The challenge for an analysis like Aparicio (2014)'s, which involves mapping individuals to their cardinalities, is how to map *Mary or Bill* into a cardinality (if there is any way that it can be said to have one).

However, (38) is potentially problematic for a clausal analysis as well. The truth-conditions in (39) require that John saw more than one phonologist, one of whom was Mary or Bill. The prediction is that the sentence should be true in a scenario where John saw both Mary and Bill, and no other phonologists. Therefore, it is somewhat surprising that the continuation in (40) is infelicitous:

(40) John saw more phonologists than just Mary or Bill — #he saw Mary and Bill.

One thing to note is that although (41a) is better than (40), it is still not perfect. (41b), on the other hand, does not suffer from the infelicity that (41a) does.

- (41) a. John saw more phonologists than just Mary or Bill — #?he saw Mary, Bill, and Sue.  
 b. John saw more phonologists than just Mary and Bill — he saw Mary, Bill, and Sue.

The contrast between (41a) and (41b) suggests that the problem with (40) comes from *or* itself: we may be seeing the effects of an implicature that John didn't see both Mary and Bill, which is acting as a confound here.

Nevertheless, it is possible to construct contexts where sentences with disjunctions in the *than*-clause can be judged as true under such circumstances. Consider the following dialogue:

(42) *Context: A college student is meeting with his advisor to select courses for the upcoming semester.*

Student: So far, I've picked three classes. For my fourth and final class, I want to take something in linguistics so that I can declare the major at the end of the semester. I've narrowed it down to two classes: either Semantics or Phonology.

Advisor (consulting the official requirements): If you want to declare the major this semester, **you'll need to take more linguistics classes than just Semantics or Phonology.** You need at least two more classes' worth of credits before you can do that.

In this scenario, the student could fulfill the requirement if he took both of the linguistics classes he mentioned, and no others. So it is possible to interpret “taking more linguistics classes than just Semantics or Phonology” as “taking more than one linguistics class,” which is what the analysis proposed here predicts. The difference between (42) and (40), and the effect of the modal environment in (42) on the presuppositions of the subset comparative, are beyond the scope of this paper.

#### 4. Conclusion

This paper has proposed a novel analysis of subset comparative constructions, motivated by the properties that they have in common with comparative quantifiers involving numerals. The major difference between this analysis and previous ones is that it uses a reduced clausal structure to derive the meanings of subset comparatives. The appeal of this analysis is that it unifies subset comparatives and numerical comparative quantifiers as two variants of the same phenomenon (depending on the content of the *than*-clause), additionally deriving subset presuppositions and the Minimal Number of Participants Generalization from the same source. The analysis predicts that subset comparatives should have clausal, rather than phrasal, properties. This prediction appears to be borne out, on the basis of evidence from English as well as other languages.

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## ***At most at last***

Doris Penka —*University of Konstanz*

**Abstract.** Recent pragmatic accounts derive the ignorance inferences to which superlative modifiers give rise as quantity implicatures in a neo-Gricean framework. While these approaches successfully account for the interaction of *at least* with modals, the behavior of *at most* remains a puzzle. I propose that *at most* is composed of an antonymizing operator and *at least* and show how this accounts for the interaction of *at most* with modals and quantifiers in a neo-Gricean framework.

**Keywords:** superlative modifiers, ignorance inferences, decomposition, antonyms

### **1. Superlative modifiers and ignorance inferences**

The superlative modifiers *at least* and *at most* have received a great deal of attention in the recent semantic and pragmatic literature (Geurts and Nouwen 2007, Büring 2008, Cummins and Katsos 2010, Nouwen 2010 and 2015, Schwarz 2011 and 2013, Cohen and Krifka 2014, Coppock and Brochhagen 2013, Kennedy 2015). What makes them a particularly interesting object of study is the fact that in most contexts, *at least* and *at most* imply speaker ignorance, i.e. they convey that the speaker isn't sure about the precise value under discussion (see Geurts and Nouwen 2007, Nouwen 2010). Sentence (1), for instance, conveys that the speaker is not sure how many beers exactly John had last night. The only thing she is sure about is that the number is not less than three. But for all she knows, John might have had four or five etc. beers.

- (1) John had **at least** three beers last night.

In certain environments, however, the implication of speaker uncertainty is absent. In particular, ignorance inferences can be suppressed in certain combinations of *at least* and *at most* with modals (see Geurts and Nouwen 2007). Sentence (2), where *at least* occurs under a necessity modal, has a reading which Büring (2008) calls authoritative. Under this reading, (2) doesn't convey speaker ignorance, but rather expresses that 10 pages is the minimally required length of the paper. This reading is graphically illustrated in (2a), where '----' signifies the range of permissible paper lengths — which I will also refer to as deontic range — and 10pp is its lower bound.

- (2) The paper **has to be at least** 10 pages long. □ + *at least*
- a. '10 pages is the minimally required length of the paper'
- [-----  
10pp authoritative reading
- b. 'According to what the speaker knows, the minimally required length might be 10 pages or it might be more.'
- [////////-  
10pp speaker insecurity reading

Sentence (2) has another reading conveying speaker ignorance, which can be brought out by

prefixing the utterance with “I don’t know exactly. But I think ...”. Under this reading, which Buring (2008) calls speaker insecurity reading, the speaker is unsure about the minimally required length of the paper. For all she knows, the lower bound of permissible paper lengths could be 10pp or more. This reading is graphically illustrated in (2b), where ‘/////’ signifies the epistemic range, i.e. the values that for all the speaker knows might or might not be permissible. To bring out the difference between the two readings, consider a situation in which the regulations specify that only papers that are 15 or more pages long will be accepted. In this situation, the sentence is judged false under the authoritative reading (2a), whereas under the speaker insecurity reading (2b) one cannot blame the speaker for making a false statement.

Regarding the readings that are available for certain combinations of modals and superlative modifiers, I basically follow Geurts and Nouwen (2007), who argue that  $\Box + \text{at least}$  and  $\Diamond + \text{at most}$  have both the authoritative and the speaker insecurity reading, whereas  $\Diamond + \text{at least}$  and  $\Box + \text{at most}$  only allow for the speaker insecurity reading (but I will return to  $\Box + \text{at most}$  in section 3.4 below). This grouping has also been confirmed in experimental studies by McNabb and Penka (2014a,b). The readings that I take to be available for the different combinations are summarized in (2) to (5).

- (3) The paper **can** be **at least** 10 pages long.  
 ‘According to what the speaker knows, the maximally allowed length might be 10 pages or more.’  
 -----[/////]  
 10pp speaker insecurity reading only
- (4) The paper **has to** be **at most** 10 pages long.  
 ‘According to what the speaker knows, the minimally required length might be 10 pages or less.’  
 [/////]-----  
 10pp speaker insecurity reading only
- (5) The paper **can** be **at most** 10 pages long.  
 a. ‘10 pages is the maximally allowed length of the paper’  
 -----]  
 10pp authoritative reading  
 b. ‘According to what the speaker knows, the maximally allowed length might be 10 pages or less.’  
 -----[/////]  
 10pp speaker insecurity reading

The ignorance implications of *at least* and *at most* and their interaction with modals are currently subject to a lot of work in semantics and pragmatics. But none of the analyses proposed so far fully accounts for the interaction of *at least* and *at most* with modals. The aim of this paper is to improve on a pragmatic account that derives ignorance inferences of superlative modifiers as quantity implicatures in a neo-Gricean framework, which is conceptually attractive and empirically well motivated. As I discuss in section 2, this approach successfully accounts for the interaction of *at least* with modals, but fails for *at most*. In section 3, I propose an analysis of *at*



*most* where it is decomposed into an antonymizing operator and *at least*. I show that this decomposition analysis combined with a neo-Gricean account of ignorance inferences correctly predicts that *at most* gives rise to an authoritative reading in combination with possibility modals. At the end I show that the decomposition analysis also accounts for further patterns of interaction between *at most* and quantifiers.

## 2. A neo-Gricean account of ignorance inferences of superlative modifiers

### 2.1. Ignorance inferences as quantity implicatures

Büring (2008), Cummins and Katsos (2010), Schwarz (2011, 2013) and Kennedy (2015) propose that the ignorance inferences triggered by *at least* and *at most* arise as quantity implicatures. This approach is supported by the fact that ignorance inferences of superlative modifiers show one of the hallmarks of conversational implicatures and are absent in downward entailing contexts.<sup>1</sup> Thus, the examples in (6), where a superlative modifier occurs in the restrictor of a universal quantifier and the antecedent of a conditional, don't convey speaker ignorance.

- (6) a. Everyone who has **at least** three children is eligible for child benefits.  
 b. You'll loose weight if you take in **at most** 1500 calories per day.

This approach builds on a parallel to ignorance inferences arising with disjunction, which are generally taken to be derived via Gricean reasoning. While the accounts of Büring (2008) and Cummins and Katsos (2010) take the parallel to disjunction at face value and assume that *at least* *n* is semantically equivalent to 'exactly *n* or more than *n*', Schwarz (2011, 2013) and Kennedy (2015) spell out an analysis of superlative modifiers as degree operators in a neo-Gricean framework. Here I follow Schwarz (2011), who shows that ignorance inferences of *at least* and *at most* can be derived in the same way as the ignorance implications of *or* in Sauerland's (2004) neo-Gricean system.<sup>2</sup> The essential ingredients of Schwarz' analysis are the following: In the semantics, *at least* and *at most* are analyzed as degree operators expressing non-strict comparison:

- (7) a.  $\llbracket \text{at least} \rrbracket = \lambda d_d. \lambda D_{dt}. \max(D) \geq d$   
 b.  $\llbracket \text{at most} \rrbracket = \lambda d_d. \lambda D_{dt}. \max(D) \leq d$

In the pragmatics, utterances with *at least* or *at most* trigger scalar alternatives which are the

<sup>1</sup> While superlative modifiers seem to be banned from the scope of negation and other negative expressions, they are more acceptable in some non-strictly negative downward entailing contexts. What causes the polarity sensitivity of superlative modifiers is an open question.

<sup>2</sup> Mayr (2013) and Schwarz (2013) note that Sauerland's algorithm needs to be revised and based on the notion of Innocent Exclusion (Fox 2007) in order to prevent the generation of unattested scalar implicatures for scalar modifiers. I neglect this issue for the purpose of this paper and circumvent the problem for Sauerland's basic algorithm by considering just those scalar alternatives that asymmetrically entail the assertion and where the number is closest to the modified numeral.

cross-product of substituting (i) the modified number by other numerals or measure phrases and (ii) *at least* and *at most* by each other and *exactly*.

$$(8) \quad [[\text{exactly}]] = \lambda d_d. \lambda D_{dt}. \max(D) = d$$

With these assumptions ignorance inferences are generated for unembedded occurrences of *at least* and *at most* in Sauerland's system, where scalar implicatures and ignorance inferences are two sides of the same coin. Scalar implicatures arise if primary implicatures of the form "the speaker is not certain that  $\phi$ ", where  $\phi$  is a stronger scalar alternative, can be strengthened to secondary or scalar implicatures of the form "the speaker is certain that not  $\phi$ ". Ignorance inferences arise if the stronger alternatives are symmetric, which means that they cannot simultaneously be false while the assertion is true, or putting it differently, the assertion is equivalent to the disjunction of the stronger alternatives. This is illustrated in the following for example (9), which has the LF and the truth-conditions shown in (10).

(9) The paper is **at least** 10 pages long.

- (10) a. [at least 10pp] [  $\lambda d$  [the paper is d long]]  
 b.  $\max\{d: \text{long}(p,d)\} \geq 10pp$   
 'The length of the paper is 10pp or more.'

The scalar alternatives of (9) correspond to the cross-product of substituting *at least* by *exactly* or *at most* and by substituting *10pp* by other paper lengths. Out of these, the alternatives that are more informative, i.e. asymmetrically entail the assertion, are the ones formed by substituting either *at least* by *exactly* or *10pp* by *11pp*.

(11) Scalar alternatives to (9):

The paper is *NumMod* *n* pages long.      where  $\text{NumMod} \in \{ \text{at least}, \text{exactly}, \text{at most} \}$   
 $n \in \{ \dots, 9, 10, 11, \dots \}$

(12) Stronger scalar alternatives:

- a. The paper is **exactly** 10 pages long.      *at least*  $\Rightarrow$  *exactly*  
 $\max\{d: \text{long}(p,d)\} = 10pp$   
 b. The paper is at least **11** pages long.      *10pp*  $\Rightarrow$  *11pp*  
 $\max\{d: \text{long}(p,d)\} \geq 11pp \iff^3$   
 $\max\{d: \text{long}(p,d)\} > 10pp$

Because the stronger alternatives in (12) are symmetric, i.e. one of them has to be true for the assertion to be true, none of the primary implicatures can be strengthened to secondary/scalar implicatures, because this would contradict the conjunction of the assertion and all the primary implicatures. Instead, the assertion and the primary implicatures taken together entail possibility implicatures. This is shown in (13), where using Gazdar's (1979) notation,  $K\phi$  corresponds to 'the speaker knows/ believes  $\phi$ ' and  $P\phi$  to 'the speaker considers  $\phi$  possible'.

<sup>3</sup> The symbol  $\iff^*$  is used when the equivalence is based on the simplifying assumption that the relevant scale is discrete, i.e. that only full-page lengths are considered, which I make for ease of exposition.

- (13) a. Assertion:  $K \max\{d: \text{long}(p,d)\} \geq 10pp$  A  
 b. Primary implicatures:  $\neg K \max\{d: \text{long}(p,d)\} = 10pp$  PiI1  
 $\neg K \max\{d: \text{long}(p,d)\} > 10pp$  PiI2  
 c. Possibility implicatures:  $P \max\{d: \text{long}(p,d)\} = 10pp$  PoI1 (follows from A + PiI2)  
 $P \max\{d: \text{long}(p,d)\} > 10pp$  PoI2 (follows from A + PiI1)

The primary and possibility implicatures together correspond to ignorance inferences, which are of the form  $P\phi$  &  $P\neg\phi$  (note that  $\neg K\phi$  is equivalent to  $P\neg\phi$ ). According to them, the speaker doesn't know whether the paper is exactly 10pp long or whether the paper is more than 10pp long. Together with the assertion, this correctly reflects the meaning of sentence (9).

- (14) Ignorance implicatures generated:  
 a.  $P \max\{d: \text{long}(p,d)\} = 10pp$  &  $P \neg \max\{d: \text{long}(p,d)\} = 10pp$   
 b.  $P \max\{d: \text{long}(p,d)\} > 10pp$  &  $P \neg \max\{d: \text{long}(p,d)\} > 10pp$

Ignorance inferences for unembedded occurrences of *at most* are generated in the same way, the only difference being that now the alternative with a lower numeral is symmetric to the alternative where *at most* is substituted by *exactly*.

- (15) The paper is **at most** 10 pages long.  
 $\max\{d: \text{long}(p,d)\} \leq 10pp$

- (16) Stronger scalar alternatives:  
 a. The paper is **exactly** 10 pages long.  $\text{at most} \Rightarrow \text{exactly}$   
 $\max\{d: \text{long}(p,d)\} = 10pp$   
 b. The paper is at most **9** pages long.  $10pp \Rightarrow 9pp$   
 $\max\{d: \text{long}(p,d)\} \leq 9pp \Leftrightarrow^* \max\{d: \text{long}(p,d)\} < 10pp$

- (17) Ignorance implicatures generated:  
 a.  $P \max\{d: \text{long}(p,d)\} = 10pp$  &  $P \neg \max\{d: \text{long}(p,d)\} = 10pp$   
 b.  $P \max\{d: \text{long}(p,d)\} < 10pp$  &  $P \neg \max\{d: \text{long}(p,d)\} < 10pp$   
 'The speaker doesn't know whether the paper is exactly 10pp long or whether the paper is less than 10pp long.'

The neo-Gricean analysis thus accounts for the fact that unembedded occurrences of *at least* and *at most* give rise to ignorance inferences. It also explains why numerals modified by superlative modifiers don't give rise to scalar implicatures, in contrast to bare numerals. Moreover, it makes certain predictions for the interaction of superlative modifiers with modals, which are discussed in the following sections.

## 2.2. Interaction with necessity modals

Since superlative modifiers are analyzed as degree operators, two different scope orders are possible when they interact with modals. If a superlative modifier is interpreted in the scope of a necessity modal, the stronger scalar alternatives in (20) are not symmetric. They can simultaneously be false while the assertion is true, namely in case of (18) if the permissible

paper length corresponds to a range including 10 and more pages. Because these alternatives are not symmetric, they give rise to the scalar implicatures in (21).

(18) The paper **has to be at least** 10 pages long.

(19) a. has to [[at least 10pp] [ $\lambda d$  [the paper be  $d$  long]]]  $\square > at\ least$

b.  $\square \max\{d: \text{long}(p,d)\} \geq 10pp$

‘In all the acceptable worlds, the length of the paper is 10pp or more.’

(20) Stronger scalar alternatives:

a.  $\square \max\{d: \text{long}(p,d)\} = 10pp$

*at least  $\Rightarrow$  exactly*

‘In all the acceptable worlds, the length of the paper is exactly 10pp.’

b.  $\square \max\{d: \text{long}(p,d)\} \geq 11pp \Leftarrow \Rightarrow^*$

*10pp  $\Rightarrow$  11pp*

$\square \max\{d: \text{long}(p,d)\} > 10pp$

‘In all the acceptable worlds, the paper is longer than 10pp.’

(21) Scalar implicatures generated:

a.  $K \neg \square \max\{d: \text{long}(p,d)\} = 10pp$

b.  $K \neg \square \max\{d: \text{long}(p,d)\} > 10pp$

According to these scalar implicatures, the speaker is sure that the paper doesn’t have to be exactly 10pp long and that the paper doesn’t have to be more than 10pp long. Together with the asserted content this is true iff the permissible paper lengths correspond to a range of values whose lower bound is 10pp. This corresponds to the authoritative reading in (22).

(22)  $\begin{array}{c} \text{[-----} \\ 10pp \end{array}$  authoritative reading

If a superlative modifier takes wide scope over a necessity modal, the speaker insecurity reading results. Although the scope order *at least*  $> \square$  is truth-conditionally equivalent to  $\square > at\ least$  (see Heim 2000), the pragmatic reasoning is different. Because wide scope of *at least* and *exactly* in the alternatives leads to symmetric alternatives – just as in the case of unembedded occurrences, ignorance inferences rather than scalar implicatures are generated.

(23) a. [at least 10pp] [ $\lambda d$  [ has to [the paper be  $d$  long]]] *at least  $> \square$*

b.  $\max\{d: \square \text{long}(p,d)\} \geq 10pp$

‘The minimally required length of the paper is 10pp or more.’

(24) Stronger scalar alternatives:

a.  $\max\{d: \square \text{long}(p,d)\} = 10pp$

*at least  $\Rightarrow$  exactly*

‘The minimally required length of the paper is exactly 10pp.’

b.  $\max\{d: \square \text{long}(p,d)\} \geq 11pp \Leftarrow \Rightarrow^* \max\{d: \square \text{long}(p,d)\} > 10pp$

*10pp  $\Rightarrow$  11pp*

‘The minimally required length of the paper is more than 10pp.’

(25) Ignorance implicatures generated:

- a.  $P \max\{d: \Box \text{long}(p,d)\} = 10pp \ \& \ P \neg \max\{d: \Box \text{long}(p,d)\} = 10pp$   
 b.  $P \max\{d: \Box \text{long}(p,d)\} > 10pp \ \& \ P \neg \max\{d: \Box \text{long}(p,d)\} > 10pp$

These ignorance implicatures express that the speaker is unsure about the minimally required length of the paper; she doesn't know whether it is exactly 10pp or more than 10pp. Together with the asserted content, this corresponds to the speaker insecurity reading.

- (26)  $\begin{array}{c} [/////////----- \\ 10pp \end{array}$  speaker insecurity reading

Under the neo-Gricean account the two readings of sentences with a necessity modal and *at least* come down to a difference in scope: The authoritative reading arises if the superlative modifier is interpreted in scope of the necessity modal, and the speaker insecurity reading results from wide scope of the superlative modifier. As evidence for this scopal ambiguity, Buring (2008) observes that only the authoritative reading is available if movement of *at least* over the modal is blocked for independent reasons, in particular if *at least* is contained within a finite clause. Sentence (27) only has the authoritative reading (22), and the speaker insecurity reading (26) is absent. It thus contrasts with the minimally different (18), where *at least* occurs in an infinitival and both readings are available.

- (27) It is **required** that the paper be **at least** 10 pages long.

The derivations for *at most* are again parallel to those for *at least*, as the reader may verify for herself. If *at most* takes narrow scope under a necessity modal the stronger scalar alternatives, generated by substituting the modified number by lower values and *at most* by *exactly*, are not symmetric and the authoritative reading is derived. If *at most* takes wide scope, the stronger scalar alternatives are symmetric and the speaker insecurity reading results.

In general, ignorance inferences are obviated if a superlative modifier is interpreted in the scope of an operator that breaks symmetry. This arguably also accounts for other cases of ignorance obviation, e.g. under universal quantifiers (Schwarz, 2011) and generics (Nouwen 2010). However, we will see in the next section that a possibility modal does not break symmetry.

### 2.3. Interaction with possibility modals

While we just saw that a necessity modal breaks symmetry if a superlative modifier is interpreted in its scope and scalar rather than ignorance implicatures arise, a possibility modal does not break symmetry. Even if the possibility modal takes wide scope over a superlative modifier the stronger scalar alternatives cannot simultaneously be false while the assertion is true. Therefore ignorance inferences are generated. This is illustrated in the following for *at most* (the case for *at least* is again parallel).

- (28) The paper **can** be **at most** 10 pages long.
- (29) a.  $\text{can} [[\text{at most } 10pp] [\lambda d [\text{the paper be } d \text{ long}]]]$   $\Diamond > \text{at most}$   
 b.  $\Diamond \max\{d: \text{long}(p,d)\} \leq 10pp$

‘There is an acceptable world where the length of the paper is 10pp or less.’

(30) Stronger scalar alternatives:

- a.  $\Diamond \max\{d: \text{long}(p,d)\} = 10\text{pp}$  *at most*  $\Rightarrow$  *exactly*  
 ‘There is an acceptable world where the length of the paper is exactly 10pp.’  
 b.  $\Diamond \max\{d: \text{long}(p,d)\} \leq 9\text{pp}$   $\Leftarrow \Rightarrow$  \* *10pp*  $\Rightarrow$  *9pp*  
 $\Diamond \max\{d: \text{long}(p,d)\} < 10\text{pp}$   
 ‘There is an acceptable world where the length of the paper is less than 10pp.’

(31) Ignorance inferences generated:

- a.  $P \Diamond \max\{d: \text{long}(p,d)\} = 10\text{pp} \ \& \ P \neg \Diamond \max\{d: \text{long}(p,d)\} = 10\text{pp}$   
 b.  $P \Diamond \max\{d: \text{long}(p,d)\} < 10\text{pp} \ \& \ P \neg \Diamond \max\{d: \text{long}(p,d)\} < 10\text{pp}$

If *at most* is interpreted in the scope of the modal as in (29) to (31) above, a reading results which is weak for several reasons. For one thing the truth conditions merely say that there is an acceptable world where the length of the paper is 10pp or less. In addition, strong ignorance inferences are generated according to which the speaker doesn’t know whether the paper can be exactly 10pp long or whether the paper can be less than 10pp long. Thus for all the speaker knows, the maximally allowed length might be 5pp or the minimally required length might be 10pp. This reading might not be detectable because there is another reading with stronger truth conditions and sensible ignorance inferences, derived from an LF where the superlative modifier takes wide scope, as shown in (32) to (35).

- (32) a. [at most 10pp]  $\lambda d$  [allowed [the paper be d long]] *at most*  $>$   $\Diamond$   
 b.  $\max\{d: \Diamond \text{long}(p,d)\} \leq 10\text{pp}$   
 ‘The maximally allowed length of the paper is 10pp or less.’

(33) Stronger scalar alternatives:

- a.  $\max\{d: \Diamond \text{long}(p,d)\} = 10\text{pp}$  *at most*  $\Rightarrow$  *exactly*  
 ‘The maximally allowed length of the paper is exactly 10pp.’  
 b.  $\max\{d: \Diamond \text{long}(p,d)\} \leq 9\text{pp}$   $\Leftarrow \Rightarrow$  \* *10pp*  $\Rightarrow$  *9pp*  
 $\max\{d: \Diamond \text{long}(p,d)\} < 10\text{pp}$   
 ‘The maximally allowed length of the paper is less than 10pp.’

(34) Ignorance implicatures generated:

- a.  $P \max\{d: \Diamond \text{long}(p,d)\} = 10\text{pp} \ \& \ P \neg \max\{d: \Diamond \text{long}(p,d)\} = 10\text{pp}$   
 b.  $P \max\{d: \Diamond \text{long}(p,d)\} < 10\text{pp} \ \& \ P \neg \max\{d: \Diamond \text{long}(p,d)\} < 10\text{pp}$

According to these ignorance inferences the speaker isn’t sure whether the maximally allowed length of the paper is exactly 10pp or whether the maximally allowed length is less than 10pp. Together with the asserted content, this corresponds to the attested speaker insecurity reading illustrated in (35).

- (35) -----/////////] speaker insecurity reading  
10pp

In sum, the neo-Gricean account of ignorance inferences makes the following predictions regarding the interaction of superlative modifiers with modals: If *at least* or *at most* are

interpreted with wide scope over a necessity or possibility modal, the speaker insecurity reading is derived. The authoritative reading results from interpreting *at least* or *at most* in the scope of a necessity modal. Narrow scope under a possibility modal leads to a reading with strong ignorance inferences.

This correctly accounts for the readings observed for *at least*. As discussed in section 1, *at least* gives rise to an authoritative reading in combination with a necessity modal, but not in combination with a possibility modal. But the pattern is different for *at most*, where the authoritative reading is available in combination with a possibility modal, but doesn't seem to be available in combination with a necessity modal. Therefore the neo-Gricean analysis, while successful for *at least*, doesn't account for the interaction of *at most* and modals.

### 3. A compositional analysis of *at most*

#### 3.1. Decomposing *at most*

Following the idea that negative antonyms are generally decomposed in the syntax into an antonymizing operator and the corresponding positive antonym (Heim 2006, 2008, Büring 2007, Alxatib 2013), I propose that *at most n* is decomposed into an antonymizing operator ANT and *at least n*:

$$(36) \quad \text{at most } n = [[n\text{-ANT}]_{d(dt)}\text{-at least}]_{(dt)t}$$

As meaning for *at least* I adopt the degree operator semantics proposed by Schwarz (2011) and Kennedy (2015), and repeated as (37).

$$(37) \quad [[\text{at least}]] = \lambda d_d. \lambda D_{dt}. \max(D) \geq d$$

For the semantics of the antonymizing operator ANT, it suggests itself to use Heim's (2006) operator *little*, defined in (38) and expressing degree negation (see also Alxatib 2013).

$$(38) \quad [[\text{little}]] = \lambda d_d. \lambda D_{dt}. \neg D(d)$$

With this meaning of *little*, however, *at most n* cannot be decomposed into *little* plus *at least n*, but would rather correspond to *little* plus *more than n*. But there is in fact independent evidence that a revision of Heim's definition of *little* is needed (see also Beck 2012). This comes from sentences like (39), where *that* serves as direct degree argument of *weigh* and anaphorically picks up the measure phrase 40kg. With the definition of *little* in (38) the truth conditions in (40b) are derived, according to which Sue weighs less than 40kg. Since (39) is intuitively perfectly compatible with Sue weighing exactly 40kg, this is not what the sentence means.

$$(39) \quad [\text{Mary only weighs 40kg.}] \text{ Sue weighs that little too.}$$

$$(40) \quad \text{a. } [\text{that little}] [\lambda d [\text{Sue weighs } d\text{-much}]]$$

$$\text{b. } \neg[\text{WEIGHT}(s) \geq 40\text{kg}] = \text{WEIGHT}(s) < 40\text{kg}$$

In order to derive the correct meaning for sentence (39), we need a definition of *little* in which only higher degrees are negated, but not the degree contributed by the first argument:

$$(41) \quad [[\text{little}_2]] = \lambda d_d. \lambda D_{dt}. \forall d' > d: \neg D(d')$$

With this we derive the meaning (42b), according to which Sue doesn't weigh more than 40kg. This can then be strengthened by scalar implicature to mean that Sue's weight is exactly 40kg, just as for the sentence *Sue weighs 40kg*. This correctly captures the meaning of (39).

$$(42) \quad \begin{array}{l} \text{a. } [\text{that little}_2] [\lambda d [\text{Sue weighs } d\text{-much}]] \\ \text{b. } \forall d' > 40\text{kg}: \neg[\text{WEIGHT}(s) \geq d'] = \\ \quad \neg[\text{WEIGHT}(s) > 40\text{kg}] \end{array}$$

I thus use this revised definition of *little* as the meaning of the antonymizing operator ANT. As noted by Beck (2012), this renders the antonymizing operator ANT equivalent to the straightforward definition of *at most* repeated from (7b) above.

$$(43) \quad [[\text{ANT}]] = \lambda d_d. \lambda D_{dt}. \forall d' > d: \neg D(d')$$

$$(7b) \quad [[\text{at most}]] = \lambda d_d. \lambda D_{dt}. \max(D) \leq d$$

### 3.2. Alternatives and ignorance inferences of *at most*

With these assumptions about the syntax-semantics interface, let us now turn to the question what consequences the compositional analysis of *at most* has for the pragmatics. In particular the question needs to be addressed what the scalar alternatives are for an utterance with *at most*. In this respect I follow Katzir (2007) and Fox & Katzir (2011), who argue that alternatives are structurally defined and generated by substitution of lexical categories and deletion. In particular, I assume that the scalar alternatives for an utterance with *at most* are generated by (i) substituting numerals or measure phrases by each other; (ii) substituting *at least* by *exactly* (see Schwarz 2011) and (iii) deleting ANT (see Alxatib 2013). In addition, I adopt the common assumption that (iv) modals are substituted in the alternatives.

With these assumptions about the meaning of *at most* and scalar alternatives, ignorance inferences for unembedded occurrences of *at most* are generated in the same way as in the neo-Gricean account: the stronger scalar alternatives (47) are the same as under Schwarz' (2011) analysis. Since these are symmetric, ignorance inferences are generated.

(44) The paper is **at most** 10 pages long.

$$(45) \quad \begin{array}{l} \text{a. } \text{ANT-10pp} [\lambda d_2 [\text{at least-}d_2 [\lambda d_1 [\text{the paper is } d_1\text{-long}]]]] \\ \text{b. } \forall d' > 10\text{pp}: \neg [\max\{d: \text{long}(p,d)\} \geq d] \iff \\ \quad \neg \max\{d: \text{long}(p,d)\} > 10\text{pp} \end{array}$$





## (52) Scalar alternatives:

The paper is *Pol Mod NumMod* *n* pages long.

where  $Pol \in \{\text{ANT}, \emptyset\}$

$Mod \in \{\text{allowed}, \text{required}\}$

$NumMod \in \{\text{at least}, \text{exactly}\}$

$n \in \{\dots, 9, 10, 11, \dots\}$

We now have to consider eight scalar alternatives. It turns out that out of these, only the two shown in (53) asymmetrically entail the assertion.<sup>4</sup> Crucially, the alternative (53a), generated by substituting the measure phrase with a lower value, doesn't have a symmetric counterpart. This is due to the fact that ANT, which has the semantics attributed by Schwarz (2011) to *at most*, can be deleted in the alternatives but not substituted by *exactly*. The alternative (53a) thus leads to a scalar implicature (54a), according to which the speaker is sure that the paper can be more than 9pp long. In addition, the alternative (53b) also leads to a scalar implicature (54b), according to which the speaker is sure that the paper doesn't have to be exactly 10pp long.

## (53) Stronger scalar alternatives:

a.  $\neg \Diamond \max\{d: \text{long}(p,d)\} > 9pp$

$10pp \Rightarrow 9pp$

b.  $\Box \max\{d: \text{long}(p,d)\} = 10pp$

$\text{ANT}, \Diamond \Rightarrow \Box, \text{at least} \Rightarrow \text{exactly}$

## (54) Scalar implicatures generated:

a.  $K \Diamond \max\{d: \text{long}(p,d)\} > 9pp$

b.  $K \neg \Box \max\{d: \text{long}(p,d)\} = 10pp$

Taken together, the assertion and the scalar implicatures express that the permissible paper lengths correspond to a range of values whose upper bound is 10pp. This corresponds to the authoritative reading (55), which is in fact the most salient interpretation for sentence (49).

(55) -----] authoritative reading  
10pp

The decompositional analysis can thus derive the authoritative reading for the combination of *at most* with a possibility modal, which other analyses fail to account for. In addition to the authoritative reading, the other two readings that the basic neo-Gricean approach discussed in section 2 derives are also generated from the other two available LFs (50a) and (50b). In general, if ANT and *at least* take adjacent scope, the same truth conditions and ignorance inferences are derived as under the non-decompositional analysis of Schwarz (2011). If both ANT and *at least* are interpreted in the scope of the possibility modal as in (50a), strong ignorance inferences are derived. The speaker insecurity reading is derived from the LF (50b), where both ANT and *at least* take scope under the possibility modal.

### 3.4. Interaction of *at most* with necessity modals

To complete the discussion of the predictions of the decompositional analysis, we also need to reconsider the interaction of *at most* with a necessity modal, as in (56). Again, the three scope

<sup>4</sup> In fact, the alternative derived by substituting *at least* by *exactly* and *10pp* by *9pp* is equivalent to (53a). In case of equivalent alternatives, I only consider the one requiring the fewest changes from the utterance.

orders in (57) have to be considered.

(56) The paper **has to** be **at most** 10 pages long.

- (57) a. has to [ANT-10 [ $\lambda d_2$  [at least- $d_2$  [ $\lambda d_1$  [the paper be  $d_1$ -long]]]]]  $\square > \text{ANT} > \text{at least}$   
 b. ANT-10 [ $\lambda d_2$  [at least- $d_2$  [ $\lambda d_1$  [has to [the paper be  $d_1$ -long]]]]]  $\text{ANT} > \text{at least} > \square$   
 c. ANT-10 [ $\lambda d_2$  [has to [at least- $d_2$  [ $\lambda d_1$  [the paper be  $d_1$ -long]]]]]  $\text{ANT} > \square > \text{at least}$

In the LF (57c), which is available in the decompositional, but not the basic neo-Gricean analysis, the necessity modal takes scope in between ANT and *at least*. This scope order leads to the symmetric alternatives (59a) and (59b), and thus to strong ignorance inferences. As before, I assume that the strong ignorance reading is masked by the existence of the speaker insecurity reading with sensible ignorance inferences.

- (58) a. ANT-10pp [ $\lambda d_2$  [has to [at least- $d_2$  [ $\lambda d_1$  [the paper be  $d_1$ -long]]]]]  $\text{ANT} > \square > \text{at least}$   
 b.  $\forall d' > 10\text{pp}$ :  $\neg \square \max\{d: \text{long}(p,d)\} \geq d \iff \neg \square \max\{d: \text{long}(p,d)\} > 10\text{pp}$   
 'The paper doesn't have to be more than 10pp long.'

(59) Stronger scalar alternatives:

- a.  $\neg \square \max\{d: \text{long}(p,d)\} > 9\text{pp}$   $10\text{pp} \Rightarrow 9\text{pp}$   
 b.  $\Diamond \max\{d: \text{long}(p,d)\} = 10\text{pp}$   $\text{ANT}, \square \Rightarrow \Diamond, \text{at least} \Rightarrow \text{exactly}$   
 c.  $\neg \Diamond \max\{d: \text{long}(p,d)\} > 10\text{pp}$   $\square \Rightarrow \Diamond$

(60) Ignorance inferences generated:

- a.  $P \neg \square \max\{d: \text{long}(p,d)\} > 9\text{pp} \ \& \ P \square \max\{d: \text{long}(p,d)\} > 9\text{pp}$   
 b.  $P \Diamond \max\{d: \text{long}(p,d)\} = 10\text{pp} \ \& \ P \neg \Diamond \max\{d: \text{long}(p,d)\} = 10\text{pp}$   
 'The speaker isn't sure whether the paper is required to be longer than 9pp and she isn't sure whether the paper is allowed to be exactly 10pp long.'

(61) Scalar implicature generated:

- $K \Diamond \max\{d: \text{long}(p,d)\} > 10\text{pp}$   
 'The speaker is sure that the paper is allowed to be longer than 10pp.'

The readings derived for the two LFs (57a) and (57b) where ANT and *at least* take adjacent scope over or under the modal are again equivalent to the ones for non-decomposed *at most*. Wide scope of ANT and *at least* results in the speaker insecurity reading, and the authoritative reading is derived if both ANT and *at least* are interpreted in the scope of the necessity modal.

The decompositional analysis inherits from the neo-Gricean account the prediction that for the combination of *at most* with a necessity modal both the speaker insecurity and the authoritative reading is available. As discussed in section 1, however, only the speaker insecurity reading seems to be possible for sentence (56). Note however, that the authoritative reading is readily available if *at most* is embedded in a finite clause under a necessity modal. The naturally occurring sentences in (62) don't express speaker ignorance, but rather report or set the upper

bound of the range of permissible values:

- (62) a. [I am looking for suggestions for a dorm room microwave for my son.]  
The college **requires** that it be **at most** 1 cu feet in volume and **at most** 800 Watts.<sup>5</sup>  
'1 cu feet is the maximally allowed volume and 800 Watts is the maximally allowed power.'  
b. This algorithm **requires** that variables be used **at most** once.<sup>6</sup>  
'The maximally allowed number of variable uses is one.'

Data like (62) suggest that the authoritative reading is in fact available (and the only reading possible) if there is no choice but to interpret the modal with widest scope. Thus, I take it to be a welcome prediction that wide scope of a necessity modal results in the authoritative reading. The question remains, however, why the authoritative reading doesn't seem to be available when *at most* is contained within an infinitival complement of a necessity modal as in (56). A way to explain this could be to relate the scopal interaction of modals vis-à-vis the antonymizing operator to the one they show vis-à-vis negation. The modal verb *have to* in (56) is known to take narrow scope with respect to negation (see Iatridou and Zeijlstra 2013). This would also predict that it takes narrow scope with respect to ANT, making the authoritative reading unavailable. In order to see whether this explanation is on the right track, further types of modals and other constructions arguably involving ANT or *little* would have to be considered.<sup>7</sup> I leave this issue for future research and discuss in the remainder of the paper further aspects of the interaction of *at most* with possibility modals and quantifiers.

## 4. Further predictions of the analysis

### 4.1. Scope trapping

In the analysis I propose, the authoritative reading of *at most* plus possibility modal is derived from an LF where ANT takes wide scope. This leads to the prediction that the authoritative reading shouldn't be available if movement out of the scope of the modal is blocked for independent reasons. Evidence that this prediction is borne out comes from sentences like (63) where *at most* is embedded in a finite clause. While the sentence is less than perfect and hard to interpret, it seems clear that it doesn't have the authoritative reading, according to which 10pp is the maximally allowed length of the paper.

- (63) It is **permitted** that the paper is **at most** 10 pages long.

<sup>5</sup> <http://www.bogleheads.org/forum/viewtopic.php?f=11&t=100975> (accessed 30 June 2014).

<sup>6</sup> <http://homepages.inf.ed.ac.uk/wadler/papers/oncotech/oncotech.ps> (accessed 30 June 2014)

<sup>7</sup> One prediction would be that *at most* should readily combine with *must*, which takes wide scope with respect to negation, to yield the authoritative reading. But while the authoritative reading seems to be more easily available when *at most* is combined with *must* than when it is combined with *have to*, the combination doesn't seem to be particularly natural. This might have to do with the fact that the authoritative reading is the same as expressed by the combination of *at most* with a possibility modal. Since both possibility modals and *at most* are naturally used to express an upper bound, this combination might seem more natural than combining *at most* with necessity modals, which naturally express lower bounds (see Breheny 2008).

The absence of the authoritative reading if wide scope of the modal is enforced also provides an argument against attributing obviation of ignorance inferences under possibility modals to a Free Choice effect (see Coppock & Brochhagen (2013) and Nouwen (2015) for proposals in this direction). Current analyses of Free Choice effects arising with disjunction and indefinites (Fox 2007 among others) derive Free Choice permission readings from an LF where the possibility modal takes wide scope. If the authoritative reading of *at most* was due to a Free Choice effect, then the fact that (63) doesn't have the authoritative reading is unexpected. In the next subsection, I present further evidence for the assumption that the authoritative reading of *at most* with an existential operator is due to some meaning component of *at most* taking wide scope.

#### 4.2. Interaction with quantifiers

Interestingly, the difference in readings between *at least* and *at most* observed in section 1 is restricted to the interaction with modals. In their interaction with non-modal existential and universal operators, *at least* and *at most* behave parallel. Both *at least* and *at most* obviate ignorance inferences under universal quantifiers. The sentences in (64) and (65) don't convey that the speaker is uncertain about the length of the papers on the reading list, but rather express that the papers are of different length with the shortest (or longest in case of *at most*) paper being exactly 10pp long. This reading is parallel to the authoritative reading arising for the combination of a superlative modifier and a universal modal, the difference being that now the distribution of values is across individual papers rather than worlds.

- (64) **Every** paper on the reading list is **at least** 10 pages long.  
 ~> Some paper(s) on the reading list are exactly 10 pages long.  
 ~> Some paper(s) on the reading list are more than 10 pages long.
- (65) **Every** paper on the reading list is **at most** 10 pages long.  
 ~> Some paper(s) on the reading list are exactly 10 pages long.  
 ~> Some paper(s) on the reading list are less than 10 pages long.

Under (singular) existential quantifiers, neither *at least* nor *at most* can be used to specify a range of values. Instead, both superlative modifiers lead to a reading with strong ignorance inferences as illustrated in (66) and (67).

- (66) **Some** paper on the reading list is **at least** 10 pages long.  
 ~> The speaker doesn't know whether some paper is exactly 10 pages long.  
 ~> The speaker doesn't know whether some paper is more than 10 pages long.
- (67) **Some** paper on the reading list is **at most** 10 pages long.  
 ~> The speaker doesn't know whether some paper is exactly 10 pages long.  
 ~> The speaker doesn't know whether some paper is less than 10 pages long.

Under the compositional analysis of *at most* this difference in the interaction with modals and quantifiers is in fact predicted. It follows from the Heim-Kennedy-generalization (Heim 2000), according to which degree operators can QR over modals, but not quantifiers. Thus *at*

*least* as well as ANT obligatorily take narrow scope in (64) to (67). As predicted by the neo-Gricean account, narrow scope under a universal quantifier (or modal) results in scalar implicatures expressing a range of values, while narrow scope under an existential quantifier (or modal) leads to strong ignorance inferences. (68) summarizes the pattern of readings predicted by the neo-Gricean account augmented with the decomposition analysis of *at most*.

- (68) a.  $\Box/\forall > (\text{ANT} >) \text{ at least}$ : authoritative/range reading  
 b.  $\Diamond/\exists > (\text{ANT} >) \text{ at least}$ : strong ignorance reading  
 c.  $(\text{ANT} >) \text{ at least} > \Box/\Diamond$ : speaker insecurity reading  
 d.  $(\text{ANT} >) \text{ at least} > \forall/\exists$ : —  
 e.  $\text{ANT} > \forall/\exists > \text{ at least}$ : —  
 f.  $\text{ANT} > \Diamond > \text{ at least}$ : authoritative/range reading  
 g.  $\text{ANT} > \Box > \text{ at least}$ : strong ignorance reading

The fact that *at most* gives rise to an authoritative or range reading in combination with a possibility modal but not an existential quantifier provides further support for the assumption that this reading is due to some meaning component of *at most* taking wide scope. Moreover, the fact that *at most* readily gives rise to a range reading in combination with a universal quantifier further supports the assumption that wide scope of a universal quantifier or modal obviates ignorance inferences, but that this reading may only surface if wide scope is enforced.

## 5. Concluding remarks

This paper started from the neo-Gricean approach to ignorance inferences of superlative modifiers, which successfully accounts for the interaction of *at least* with modals, but fails for *at most*. Crucially, *at most* gives rise to an authoritative reading in combination with a possibility modal, which the analyses of Schwarz (2011, 2013) and Kennedy (2015) cannot account for. I argued that the authoritative reading can be derived if the neo-Gricean approach is supplemented with the assumption that *at most* is decomposed into an antonymizing operator and *at least*. I also argued that this analysis explains the otherwise puzzling fact that *at least* and *at most* behave parallel in their interaction with quantifiers, but not modals.

The fact that decomposing *at most* successfully accounts for the interaction of *at most* with possibility modals and quantifiers can be taken as further support for the idea that negative antonyms are generally decomposed in the syntax (Büring 2007). But the analysis also raises the question what triggers this decomposition, or putting it differently, which element of a pair of antonyms should be analysed as the negative one. For the antonym pair *at least* — *at most* it seems that semantic rather than morphological properties are decisive. The evidence from the interaction with modals suggests that it is *at most* which is more complex and composed of the antonymizing operator, rather than *at least*, although the former is morphologically based on the positive form *much* and the latter on the negative form *little*. It might seem that *at least* is the more likely candidate for decomposition, since it already contains *little*, which is semantically equivalent to the antonymizing operator. Instead, in the analysis I propose to account for the readings of superlative modifiers, it is the downward monotonic modifier *at most* that involves the antonymizing operator.

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# Imperfective in Ga (Kwa)

Agata Renans — *University of Potsdam*

**Abstract.** This paper discusses the semantics of imperfective aspect in Ga focusing on its progressive interpretation. The data from Ga show the existence of the cross-categorical definite determiner that can attach either to the NP or to the VP. I argue that in order to account for the data one needs the same domain restriction mechanisms in the verbal domain as in the nominal domain. I claim that a progressive interpretation in Ga is the result of domain restriction mechanisms in the verbal domain which is modeled in terms of situation semantics in line with domain restriction mechanisms in the nominal domain.

**Keywords:** imperfective aspect, progressive, situation semantics, Ga language

## 1. Introduction

In this paper, I present a semantic analysis of the progressive in Ga, a Kwa language spoken by ca. 600.000 speakers in the Greater Accra Region of Ghana. Ga has a rich system of overt aspectual markers.<sup>1</sup> The general imperfective is marked by the suffix *-ɔ*, as illustrated by its compatibility with a habitual aspectual reference in (1) and a progressive aspectual reference in (3):<sup>2</sup>

(1) *context:* Every Sunday Kofi goes to swim in the ocean.

Kofi sele-*ɔ*.

Kofi swim-IMPF

‘Kofi swims.’

Interestingly, there are two ways of expressing progressive interpretation in Ga. First, one can use the verbal prefix *mii-*:

(2) **Progressive 1**

*context:* Tom and his family (wife, two sons, and two daughters) are on the beach. Tom and his wife can see that Kofi is in the process of swimming. Toms’s wife says:

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<sup>1</sup>Ga can be analyzed as a tensed language in the spirit of Matthewson (2006) or as a tenseless language in line with Tonhauser (2011). To decide which analysis is more adequate for Ga data is left for future research.

<sup>2</sup>The glosses used in this paper are as follows: DET = determiner; SG = singular; PL = plural; 1 = First person; 2 = Second person; 3 = Third person; FM = focus marker; IMPF = imperfective; PROG = progressive. An example marked with ‘#’/‘??’ means that the example was judged to be unacceptable in the given context and I hypothesize that it is for semantic or pragmatic reasons; in the case of ‘??’ the judgments were not so clear as in the case of ‘#’. Examples without any diacritics were judged as acceptable in the given context.

Kofi mii-sele.  
 Kofi PROG-swim  
 ‘Kofi is swimming.’

Second, one can add to an imperfective sentence the focus marker *ni* and the final-clausal definite determiner *le*, as in (3). Sentences of this form invariably obtain a progressive interpretation.

(3) **Progressive 2**

*context:* Tom and his family (wife, two sons, and two daughters) are on the beach. Tom and his wife can see a swimming child. Toms’s wife says:

- a. Kofi #(ni) sele-ɔ        le.  
      Kofi FM swim-IMPF DET
- b. #Kofi ni seleɔ.  
      Kofi FM swim-IMPF  
      ‘It is Kofi who is swimming.’

Crucially, (3) without the focus marker *ni* is unacceptable. Moreover, (3) without the definite determiner *le* obtains a habitual interpretation, as in (4):

(4) *context:* Tom’s two sons and daughters do not like swimming and they do not do it, but his oldest son, Kofi, loves swimming and he does it regularly.

- a. #Kofi ni seleɔ        le.  
      Kofi FM swim-IMPF DET
- b. Kofi ni seleɔ.  
      Kofi FM swim-IMPF.  
      ‘It is Kofi who swims.’

It follows that in Progr2, a progressive interpretation arises only when both the focus marker *ni* and the definite determiner *le* are present in an imperfective sentence.

Even though both Progr1 and Progr2 express a progressive interpretation, their semantics is not alike. Whereas Progr1 is a general, unmarked form of progressive similar to the English one, the interpretation of Progr2 is restricted to the actual ongoing situation that the speaker has direct evidence for. I argue that the progressive interpretation in Progr2 is the result of a domain restriction mechanism in the verbal domain analogous to the one in the nominal domain modeled in the situation semantics terms.

The structure of the paper is as follows. In Section 2, I discuss the data illustrating the differences in the semantics of both types of progressive in Ga. In section 3, I present the semantic analysis of the particle *ni*, the general imperfective suffix *-ɔ*, and the definite particle *le*. A short introduction to situation semantics is given in section 4. In section 5, I present the syntactic structure and the compositional derivation of Progr2. In section 6, I show how the analysis accounts for the data presented in section 2 and, finally, section 7 concludes.

## 2. Two types of progressive

In this section, I give a short overview of the semantic differences between two kinds of progressive in Ga. Subsection 2.1 discusses the evidential effects of both types of progressive. While Progr1 is acceptable in both direct and indirect evidential contexts, Progr2 is only acceptable in direct evidential contexts. Moreover, data in subsection 2.2 show that Progr1 can refer to *not-ongoing* events, unlike Progr2.<sup>3</sup>

### 2.1. Evidentiality

While Progr1 is acceptable in both direct and indirect evidential contexts, Progr2 is only acceptable in direct evidential contexts, as illustrated in (5) and (6):

- (5) *Direct evidence context:* Tom and his family (wife, two sons, and two daughters) are on the beach. Tom can see that his two sons and the youngest daughter are playing with sand, and his oldest daughter, Anna, is swimming. He says to his wife:
- a. Anna **mii**-sele.  
Anna PROG-swim
  - b. Anna **ni** sele-ɔ **le**.  
Anna FM swim-IMPF DET  
'ANNA is swimming.'
- (6) *Indirect evidence context:* Tom and his family (wife, two sons, and two daughters) are on the beach. Tom can see that his two sons and the youngest daughter are playing with sand. He cannot see his oldest daughter, but the younger one told him that she was in the process of swimming. Tom says to his wife:
- a. Anna **mii**-sele.  
Anna PROG-swim
  - b. #Anna **ni** sele-ɔ **le**.  
Anna FM swim-IMPF DET  
'ANNA is swimming.'

<sup>3</sup>By *not-ongoing* events I mean events that are literally not ongoing in the utterance time as in (7) and (8).

Moreover, Progr2 additionally emphasizes that it is Anna (and not anybody else) who is swimming right now.

## 2.2. *Not-ongoing* events

Whereas Progr1, as English progressive, can refer to *not-ongoing* events, Progr2 cannot, as shown in (7) and (8):

- (7) Tom and John are jogging. They are talking about books. Tom asks John which books he is reading. John replies:
- a. **Mii**-kane ‘Harry Potter’.  
1 SG.PROG-read ‘Harry Potter’
  - b. #‘Harry Potter’ **ni** mi kane-ɔ **le**.  
‘Harry Potter’ FM 1 SG read-IMPF DET  
‘I am reading ‘Harry Potter’.’
- (8) One year ago John started building a new house for his family. He wants it to be ready by December 2014. Right now John is at work in his office.
- a. John **mii**-ma shia.  
John PROG-build house
  - b. ??John **ni** ma-**a** shia **le**.  
John FM build-IMPF house PRT  
‘John is building a house.’

Table 1: Differences in the semantics of Progr1 and Progr2

	direct evident.	indirect evident.	<i>not-ongoing</i> events
Progr1 (mii-)	✓	✓	✓
Progr2 (ni, -ɔ, le)	✓	—	—

The summary of the semantic differences between Progr1 and Progr2 is presented in Table 1. The data suggest that the interpretation of Progr2 is restricted to actual ongoing situations. I argue that this is the result of domain restriction in that a domain restriction on the VP can change an aspectual interpretation of a sentence. I propose modeling this in terms of situation semantics (Kratzer 1998, Schwarz 2009) on a par with domain restriction in the nominal domain.

## 3. Analysis

In this section, I present the semantic analysis of the particle *ni*, the suffix -ɔ, and the particle *le*. Since the semantics of *ni* is a bit off the discussion of aspect and since the structure generated by

*ni* provides the basis for the subsequent considerations, I present its semantics at the beginning of this section, in subsection 3.1. In subsection 3.2, I discuss the basic assumptions regarding the semantics of aspect and in subsection 3.3 I discuss the semantics of the imperfective in Ga (suffix -ɔ). The analysis of the particle *le* and its influence on the aspectual interpretation of sentences is presented in subsection 3.4.

### 3.1. Particle *ni*

The particle *ni* induces a structural bi-partition in which the focused constituent is to its left and backgrounded/presupposed material is to its right. This is illustrated in (9) which shows that *ni* cannot be attached to non-focus constituents:

- (9)    Namɔ (ni) kane wolo?  
          who   FM read book  
          ‘Who read a book?’
- a.    Kofi (ni) kane wolo (#ni).  
              Kofi FM read book FM  
              ‘It is Kofi who read a book.’
- b.    #Wolo (ni) Kofi kane.  
              book FM Kofi read  
              ‘It is a book that Kofi read.’

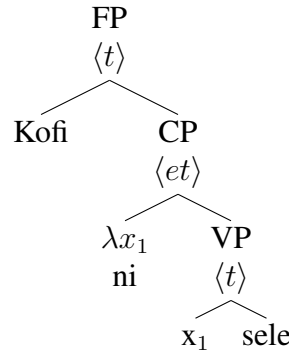
Crucially for the analysis, *ni* gives rise to an exhaustive interpretation.<sup>4</sup> If *ni* did not give rise to an exhaustive interpretation, then (10) would be acceptable, contrary to fact.

- (10)   #Felix ni kane-ɔ    wolo ni   Kofi ni kane-ɔ    wolo.  
          Felix FM read-IMPF book and Kofi FM read-IMPF book  
          ‘It is John who reads a book and it is Kofi who reads a book.’

I claim that *ni* introduces a cleft-like structure and indicates that an element attached to it should be interpreted exhaustively, i.e. it gives rise to the structure in (11):

<sup>4</sup>Data from Ga show that an exhaustivity effect generated by *ni* is not as strong as an exhaustivity effect generated by *only* but rather resembles an exhaustivity generated by English cleft constructions.

(11)



### 3.2. Aspect — background information

Following Reichenbach (1947), Klein (1994), i.a., I assume a threefold distinction between event time, i.e., the time at which an event takes place, topic time, i.e., the time the speaker talks about, and utterance time, i.e., the time at which the truth of the proposition is evaluated. The role of aspect is to relate the event time and the topic time. In particular, imperfective aspect locates the topic time within the running time of the event (Klein 1994, Kratzer 1998):

$$(12) \quad \llbracket \text{Imperfective} \rrbracket = \lambda P. \lambda t. \lambda w. \exists e [t \subseteq \tau(e) \wedge P(e)(w)] \quad [\text{from Kratzer (1998)}]$$

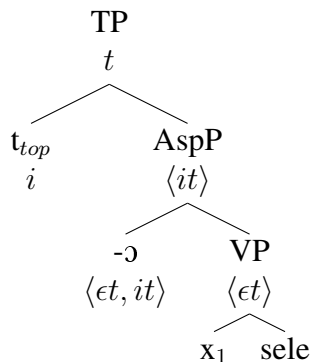
I argue that general imperfective in Ga is marked by the suffix *-ɔ*. The proposed lexical entry for *-ɔ* is given in (13) which is a modification of Kratzer's (1998) lexical entry presented in (12). The difference is that I do not assume that the imperfective takes a world argument:

$$(13) \quad \llbracket -\mathfrak{O} \rrbracket = \lambda P. \lambda t. \exists e [t \subseteq \tau(e) \wedge P(e)]$$

- (14) Kofi sele-*ɔ*.  
 Kofi swim-IMPF  
 'Kofi swims.'

It follows that (14) is compatible with both habitual and progressive interpretation. However, due to the blocking principle it obtains by default a habitual interpretation. The structure of (14) up to the TP is in (15) and its interpretation is given in (16):

(15)



- (16)  $\llbracket \text{TP} \rrbracket^g = 1$  iff  $\exists e[t_{top} \subseteq \tau(e) \wedge e = \text{swim} \wedge Ag(e) = g(1)] \approx$  There is an event of swimming, the running time of which  $(\tau(e))$  includes the topic time  $(t_{top})$

### 3.3. Habitual and Progressive

There is an ongoing discussion whether the imperfective and the progressive/habitual can get a unified analysis. Bonomi (1997), Cipria and Roberts (2000), Ferreira (2005), Hacquard (2006), Deo (2009), Rivero and Arregui (2010) propose versions of a unified analysis of imperfective and progressive/habitual aspect. On the other hand, Boneh and Doron (2010) claim that the habitual cannot be reduced to the imperfective and propose an independent habitual operator. I advocate for the unified analysis for the imperfective and the habitual/progressive in Ga.

I build the analysis on Ferreira (2005) who claims that the habitual and the progressive have the same temporal (and modal) components, but they differ with respect to the number of events being quantified over. Whereas in the progressive a singular event is quantified over, thereby expressing the meaning that a singular event is ongoing (17-a), in the habitual plural events are quantified over, thereby expressing the meaning that a sequence of events is ongoing (17-b):

- (17) a.  $\llbracket \text{Imp}_{sg} \rrbracket = \lambda P_{sg}.\lambda t.\exists e[t \subseteq \tau(e) \wedge P(e) = 1] \rightarrow$  progressive interpretation  
 b.  $\llbracket \text{Imp}_{pl} \rrbracket = \lambda P_{pl}.\lambda t.\exists e[t \subseteq \tau(e) \wedge P(e) = 1] \rightarrow$  habitual interpretation  
 (Ferreira 2005)

I argue that there is a quantification over a definite singular event in Progr2 in Ga. Nonetheless, unlike in Ferreira's (2005) account, the singular event in the denotation of Progr2 in Ga is not introduced by a covert singular determiner but by the interaction between the definite determiner *le* and the exhaustive focus marker *ni*. In the next subsection, I discuss the semantic contribution of *le*. The role of *ni* in the Progr2 construction, on the other hand, is explained in section 4.

### 3.4. Particle *lɛ*

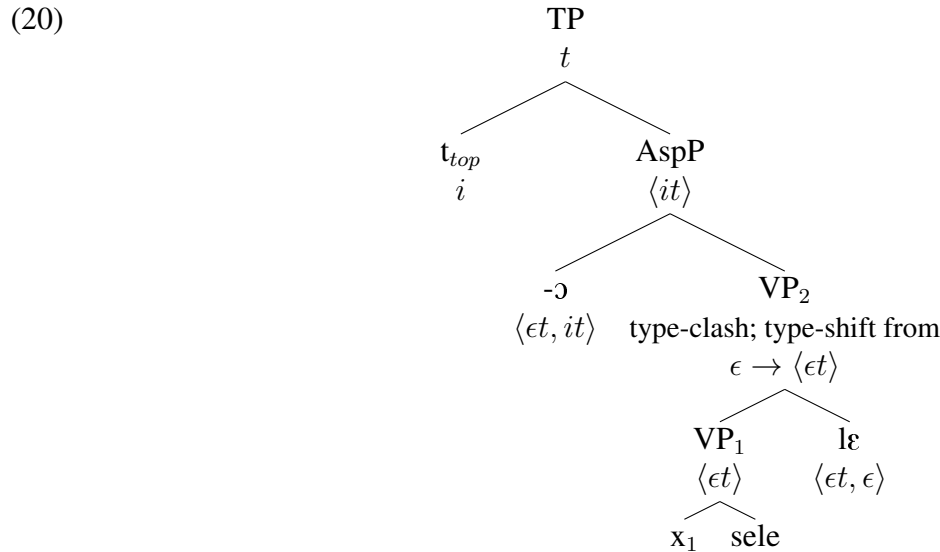
The particle *lɛ* can attach to the NP or to the VP. When attached to the NP, *lɛ* functions as a definite determiner, as illustrated by the unacceptability of (18):

- (18) #Shikatoohɛ lɛ yɛ Osu ni shikatoohɛ lɛ yɛ Jamestown.  
 bank DET TO.BE Osu and bank DET TO.BE Jamestown  
 ‘The bank is in Osu and the bank is in Jamestown.’

I argue for a full parallelism between the nominal and the verbal domain. Therefore, I claim that the particle *lɛ* functions as the definite determiner also when attached to the VP. It takes a property and says that the unique contextually salient event has that property, as in (19):

- (19)  $\llbracket lɛ \rrbracket = \lambda P. \iota e P(e)$  [preliminary]

Hence, the structure of the imperfective TP with *lɛ* is as in (20) and its denotation is given in (21):



- (21)  $\llbracket TP \rrbracket^g = 1$  iff  $\exists e [t_{top} \subseteq \tau(e) \wedge e = \iota e' \wedge swim(e) \wedge Ag(e) = g(1)] \approx$  There is a unique event of swimming, the running time of which includes the topic time

Since there is a type-clash between  $VP_2$  and  $-ɔ$  (aspect requires an input of type  $\langle \epsilon, t \rangle$ , whereas  $VP_1$  modified by *lɛ* is of type  $\epsilon$ ),  $VP_2$  must be type-shifted in a Partee-style (1987) from  $\epsilon$  to  $\langle \epsilon t \rangle$ .



However, the *VP* *le*, same as the *NP* *le*, is usually not interpreted with respect to the whole world but with respect to a part of the world — a salient situation. Therefore, there is a need for a domain restriction mechanism which would constraint the interpretation of *NP le* and *VP le* to a given situation. I argue that the required domain restriction mechanism can be modeled in a situation semantic framework (Kratzer 2007, Schwarz 2009).

#### 4. Situation semantics

This section discusses some basic assumptions of situation semantics (Kratzer 2007, Schwarz 2009). In this framework, a proposition is not a set of possible worlds but a set of possible situations. A situation itself is a part of the world with the world being the maximal situation.

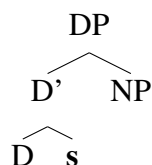
In subsection 4.1, I discuss situation pronouns. I assume a situation pronoun in the syntax (Percus 2010, Schwarz 2009; 2012) which restricts either the interpretation of the NP or the VP. Following Musan (1995), Keshet (2008), Büring (2004), Schwarz (2009), I argue that a situation pronoun is introduced in the syntax as the sister of a (strong) determiner. Subsequently, in subsection 4.2 I discuss the role of topic situations in domain restriction. Finally, in subsections 4.3 and 4.3.4 I explain the concept of exemplification (Kratzer 2007) and its role in the aspectual interpretation of a sentence.

##### 4.1. Situation pronouns

In situation semantics, NPs are interpreted relative to a situation introduced by a covert situation pronoun present in the syntax. For that reason the meaning of an NP is constrained to entities within a given situation, i.e., within the given part of the world. I advocate for a full parallelism between domain restriction in the nominal and verbal domain. Therefore, I argue that the interpretation of a VP can also be restricted by a situation pronoun to the events within the given situation, i.e., within a certain part of the world.

There is an ongoing discussion, where the situation pronoun can be present in the syntax. I am following Musan (1995), Büring (2004), Keshet (2008), Schwarz (2009) in saying that the situation pronoun is introduced in the syntax by a strong determiner, as in (22):

(22)



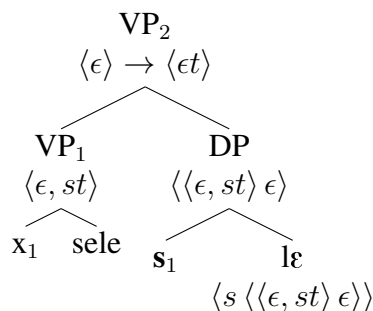
Looking at Ga, I argue that the situation pronoun is also introduced by a strong determiner, namely

the definite determiner  $l\epsilon$ . It can be attached either to the NP or to the VP introducing the situation pronoun which restricts the interpretation of the respective element.

Therefore, the lexical entry of  $l\epsilon$  given in (19) must be revised as in (23):

$$(23) \quad \llbracket l\epsilon \rrbracket = \lambda s. \lambda P. \iota e P(e)(s) \text{ [final]}$$

(24)



The situation pronoun, as other pronouns, can be either bound or interpreted with respect to an assignment function. I argue that in Progr2, the situation pronoun is bound by a topic situation.

## 4.2. Topic situation

In situation semantics, each sentence is interpreted with respect to a topic situation (Kratzer 2007, Schwarz 2009), i.e., the situation a sentence is about. Consider (25):

- (25) A: What was Maria doing yesterday at 17:00?  
 B: Maria was swimming.

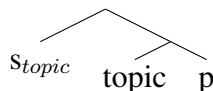
The topic situation of (25) is a Maria-swimming situation that took place yesterday at 17:00. Formally, the topic situation can be indicated by a topic time or/and by a question under discussion (QUD). Following Kratzer (2007) and Schwarz (2009), I claim that the topic situation is provided by a QUD, where the question extension is the one proposed by Groenendijk and Stokhof (1984):<sup>5</sup>

- (26) topic situation:  
 $s_{topic} = \iota s. EX(\text{question extension})(s) \wedge s \leq w_0$

Topic situations are introduced in the syntax as arguments of a topic operator, defined in (27):

<sup>5</sup>EX stands for *exemplification* which will be discussed in subsection 4.3.

$$(27) \quad [[\text{topic}]] = \lambda p. \lambda s'. \lambda s. s \approx s' \wedge p(s) \text{ (Schwarz 2009)}$$



Crucially for the analysis, I argue that in Progr2 the situation pronoun – introduced by the definite determiner *le* attached to the VP – is bound by the topic situation. This restricts the VP interpretation to events within the topic situation, the situation a sentence is about. In the same way the interpretation of the NP denotation can be restricted to entities within the topic situation when *le* attaches to an NP.

However, it seems that the notion of the topic situation should be more restrictive, i.e., the possibility that the topic situation of (25) includes Maria and other people, or Maria swimming and doing other things should be excluded, at least in some cases. It occurs that topic situations should be in some sense minimal. The concept of minimality I adopt is provided by the notion of exemplification (Kratzer 2007), discussed in the next subsection.

### 4.3. Exemplification

#### 4.3.1. Exemplification in the nominal domain

The simple notion of minimality which says that a situation is a minimal situation in which a proposition *p* is true iff it has no proper parts in which *p* is true, cf. (28-b), causes problems for mass nouns in the nominal domain and for the states and progressive events in the verbal domain. For example, it makes it impossible to detect the minimal situation of a sitting event. Kratzer (2007) defines a notion of *exemplification* which provides a concept of minimality also for the problematic cases:

- (28) a. A situation *s* exemplifies a proposition *p* iff whenever there is a part of *s* in which *p* is not true, then *s* is a minimal situation in which *p* is true.  
 b. A situation is a minimal situation in which a proposition *p* is true iff it has no proper parts in which *p* is true. (Kratzer 2007, Schwarz 2009)

The definiens in (28-a) has the form of implication:  $p \rightarrow q$ , which equals  $\neg p \vee q$ . It follows that a situation *s* exemplifies a proposition *p* if either *p* is true in all subparts of *s* or *s* is a minimal situation in which *p* is true. Intuitively, exemplification assures that there is nothing in a situation that is not needed to evaluate the truth of a sentence. Consider situation M and the proposition in (29):

Situation<sub>M</sub>: mud

(29)  $\lambda s$ . there is mud in  $s$

The proposition in (29) is not only true in  $s_M$  but since it is true in all subsituations of  $s$ , it is also exemplified by  $s_M$ . Now, consider situation 1, situation 2, and the proposition in (30):

Situation 1: three turtles

Situation 2: one turtle

(30)  $\lambda s$ . there is a turtle in  $s$

The proposition in (30) is true in  $s_1$ . However, since there are two turtles in  $s_1$  that are not needed to evaluate the truth of (30),  $s_1$  is not a minimal situation in which (30) is true. Hence, (30) is not exemplified by  $s_1$ . By contrast, there is nothing in  $s_2$  that is redundant to evaluate the truth of (30), i.e.,  $s_2$  is a minimal situation in which (30) is true. Therefore, (30) is not only true in  $s_2$  but also exemplified by  $s_2$ .

#### 4.3.2. Exemplification in the verbal domain

There is an analogous mechanism of exemplification in the verbal domain as in the nominal domain, presented above. Consider the proposition in (31):

(31)  $\lambda s$ . Kofi swim in  $s$

The proposition in (31) is true in a situation with a multitude of swimming events but it is not exemplified by this situation. On the other hand, (31) is not only true in a situation with a single event but also exemplified by this situation.

I claim that it is encoded syntactically whether exemplification proceeds with respect to the NP or the VP denotation. As already discussed in subsection 4.1, I assume a covert situation pronoun in the syntax that restricts either the interpretation of the NP or the VP, depending on its position in the structure. Since I argue that the situation pronoun is introduced as the sister of the definite determiner  $l\epsilon$ , the syntactic position of  $l\epsilon$  determines with respect to which element the exemplification proceeds. When  $l\epsilon$  attaches to the NP, then the NP denotation is exemplified, when it attaches to the VP, then the VP denotation is exemplified.

In the next subsection, I discuss in which case a proposition is exemplified by a topic situation and when not.

#### 4.3.3. Exemplification and exhaustivity

Crucially for the analysis, there is an intimate connection between an exhaustive answer to a QUD (which in Ga is morphologically marked by the exhaustive focus marker *ni*) and exemplification. Kratzer (2007) advocates that exhaustive answers are necessarily exemplified by topic situations, whereas non-exhaustive answers are merely true in topic situations. Therefore, the presence of *ni*, the exhaustive focus marker, assures that a proposition expressed by a sentence is exemplified by a topic situation. Hence, the following generalization holds:

- **+ni** → a proposition is necessarily exemplified by a topic situation
- **-ni** → a proposition is true in a topic situation

In the next subsection, I discuss informally how the combination of the focus marker *ni*, the definite determiner *le*, and the general imperfective *-ɔ* invariably give rise to a progressive interpretation.

#### 4.3.4. Aspectual interpretation of a sentence in situation semantics

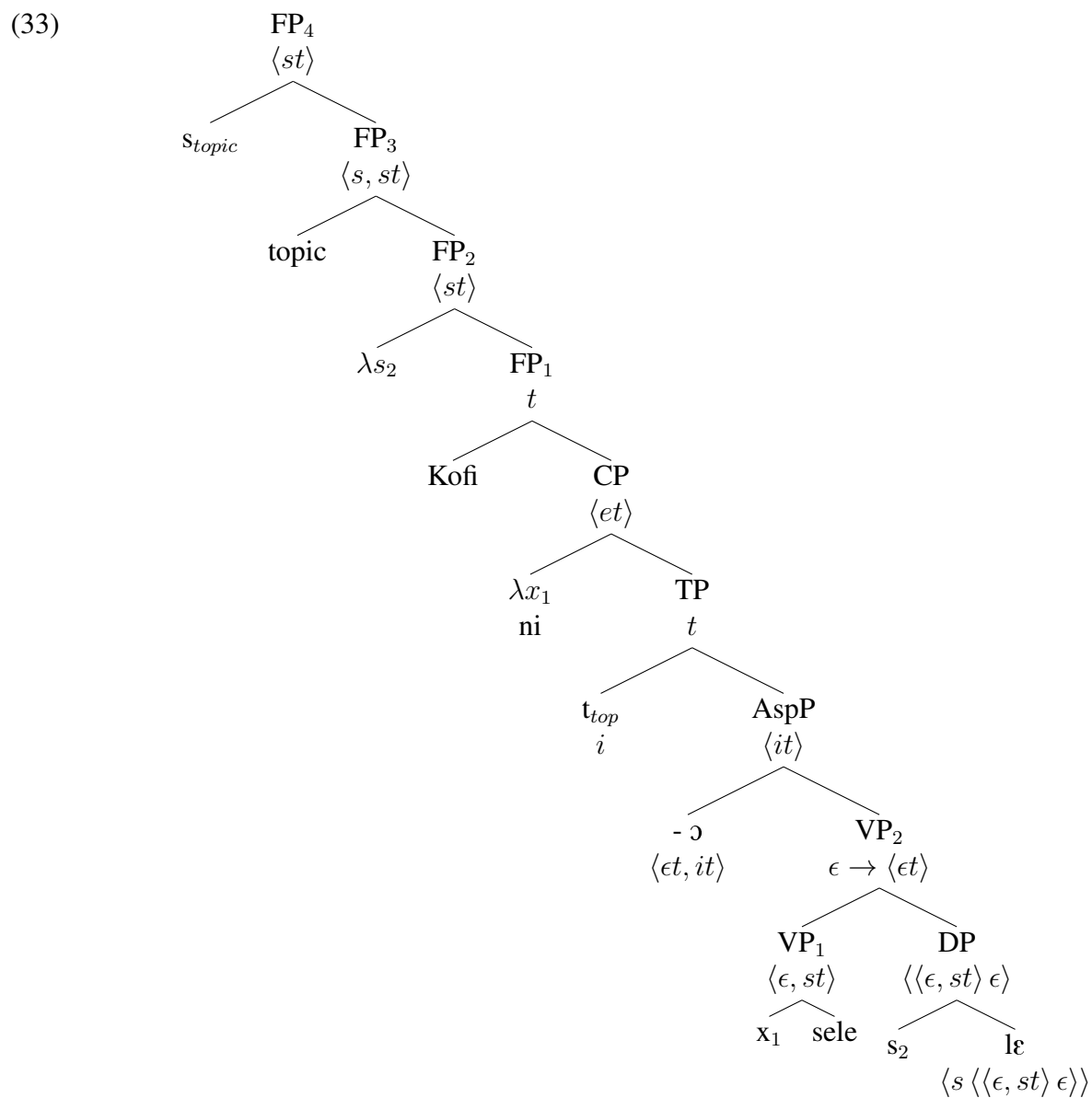
Exhaustive answers to QUDs are exemplified by a topic situation and non-exhaustive answers are merely true in a topic situation. Hence, the presence of the exhaustive focus marker *ni* assures that the proposition denoted by a sentence is exemplified by a topic situation. On the other hand, a situation pronoun is introduced in the syntax as the sister of the definite determiner *le*. Hence the syntactic position of *le* determines whether the NP or the VP denotation is interpreted with respect to the topic situation. When *le* attaches to the VP, the *iota* operator denoted by *le* and exemplification introduced by *ni* assure that there is only one event of the given type in the topic situation. Therefore, an imperfective sentence with *le* attached to the VP and *ni* expresses the meaning that one event is ongoing which invariably leads to a progressive interpretation. On the other hand, when there is no *le* attached to the VP, the VP denotation is not exemplified by the topic situation. Hence the sentence can express the meaning that the plural events are ongoing, thereby leading to a habitual interpretation.

In the next section, I present the formal compositional implementation of the informal ideas presented so far.

## 5. Structure and derivation

In this section, I present the compositional derivation of (3), repeated in (32). Its syntactic structure is given in (33) and its derivation in (34).

- (32) Kofi ni sele-ɔ lɛ.  
 Kofi FM swim-IMP DET  
 ‘It is Kofi who is swimming.’



The situation pronoun, introduced in the syntax as the sister of the definite determiner  $l\epsilon$  and bound by the topic situation, restricts the interpretation of the VP to the events within the topic situation. The presence of the exhaustive focus marker  $ni$  assures that the proposition denoted by (32) is exemplified by the topic situation. The exhaustive focus marker  $ni$  and the *iota* operator denoted by  $l\epsilon$  assure that there is only one swimming event in the topic situation.

The imperfective marker  $-\textcircled{\smile}$  relates the topic time and the event time, i.e., it locates the topic time within the running time of the event. Since  $ni$  and  $l\epsilon$  assure that there is only one event in the VP denotation, (32) necessarily obtains the interpretation that there is one event of swimming by Kofi, the running time of which is included in the running time of the event leading invariably to the progressive interpretation. Therefore, an imperfective sentence (marked by  $-\textcircled{\smile}$ ) with the focus marker  $ni$  and the definite determiner  $l\epsilon$  attached to the VP always obtain an ongoing, progressive interpretation. The formal derivation of (32) is presented in (34):

- (34)
- a.  $[[l\epsilon]] = \lambda s. \lambda P. \iota e P(e)(s)$
  - b.  $[[DP]] = [[l\epsilon]](s_2) = [\lambda s. \lambda P. \iota e P(e)(s)](s_2) = \lambda P. \iota e P(e)(s_2)$
  - c.  $[[VP_1]] = \lambda e. \lambda s. \text{swim}(e)(s) \wedge Ag(e)(s) = x_1$
  - d.  $[[VP_2]] = [[DP]]([VP_1]) = [\lambda P. \iota e P(e)(s_2)](\lambda e. \lambda s. \text{swim}(e)(s) \wedge Ag(e)(s) = x_1)$   
 $= \iota e [\text{swim}(e)(s_2) \wedge Ag(e)(s_2) = x_1]$ ; type clash with Imp, type-shift form  $\epsilon$  to  $\langle \epsilon, t \rangle$ :  
 $= \lambda e. e = \iota e' [\text{swim}(e')(s_2) \wedge Ag(e')(s_2) = x_1]$
  - e.  $[[-\textcircled{\smile}]] = \lambda P. \lambda t. \exists e [t \subseteq \tau(e) \wedge P(e)]$
  - f.  $[[Asp]] = [[-\textcircled{\smile}]]([VP_2])$   
 $= [\lambda P. \lambda t. \exists e [t \subseteq \tau(e) \wedge P(e)]](\lambda e. e = \iota e' (\text{swim}(e')(s_2) \wedge Ag(e')(s_2) = x_1))$   
 $= \lambda t. \exists e [t \subseteq \tau(e) \wedge e = \iota e' (\text{swim}(e')(s_2) \wedge Ag(e')(s_2) = x_1)]$
  - g.  $[[TP]] = \lambda t. \exists e [t \subseteq \tau(e) \wedge e = \iota e' (\text{swim}(e')(s_2) \wedge Ag(e')(s_2) = x_1)](t_{top})$   
 $= \exists e [t_{top} \subseteq \tau(e) \wedge e = \iota e' (\text{swim}(e')(s_2) \wedge Ag(e')(s_2) = x_1)]$
  - h.  $[[CP]] = \lambda x. \exists e [t_{top} \subseteq \tau(e) \wedge e = \iota e' (\text{swim}(e')(s_2) \wedge Ag(e')(s_2) = x)]$
  - i.  $[[FP_1]] = \lambda x. \exists e [t_{top} \subseteq \tau(e) \wedge e = \iota e' (\text{swim}(e')(s_2) \wedge Ag(e')(s_2) = x_1)](\text{Kofi})$   
 $= \exists e [t_{top} \subseteq \tau(e) \wedge e = \iota e' (\text{swim}(e')(s_2) \wedge Ag(e')(s_2) = \text{Kofi})]$
  - j.  $[[FP_2]] = \lambda s_2. \exists e [t_{top} \subseteq \tau(e) \wedge e = \iota e' (\text{swim}(e')(s_2) \wedge Ag(e')(s_2) = \text{Kofi})]$
  - k.  $[[\text{topic}]] = \lambda p. \lambda s''. \lambda s'. s' \approx s'' \wedge p(s')$
  - l.  $[[FP_3]] = [[\text{topic}]]([FP_2]) = [\lambda p. \lambda s''. \lambda s'. s' \approx s'' \wedge p(s')](\lambda s_2. \exists e [t_{top} \subseteq \tau(e) \wedge e = \iota e' (\text{swim}(e')(s_2) \wedge Ag(e')(s_2) = \text{Kofi})])$   
 $= \lambda s''. \lambda s'. s' \approx s'' \wedge [\lambda s_2. \exists e [t_{top} \subseteq \tau(e) \wedge e = \iota e' (\text{swim}(e')(s_2) \wedge Ag(e')(s_2) = \text{Kofi})]](s')$   
 $= \lambda s''. \lambda s'. s' \approx s'' \wedge \exists e [t_{top} \subseteq \tau(e) \wedge e = \iota e' (\text{swim}(e')(s') \wedge Ag(e')(s') = \text{Kofi})]$
  - m.  $[[FP_4]] = [[FP_3]](s_{topic}) =$   
 $= \lambda s'. s' \approx s_{topic} \wedge \exists e [t_{top} \subseteq \tau(e) \wedge e = \iota e' (\text{swim}(e')(s') \wedge Ag(e')(s') = \text{Kofi})]$   
 $\approx$  counterparts of the topic situation (the actual situation exemplifying the proposition that Kofi swim) in which there is a unique event of Kofi swimming, the running time of which includes the topic time

Now I will discuss what happens when either the definite determiner *le* or the exhaustive focus marker *ni* is not present in an imperfective sentence. Consider:

- (35) Kofi ni sele-ɔ.  
 Kofi FM swim-IMPF  
 ‘It is Kofi who swims.’

Because there is no *le* attached to the VP, there is no *iota* operator imposing a uniqueness requirement on the VP denotation. Moreover, the VP interpretation is not restricted to the topic situation, i.e., the exemplification does not influence the interpretation of the VP. Hence, there can be more than one swimming event in the topic situation with respect to which (35) is interpreted allowing for its habitual interpretation. By contrast, (35) without *ni* is not acceptable, as illustrated by (36).

- (36) #Kofi sele-ɔ le.  
 Kofi swim-IMPF DET  
 ‘Kofi swims.’

Since *le* imposes a uniqueness requirement on the VP denotation, I argue that *VP le* must be interpreted with respect to the topic situation exemplifying the VP denotation. Otherwise, *le* cannot be felicitously used. Since there is no *ni* in (36) assuring the exemplification, *le* cannot be felicitously used in (36) and thereby (36) is not acceptable.

To sum up this section, I have presented the compositional derivation of Progr2. It was shown that the progressive interpretation in Progr2 is an effect of the domain restriction for the VP interpretation and it is caused by the interaction between the imperfective aspect marked by the suffix -ɔ, the definite determiner *le*, and the exhaustive focus marker *ni*.

## 6. Evidentiality and *not-ongoing* events

In this section, I show how the proposed analysis accounts for the data presented in section 2. As illustrated in example (37), repeated below, Progr2 is unacceptable in indirect evidential contexts:

- (37) *Indirect evidence context:* Tom and his family (wife, two sons, and two daughters) are on the beach. Tom can see that his two sons and the youngest daughter are playing with sand. He cannot see his oldest daughter, but the younger one told him that she was in the process of swimming. Tom says to his wife:
- a. #Anna ni sele-ɔ le.  
 Anna FM swim-IMPF DET  
 ‘Anna is swimming.’



I argue that the direct evidence requirement in Progr2 is the by-product of the domain restriction mechanism. The interpretation of Progr2 is constrained to the actual ongoing situation exemplifying the VP denotation. Sentence (37-a) is unacceptable because the proposition denoted by (37-a) ( $\lambda s$ .Anna swim in  $s$ ) is not exemplified by the contextually provided situation. Moreover, it was shown that Progr2 cannot refer to the not-ongoing events, as was presented in (7), repeated in (38):

- (38) Tom and John are jogging. They are talking about books. Tom asks John which books he is reading. John replies:
- a. **Mii**-kane ‘Harry Potter’.  
PROG-read ‘Harry Potter’
  - b. #‘Harry Potter’ **ni** mi kane-ɔ **le**.  
‘Harry Potter’ FM 1SG read-IMPF DET  
‘I am reading ‘Harry Potter’.’

I argue that (38-b) is unacceptable in the context of (38), because the event of reading *Harry Potter* is not an ongoing, actual situation. Furthermore, the situation of jogging and talking about books by John does not exemplify the proposition denoted by (38-b).

## 7. Summary

It was argued that *le* is a cross-categorial definite determiner that attached either to the NP or to the VP denotation. In order to account for the observed data, one needs the same domain restriction mechanisms in the verbal domain as in the nominal domain. Crucially, it was shown that domain restriction in the verbal domain can influence the aspectual interpretation of a sentence. Moreover, it was presented how Progr2 can be compositionally derived from the interaction between the general imperfective marker -ɔ, the exhaustive focus marker *ni*, and the definite determiner *le*.

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# High Negation in Subjunctive Conditionals and Polar Questions\*

Maribel Romero — *University of Konstanz*

**Abstract.** In certain environments, negation does not anti-license Positive Polarity Items in English and can precede definite noun phrases in German. Instances of negation with these characteristics are labeled 'high' negation. There are two environments where high negation –as opposed to regular, 'low' negation– has been argued to correlate with an additional meaning effect: mandatory counterfactuality in subjunctive conditionals and obligatory epistemic bias in polar questions. Analyses of high negation in the literature have targeted one construction or the other, but not both. The present paper provides an unified analysis of high negation that derives its interpretive effects in both environments.

**Keywords:** negation, high negation, subjunctive conditional, polar question, VERUM, counterfactuality, epistemic bias

## 1. Introduction

It is known that negation anti-licenses Positive Polarity Items (PPIs) in its immediate scope in English (Ladusaw 1979) and that it cannot precede definites (and other expressions) in German (Schwarz 2004). For example, to convey the scopal reading  $\neg > \exists$  in English, we can use (1a) but not (1b) (unless the latter is used as a denial, as we will later see). Similarly, in German, the normal way to express the proposition "It is not the case that Fritz answered question 3" is (2a); (2b) is inappropriate (again, unless used as a denial). Instances of negation with these properties will be referred to as 'low negation' in this paper.

- (1) a. John didn't<sub>Low</sub> call anyone.  
b. John didn't call someone. \*  $\neg > \exists$  (unless as denial)
- (2) a. Fritz hat Frage 3 **nicht**<sub>Low</sub> beantwortet.  
Fritz has question 3 not answered  
'Fritz didn't answer question 3.'  
b. # Fritz hat nicht Frage 3 beantwortet. (# unless as denial)  
Fritz hat not question 3 answered

However, in certain environments, negation does not anti-license PPIs in English and can precede definites in German: (3)-(4) (Schwarz 2004, Szabolcsi 2004).<sup>1</sup> Instances of negation with these properties will be referred to as 'high negation'.

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<sup>1</sup> The versions of (3) and (4) with low negation and NPIs are grammatical too.

- (3) a. I am surprised that John didn't<sub>High</sub> call someone<sub>PPI</sub>. (Szabolcsi 2004)  
 b. Every boy that didn't<sub>High</sub> call someone<sub>PPI</sub> was doomed.  
 c. If we don't<sub>High</sub> call someone<sub>PPI</sub>, we are doomed.
- (4) a. Wir waren überrascht, dass Fritz **nicht**<sub>High</sub> Frage 3 beantwortet hat. (Schwarz 2004)  
 We were surprised that Fritz not questions 3 answered has  
 'We were surprised that Fritz didn't answer question 3.'  
 b. Wir haben jeden abgelehnt, der **nicht**<sub>High</sub> Frage 3 beantwortet hat.  
 We have everyone rejected who not question 3 answered has  
 'We rejected everyone that didn't answer question 3.'  
 c. Wenn Hans **nicht**<sub>High</sub> Frage 3 beantwortet, wird er abgelehnt.  
 If Hans not question 3 answers, is.PASS he rejected  
 'If Hans doesn't answer question 3, he will be rejected.'

It has been proposed that what characterizes the environments allowing for high negation is downward monotonicity (or, more generally, whatever property of a context is responsible for licensing the occurrence of NPIs) (Krifka 1992, Szabolcsi 2004): (5).

- (5) High negation is allowed iff it appears in a downward entailing context.

However, there are two constructions where downward monotonicity does not suffice to license high negation. That is, there are two constructions where, though they are downward entailing (in the broader sense), high negation correlates with the presence of a strong additional effect. These constructions are subjunctive conditionals and polar questions. We will see them in turn.<sup>2,3</sup>

We start with **subjunctive conditionals**. High (as well as low) negation is felicitous in counterfactually used subjunctive conditionals like (6) and (7). However, it is known that the message of antecedent falsity is not an entailment or a presupposition of subjunctive conditionals, but a cancellable implicature, being absent in examples like Anderson's (1951) (8). What happens when we use negation in an Anderson-style example? While low negation is licit in Anderson-style examples, high negation is not, as shown by the contrast between the (a) and (b) versions in (9)-(10) (Meibauer 1990, Schwarz 2004, Schwarz and Bhatt 2006, Ippolito and Su 2009). Based on this observation, antecedent falsity in subjunctive conditionals has been argued to be uncancellable in the presence of high negation, as stated in (11).

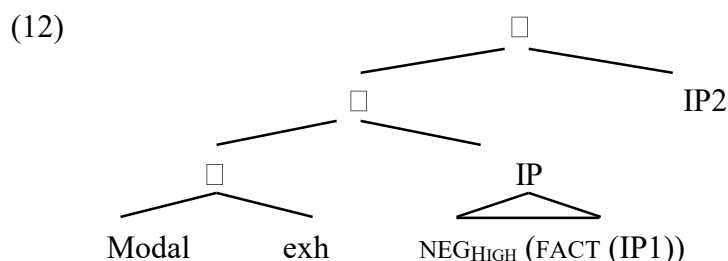
- (6) Good that there was oil in the tank! If there hadn't<sub>High</sub> been some<sub>PPI</sub> oil in the tank, the furnace would have exploded.

<sup>2</sup> Subjunctive conditionals are Strawson-downward entailing under a strict conditional semantic analysis (von Stechow 1999). As for polar questions, van Rooij (2003) generalizes the notion of strength underlying downward monotonicity into that of maximal entropy, providing a unified account of NPI licensing in assertions and questions.

<sup>3</sup> Schwarz and Bhatt (2006:§4.2) note that low and high negation are not fully interchangeable in (4b) either. They speculate that high negation must, but low negation need not, introduce a new non-accidental generalization.

- (7) (Good that Fritz answered question 3! ...)  
 Wenn er **nicht**<sub>HIGH</sub> Frage 3 beantwortet hätte, wäre er durchgefallen.  
 If he not question 3 answered had, would-be he failed  
 'If he hadn't answered question 3, he would have failed.'
- (8) If Jones had taken arsenic, he would have shown the symptoms that he indeed showed.  
 So, it is likely that he took arsenic. (Anderson 1951)
- (9) a. If there hadn't<sub>LOW</sub> been any / had been **no**<sub>LOW</sub> oil in the tank, the furnace would have made exactly the noise that it in fact did. So, it's likely that the tank was empty.  
 b. # If there hadn't<sub>HIGH</sub> been some<sub>PPI</sub> oil in the tank, the furnace would have made exactly the noise that it in fact did. So, it's likely that the tank was empty.
- (10) A: Why, you think, has Fritz failed?  
 B: I'm not sure, but ...  
 a. ... wenn Fritz Frage 3 **nicht**<sub>LOW</sub> beantwortet hätte, wäre er durchgefallen.  
 ... if Fritz question 3 not answered had, would-be he failed  
 '... if Fritz hadn't answered question 3, he would have failed.'  
 b. # ... wenn Fritz **nicht**<sub>HIGH</sub> Frage 3 beantwortet hätte, wäre er durchgefallen.  
 ... if Fritz not question 3 answered had, would-be he failed
- (11)  $[If_{SUBJ} [NEG_{HIGH} p], q]$  is acceptable only if interpreted counterfactually, i.e., only if  $p$  is taken to be true.

Following a suggestion in Schwarz (2006), Ippolito and Su (2009) propose that  $NEG_{HIGH}$  in (11) associates with a factive operator **FACT** presupposing that its complement (e.g. “there was some oil in the tank” in (9b)) is true. The structure is shown in (12). **FACT** shields the PPI from the anti-licensor  $NEG_{HIGH}$ .<sup>4,5</sup>



<sup>4</sup> Ippolito and Su (2009) also argue that high negation correlates with non-cancellable conditional strengthening, a correlation that they capture by introducing the operator *exh* (i) into the structure (12). Though we will not pursue this point, Ippolito and Su's *exh* can be incorporated into the analysis to be developed in the present paper.

(i)  $\llbracket exh \rrbracket = \lambda Q_{\langle st, \langle st, t \rangle \rangle} . \lambda p . \lambda q . Q(p)(q) = 1 \wedge \forall (q)(p) = 1$

<sup>5</sup> After the research for the present paper was completed, a modified version of the original analysis by Ippolito and Su (2009) appeared in Ippolito and Su (2014). While their new analysis merges *exh* and  $NEG_{HIGH}$  in one single **L(ight) N(egation)** operator, the features and predictions of their analysis that are crucial for us remain the same.

We turn now to **polar questions**. Polar questions, while being information-seeking, can be used in an unbiased way, as in (13), or in a biased fashion, as in (14S), which conveys a speaker bias for the proposition "that Jane is not coming". What happens when we use negation in a polar question? Both low and high negation are acceptable in a biased context: (15S) with low negation and (15S') with high negation convey a speaker bias for the proposition "that Jane is coming".<sup>6</sup> But in an unbiased context like (16), the low negation question (16S) is appropriate while the high negation question is not. That is, while low negation can but need not convey an epistemic bias, high negation mandatorily conveys it (Ladd 1981, Romero and Han 2004). The same holds for the German versions in (17). The empirical generalization is summarized in (18).

- (13) Scenario: The speaker has no previous belief on whether Jane is coming or not.  
S: Is Jane coming?
- (14) A: We can't leave yet. We have to wait for Jane. S: Is she really coming?
- (15) A: We are all here. Let's go! S: Is Jane NOT coming? S': Isn't Jane coming?
- (16) Scenario: The speaker is organizing rides after a party and is looking for people that didn't drink alcohol that night. The speaker is going through the list of guests. She has no previous belief or expectation about what they drank.  
A: Jane and Mary did not drink.  
S: OK. What about John? Did he **not**<sub>Low</sub> drink any alcohol?  
S': # OK. What about John? Didn't<sub>High</sub> he drink some<sub>PPI</sub> alcohol?
- (17) a. Hat Hans Maria **nicht**<sub>Low</sub> gesehen?  
Has Hans Maria not seen 'Did Hans not see Maria?'  
b. Hat Hans **nicht**<sub>High</sub> Maria gesehen?"  
Has Hans not Maria seen 'Didn't Hans see Maria?'
- (18)  $[Q \text{ NEG}_{\text{HIGH}} p]$  is acceptable only if interpreted as a biased question, i.e. only if interpreted as conveying the speaker's epistemic bias towards  $p$ .

Romero and Han (2004) derive the epistemic bias described in (18) from the presence of the operator VERUM, as shown in (19)-(20). VERUM shields the PPIs from the anti-licensor NEG<sub>HIGH</sub>.

- (19)
- 
- ```

graph TD
    CP --> Q
    CP --> IP
    IP --> NEG_HIGH[NEGHIGH]
    IP --> VERUM_IP[VERUM (IP)]
    style VERUM_IP stroke-width:2px
  
```
- NEG<sub>HIGH</sub> (VERUM (IP))

<sup>6</sup> Throughout the paper, relevant instances of focus will be marked in capitals.

$$(20) \quad \llbracket \text{VERUM} \rrbracket = \lambda p_{\langle s, t \rangle}. \lambda w_s. \forall w' \in \text{Epi}_x(w) [ \forall w'' \in \text{Conv}_x(w') [ p \in \text{CG}_{w''} ] ]$$

The **goal** of this paper is to provide an unified analysis of the special meaning effect associated with high negation in subjunctive conditionals and polar questions. The two obvious lines to explore are: (i) exporting the operator FACT from subjunctive conditionals to polar questions, and (ii) exporting VERUM from polar questions to subjunctive conditionals. Line (i) would yield the wrong result: (15S') and (17b), though biased towards  $p$ , are information-seeking questions and do not presuppose  $p$ . We will thus pursue the VERUM line. We will see that the empirical generalization (11) on subjunctive conditionals is too strong: rather than the factive presupposition that  $p$  is true, the correct generalization involves the weaker notion of epistemic bias towards  $p$ , thus leaving open the path to a unified analysis within the VERUM line.

The rest of the paper is organized as follows. In section 2, we will examine the behavior of so-called Common Ground (CG) management operators. Section 3 elaborates on previous analyses of high negation in polar questions. Section 4 presents a new proposal for high negation in subjunctive conditionals. Section 5 concludes.

## 2. CG-managing operators

Certain items, like the German discourse particle *ja* in (21), have been argued to indicate the C(ommon) G(round) status of the uttered proposition. We will call this information “CG-management content” (Repp 2013; see also Krifka 2008), remaining agnostic as to whether it is a conventional implicature (CI) (Kratzer 1999), a presupposition (Kaufmann 2010) or neither.

(21) Discourse particle *ja* :

a. At-issue content:  $\lambda p_{\langle s, t \rangle}. p$

b. CG-man. content:  $\lambda p_{\langle s, t \rangle}. \text{speaker thinks that addressee might know that } p$

Key to our analysis will be the CG-managing operators VERUM and FALSUM. VERUM has as overt reflexes the particle *really* and focus stress (typically) on the finite verb, as exemplified in the declarative clauses in (22) (Höhle 1992, Romero and Han 2004). Intuitively, VERUM is used to communicate that the speaker is certain that the proposition  $p$  that it combines with should be added to the Common Ground (CG). VERUM is defined by Romero and Han (2004) in (20) and treated as a CG-managing operator in Repp (2013). We combine these ideas into the lexical entry (23). The CG-management content of [VERUM IP] will be abbreviated as FOR-SURE-IN-CG( $p$ ), where  $p$  is the proposition expressed by IP.

(22) a. John REAlly IS dead.                      b. John IS dead.

(23) VERUM:

a. At-issue content:  $\lambda p_{\langle s, t \rangle}. p$

b. CG-man. content:  $\lambda p_{\langle s, t \rangle}. \lambda w_s. \forall w' \in \text{Epi}_x(w) [ \forall w'' \in \text{Conv}_x(w') [ p \in \text{CG}_{w''} ] ]$

b'. Paraphrase: “ $x$  is sure that, in all the worlds satisfying  $x$ ’s conversational goals,  $p$  is added to the CG”.

b". Abbreviation: FOR-SURE-IN-CG( $p$ )

FALSUM is the polar antonym of VERUM, conveying that the speaker is certain that the proposition  $p$  that it combines with should *not* be added to the Common Ground. In declarative clauses it appears e.g. in denials like (24B), which is analyzed as (24c) by Repp (2013). We propose the lexical entry for FALSUM in (25), where (25b) is from Repp (2013) and (25a) is our innovation. The CG-management content of [FALSUM IP] will be abbreviated as FOR-SURE-NOT-IN-CG(p). Note that negation in denials, i.e. FALSUM, does not anti-license PPIs, as shown in (24B).

- (24) A: He found something. (Szabolcsi 2004)  
 B: Wrong! He DIDN't find something.  $\checkmark \neg > \exists$   
 c. [ASSERT [ FALSUM [he found something] ]
- (25) FALSUM:  
 a. At-issue content:  $\lambda p_{\langle s,t \rangle}. \neg p$   
 b. CG-man. content:  $\lambda p_{\langle s,t \rangle}. \lambda w_s. \forall w' \in \text{Epi}_x(w) [ \forall w'' \in \text{Conv}_x(w') [ p \notin \text{CG}_{w''} ] ]$   
 b'. Paraphrase: "x is sure that, in all the worlds satisfying x's conversational goals, p is not added to the CG".  
 b". Abbreviation: FOR-SURE-NOT-IN-CG(p)

Two important properties of CG-managing operators are the following. First, according to Repp (2013:8), CG-management content is semantically embeddable under illocutionary operators, e.g. ASSERT and the question morpheme Q. We propose that such semantic embedding takes place at the CG-management tier. We implement this idea by doubling the standard denotation of Q as at-issue and as CG-management content, as in (26), and letting the CG-management contents of VERUM/FALSUM and Q combine.<sup>7</sup>

- (26) Q-morpheme:  
 a. At-issue content:  $\lambda p_{\langle s,t \rangle}. \{p, \neg p\}$   
 b. CG-management content:  $\lambda p_{\langle s,t \rangle}. \{p, \neg p\}$

Second, GC-management content is not semantically embedded in the at-issue tier. Hence, if a CG-management item appears syntactically in a non-root environment, as in (27), its meaning contribution will not be part of the at-issue content of the *because*-clause. The same holds if the CG-management item appears in a polar question or in the antecedent of a conditional: it will not contribute to the at-issue content of either.

- (27) Karl hat seinen Job verloren, [CP weil er **ja** in der Gewerkschaft war].  
 Karl has his job lost, because he JA in the union was  
 'Karl lost his job [CP because he was JA in the union']

<sup>7</sup> This means that we depart from Potts' (2005) logic for conventional implicatures in two (independently attested) ways (McCready 2010): we treat Q as introducing both at-issue and CG-management content, comparably to *Kraut* in (i.a), and we let CG-management content be modified by CG-management content, comparably to (i.b).

- (i) a. He is a Kraut. (= 'He is German' plus pejorative flavor) b. Totally ouch (, dude).



### 3. High negation in polar questions

In this section we modify the analysis of biased polar questions in Romero and Han (2004). Their original approach faces two problems. First, there is a mismatch between the propositions predicted to be in the question denotation and the meaning of the actual answers (**problem A**) (Romero 2006). Second, there is no independent motivation for the scopal configuration  $\neg\text{VERUM}$  they postulate (**problem B**) (AnderBois 2011). By adding two innovations from section 2 – namely, the operator *FALSUM* and the separation between at-issue and CG-management content – these two problems will be circumvented. We examine epistemic bias in positive polar questions in section 3.1 and epistemic in bias polar questions with high negation in section 3.2.

#### 3.1. Positive polar questions with *really* and focus stress

Romero and Han (2004) assign the polar interrogative clauses in (29a,a'), with the particle *really* and focus on the finite verb, the Logical Form (LF) representation in (29b). Their original unidimensional lexical entry for *VERUM* is repeated in (28) (=20)), contributing solely to the at-issue content. This produces the Hamblin-style question denotation in (30).

$$(28) \quad \llbracket \text{VERUM} \rrbracket = \lambda p_{\langle s, t \rangle} . \lambda w_s . \forall w' \in \text{Epi}_x(w) [ \forall w'' \in \text{Conv}_x(w') [ p \in \text{CG}_{w''} ] ]$$

(=20))

- (29) a. Is Jane really coming?  
 a'. IS Jane coming?  
 b. LF: [ Q [ VERUM [ Jane is coming ] ] ]

- (30) At-issue content: { FOR-SURE-IN-CG(Jane is coming),  
 $\neg$ FOR-SURE-IN-CG(Jane is coming) }

Now, assuming that the at-issue content (30) provides the cells of the partition the addressee is requested to choose from, the wrong answer meaning is derived. The answer 'yes' would correspond to the cell FOR-SURE-IN-CG(Jane is coming) and the answer 'No' to the cell  $\neg$ FOR-SURE-IN-CG(Jane is coming), as indicated in (31). While one could argue about the first result, the second prediction is clearly wrong. The answer 'No' to (29a) is predicted to convey that the addressee is not fully convinced about the appropriateness of adding *p* (= "Jane is coming") to the CG, while intuitively it conveys a stronger meaning, namely that the speaker endorses  $\neg p$ .

- (31) a. Yes = FOR-SURE-IN-CG(Jane is coming)  
 b. No =  $\neg$ FOR-SURE-IN-CG(Jane is coming)

By adopting the bidimensional lexical entry for *VERUM* in (32) (=23a,b)), the answer pattern can be appropriately accounted for. From the LF in (29b), we obtain the at-issue question meaning in (33a) and the CG-management question meaning in (33b). The at-issue content (33a) provides

the cells of the partition to be chosen from, corresponding to the answers ‘Yes’ and ‘No’, as indicated in (34). This solves problem A: The ‘Yes’ answer corresponds to the cell (*Jane is coming*) and the ‘No’ answer to the cell  $\neg(\textit{Jane is coming})$ .

(32) VERUM: (=(23))

- a. At-issue content:  $\lambda p_{\langle s, t \rangle}. p$   
 b. CG-man. content:  $\lambda p_{\langle s, t \rangle}. \lambda w_s. \forall w' \in \text{Epi}_x(w) [ \forall w'' \in \text{Conv}_x(w') [ p \in \text{CG}_{w''} ] ]$   
 Abbreviated: FOR-SURE-IN-CG( $p$ )

(33) a. At-issue content:  $\{ \textit{Jane is coming}, \neg(\textit{Jane is coming}) \}$   
 b. CG-man. content:  $\{ \text{FOR-SURE-IN-CG}(\textit{Jane is coming}), \neg\text{FOR-SURE-IN-CG}(\textit{Jane is coming}) \}$

(34) a. Yes = *Jane is coming* b. No =  $\neg(\textit{Jane is coming})$

Besides the at-issue partition in (33a), a second partition is carried out as part of the CG-management content.<sup>8</sup> This second partition is the one responsible for deriving the epistemic bias, à la Romero and Han (2004). In a nutshell, the speaker wonders – though does not ask – whether the addressee has fully convincing evidence for adding  $p$  to the CG, suggesting that the speaker is biased towards  $\neg p$  and would need strong evidence to be convinced that  $p$  should be added to CG.<sup>9</sup>

### 3.2. Negative polar questions with high negation and PPIs

Romero and Han (2004) argue that preposing of negation signals the presence of VERUM. Furthermore, when a PPI is present, negation scopes over the VERUM operator, producing the scopal relation  $\neg\text{VERUM}$ . This generates for (35a) the LF (35b). Applying their original

<sup>8</sup> The status of this second, expressed but unasked question could be compared to that of German matrix verb-final questions, illustrated in (i.a). Such questions, often labeled ‘deliberative’ questions, convey the state of wondering of the speaker without positing a question to the addressee, in contrast to matrix V2 interrogatives like (i.b), which request an answer from the addressee (Truckenbrodt 2004). A related case is Japanese Speaker-Oriented Embedded Questions like (ii): (ii) asserts that the ground is wet and conveys that the speaker is wondering whether it rained, which is treated as a not-at-issue, conventionally implicated question (Tomioka 2014). A possible way to distinguish asked vs. conventionally implicated questions would be to distinguish between the common public QUD stack (for at-issue questions) and the speaker's public QUD stack (for conventionally implicated questions). See footnote 11.

(i) a. Ob sie morgen kommt? [German]  
 If/whether she tomorrow comes ‘Whether she’ll come tomorrow, I wonder.’  
 b. Kommt sie morgen?  
 Comes she tomorrow? ‘Will she come tomorrow?’  
 (ii) [Ame-ga hut-ta-no-ka] jimen-ga nurete-iru. [Japanese]  
 rain-Nom fall-Past-NML-Q ground-Nom wet-Prog ‘[Whether it rained], the ground is wet.’

<sup>9</sup> The existence of an epistemic bias is derived as an implicature from the Principle of Economy in (i), where a meta-conversational move is e.g. to question a move. See Romero and Han (2004) for details. To explain the uncanceledability of this bias, Lauer (2014) treats it as a ‘Need a Reason’ implicature.

(i) Do not use a meta-conversational move unless necessary (to resolve epistemic conflict or to ensure Quality).

unidimensional lexical entry for VERUM, the at-issue question meaning in (36) is obtained.

- (35) a. Isn't Jane coming too?  
 b. LF: [ Q [  $\neg$  VERUM [ Jane is coming ] ] ]
- (36) At-issue content: { FOR-SURE-IN-CG(Jane is coming),  
 $\neg$ FOR-SURE-IN-CG(Jane is coming) }

The partition in (36) leads again to problem A. Assuming that the answer 'Yes' picks a positive proposition from the partition and the answer 'No' a negative one (Kramer & Rawlins 2010, Holmberg 2013), the wrong meaning is derived for the answers: (37). While the 'Yes' answer may be argued to correspond to the FOR-SURE-IN-CG(Jane is coming) cell, the 'No' answer is assigned too weak a meaning. It is predicted to express that the addressee is not fully convinced about the appropriateness of adding  $p$  (= "Jane is coming") to the CG. But, again, the 'No' answer intuitively communicates the stronger meaning that the speaker endorses  $\neg p$ .

- (37) a. Yes = FOR-SURE-IN-CG(Jane is coming)  
 b. No =  $\neg$ FOR-SURE-IN-CG(Jane is coming)

Furthermore, the analysis in (35) leads to problem B: the meaning  $\neg$ VERUM postulated for high negation in (35a) is not attested in other environments. Most evidently, high negation in a denial like (38B) does not have the reading (38d), which would arise if (38c) was a possible LF.

- (38) A: Jane is coming too.  
 B: Jane ISN'T coming too.  
 c. LF: [  $\neg$  VERUM [ Jane is coming ] ]  
 d.  $\neg$ FOR-SURE-IN-CG(Jane is coming)

Both problems are avoided if preposed negation followed by a PPI is treated as FALSUM under its bidimensional lexical entry (39) (= (25a,b)). This yields the LF representation (40b) for sentence (40a), and the corresponding bidimensional meaning contribution in (41).

- (39) FALSUM: (=(25a,b))  
 a. At-issue content:  $\lambda p_{\langle s,t \rangle}. \neg p$   
 b. CG-man. content:  $\lambda p_{\langle s,t \rangle}. \lambda w_s. \forall w' \in \text{Epi}_x(w) [ \forall w'' \in \text{Conv}_x(w') [ p \notin \text{CG}_{w''} ] ]$   
 Abbreviated: FOR-SURE-NOT-IN-CG( $p$ )
- (40) a. Isn't Jane coming (too)?  
 b. LF: [ Q [ FALSUM [ Jane is coming ] ] ]
- (41) a. At-issue content: {  $\neg$ (Jane is coming),  $\neg\neg$ (Jane is coming) }  
 That is: { Jane is coming,  $\neg$ (Jane is coming) }  
 b. CG-man. content: { FOR-SURE-NOT-IN-CG(Jane is coming),

–FOR-SURE-NOT-IN-CG(Jane is coming) }

This move circumvents the problems A and B above. With respect to problem A, the right meaning of answers is derived from the at-issue content: the ‘Yes’ answer corresponds to the positive proposition from the at-issue partition (41a) and the ‘No’ answer to the negative one, as indicated in (42). With regard to problem B, interpreting high negation with a PPI not as negation scoping over VERUM but as a single, bidimensional operator FALSUM allows for a unified treatment of high negation in polar questions and declaratives. Parallel to the polar question (40), the denial in (43) receives the LF representation in (43c). The resulting at-issue content communicates the speaker’s endorsement of  $\neg p$  (with  $p$  = “Jane is coming”) and the CG-management content conveys that the speaker is sure that  $p$  should not be added to the CG.

- (42) a. Yes = Jane is coming                      b. No =  $\neg$ (Jane is coming)
- (43) A: Jane is coming too.  
 B: Jane ISN’T coming too.  
 c. LF: [FALSUM [ Jane is coming ] ]  
 d. At-issue content:                       $\neg$ (Jane is coming)  
 e. CG-management content: FOR-SURE-NOT-IN-CG(Jane is coming)

Finally, the CG-management content (41b) derives the epistemic bias in a way parallel to the previous case: the speaker wonders – though does not ask – whether the addressee has fully convincing evidence for not adding  $p$  to the CG, suggesting that the speaker is biased towards  $p$  and would need strong evidence to be convinced that  $p$  should not be added to CG.

### 3.3. Negative polar questions with low negation

Recall that polar questions with low negation, like (44), can be used without original epistemic bias on the speaker’s side. Here we simply maintain the analysis in Romero and Han (2004), where low negation is assigned the at-issue content  $[\lambda p_{\langle s,t \rangle}. \neg p]$ . This derives the meaning in (45), which corresponds to an epistemically unbiased question.

- (44) a. (OK. What about John?... ) Did he **not**<sub>Low</sub> drink any alcohol?                      (= (16S))  
 b. LF: : [ Q [ not [ John drank alcohol ] ] ]
- (45) At-issue content:                      {  $\neg$ (John drank alcohol),  $\neg\neg$ (John drank alcohol) }  
 That is: { John drank alcohol,  $\neg$ ( John drank alcohol) }

To sum up section 3, by adding Repp’s (2013) FALSUM and by assigning the operators VERUM and FALSUM a bidimensional meaning contribution, the account by Romero and Han (2004) has been modified to derive epistemic bias while avoiding previous problems. The at-issue content of the interrogative delivers an information-seeking question, which the answers match; the CG-management content of the interrogative derives the speaker epistemic bias.

## 4. High negation in subjunctive conditionals

### 4.1. Conditional antecedents and questions

It has been noted that there is a connection between questions and conditional antecedents, in that clauses that have the internal syntax of an interrogative clause can semantically serve as antecedents of several types of conditionals sentences (Rawlins 2008, Onea and Steinbach 2011). This is exemplified with the *whether*-clause in (46), which functions as an unconditional.

(46) Whether Mary comes or not, the party will be fun.

We argue that a connection in the opposite direction exists as well: conditional syntax – more concretely, an antecedent clause  $[if\ \alpha]$  – signals that there is an open issue as to whether or not  $\alpha$  is the case in the relevant domain of worlds. More formally, it signals that the domain  $D$  of worlds provided by the Modal Base and the Ordering Source that the conditional quantifies over can be partitioned into  $\{\alpha, \neg\alpha\}$ . In the case of indicative conditionals like (47), the domain  $D$  is a subset of the context set ( $CS$ ), while, in the case of subjunctive conditionals like (48), the domain (may) reach outside of the  $CS$  (von Fintel 1997, Leahy 2011). When a subjunctive conditional  $[if\ \alpha]$  is used counterfactually, there are only  $\neg\alpha$ -worlds in the  $CS$ . When it is used in Anderson-style contexts, there are  $\alpha$ -worlds and  $\neg\alpha$ -worlds in the  $CS$ .

(47) Indicative conditional:

If Mary went to the party yesterday, it was fun.

$D \subseteq CS$

(48) Subjunctive conditional:

If Mary had gone to the party yesterday, it would have been fun.

$D \not\subseteq CS$

a. Interpreted as counterfactual: only  $\neg p$ -worlds in  $CS$

b. Interpreted as in Anderson (1951)'s example:  $p$ -worlds and  $\neg p$ -worlds in  $CS$

We cast this idea in a Questions under Discussion (QUD) framework (Roberts 1996), as in (49):

(49) A conditional antecedent  $[if_D\ \alpha]$  conveys that the question  $\llbracket Q \rrbracket(\llbracket \alpha \rrbracket^{\text{at-issue-content}})$  partitioning domain  $D$  is – truly or hypothetically – a question in the QUD stack.<sup>10</sup>

This applies to the conditional sentences above as follows. In the case of the indicative conditional (47), the question  $\{Mary\ \text{went to party}, \neg(Mary\ \text{went to party})\}$  partitions the domain

<sup>10</sup> Starr (2014) develops a semantics for conditionals of the form  $[if\ p\ \text{then}\ q]$  within Inquisitive Semantics involving the following steps: (i) hypothetically adding the question  $p$ ? to the issues under consideration while highlighting the positive answer, and (ii) concluding that  $q$  follows from adding the highlighted answer to the contextual information (Starr 2014:10). For a formalization of hypothetical additions, see Starr (2014:2.4). I leave a concrete implementation of hypothetical QUD stacks in the QUD framework for future research. Also, we remain agnostic as to whether the effect described in (49) is a presupposition, a conventional implicature or some other related effect.

of worlds  $D$ . Given that  $D \subseteq CS$ , the question  $\{Mary\ went\ to\ party, \neg(Mary\ went\ to\ party)\}$  is truly an open question in the QUD stack. In the case of the subjunctive conditional (48) under an Anderson-style interpretation, the domain of worlds  $D$  includes (and possibly goes beyond) the  $CS$ . Given that there are  $p$ -worlds and  $\neg p$ -worlds in  $CS$ , partitioning  $D$  leads to partitioning the current  $CS$ , which means that the question  $\{Mary\ went\ to\ party, \neg(Mary\ went\ to\ party)\}$  truly is an open question in the QUD stack. Finally, under the counterfactual interpretation of (48), the question  $\{Mary\ went\ to\ party, \neg(Mary\ went\ to\ party)\}$  establishes a partition in the domain  $D$  but not in the current  $CS$ , where  $\neg(Mary\ went\ to\ party)$  is already settled. Hence, the question is an open question in a hypothetical QUD stack.

Furthermore, we propose that, besides a question being raised out of the at-issue content of the *if*-clause, as in (47) and (48), a polar question is raised out of the CG-management content of the antecedent clause as well. This is stated in (50).<sup>11</sup>

- (50) A conditional antecedent  $[if_D \alpha]$  conveys that the question  $[[Q]]([[\alpha]]^{CG-man-content})$  partitioning domain  $D$  is – truly or hypothetically – a question in the QUD stack.

With these ingredients in place, we are ready to turn to high negation in subjunctive conditionals.

#### 4.2. Deriving the infelicity of high negation in Anderson-style subjunctive conditionals

As we saw in section 1, while both low and high negation are appropriate in counterfactually used subjunctive conditionals like (51), low negation is felicitous but high negation is infelicitous in an Anderson-style examples like (52).

- (51) a. Good that there was oil in the tank! If there hadn't<sub>Low</sub> been any / had been **no**<sub>Low</sub> oil in the tank, the furnace would have exploded.  
 b. Good that there was oil in the tank! If there hadn't<sub>High</sub> been some<sub>PPI</sub> oil in the tank, the furnace would have exploded.
- (52) a. If there hadn't<sub>Low</sub> been any / had been **no**<sub>Low</sub> oil in the tank, the furnace would have made exactly the noise that it in fact did. So, it's likely that the tank was empty.  
 b. # If there hadn't<sub>High</sub> been some<sub>PPI</sub> oil in the tank, the furnace would have made exactly the noise that it in fact did. So, it's likely that the tank was empty.

To capture this contrast, we extend the analysis of low and high negation in polar questions to low and high negation in subjunctive conditionals, respectively. Just like low negation simply has the at-issue content  $[\lambda p_{<s,t>}. \neg p]$  in polar interrogatives (and in declaratives), it does so in subjunctive conditionals as well. Just as high negation is the overt realization of the CG-

<sup>11</sup> In the same way that we distinguish between common public beliefs shared by the conversationalists and e.g. the speaker's public beliefs (Gunlogson (2003) a.o.), we may want to distinguish between the common public QUD stack and the speaker's public QUD stack. Then, (49) would concern the former QUD stack and (50) the latter.

management operator **FALSUM** in polar interrogatives (and in declaratives), it denotes bidimensional **FALSUM** (39) in subjunctive conditionals as well. Let us see the two cases in turn.

In the case of low negation, our analysis assigns to the antecedent clause of sentence (53) the LF (54) and the content in (55). At the at-issue level, the conditional sentence quantifies over worlds where there was not oil in the tank, i.e., the worlds in (55a). Furthermore, it is conveyed that the question in (55b) is – truly or hypothetically – a question in the QUD stack: truly in an Anderson-style context and hypothetically in a counterfactual use. The raised QUD  $\{p, \neg p\}$  is unbiased and does not clash with the speaker taking  $p$  for granted in the counterfactual cases or the speaker trying to argue for  $\neg p$  in Anderson's examples.

(53) If there hadn't<sub>Low</sub> been any / had been **no**<sub>Low</sub> oil in the tank, the furnace would have exploded.

(54) [<sub>CP</sub> If [<sub>IP</sub> not [<sub>IP</sub> there had been some oil in the tank] ] ]

(55) a. At-issue content:  $\lambda w. \neg(\text{there was oil in tank})$   
 b. Raised QUD:  $\{ \lambda w. \neg(\text{there was oil in tank}), \lambda w. \text{there was oil in tank} \}$

In the case of high negation, the antecedent clause of sentence (56) is assigned the LF in (57) and the content in (58). At the at-issue level, the conditional sentence correctly quantifies simply over worlds where there wasn't oil in the tank, i.e., the worlds in (58a). Additionally, it is conveyed that the question in (58b) is – truly or hypothetically – a question in the QUD stack. Crucially, the raised question is now biased: the speaker wonders whether the addressee has fully convincing evidence against adding  $p$  ( $p$  = 'there was oil in the tank') to the actual CG, which suggests that the speaker is biased towards  $p$  and would have to be convinced otherwise.

(56) If there hadn't<sub>High</sub> been some<sub>PP1</sub> oil in the tank, the furnace would have exploded.

(57) [<sub>CP</sub> If [ **FALSUM** [<sub>IP</sub> there had been some oil in the tank] ] ]

(58) a. At-issue content:  $\lambda w. \neg(\text{there was oil in tank})$   
 b. Raised QUD:  $\{ \lambda w. \text{FOR-SURE-NOT-IN-CG}_w(\text{there was oil in tank}), \lambda w. \neg\text{FOR-SURE-NOT-IN-CG}_w(\text{there was oil in tank}) \}$

How does this bias fit with the counterfactual and Anderson-style interpretations? Consider first the counterfactual use. The speaker bias towards  $p$  (= 'there was oil in the tank') arising from the hypothetical QUD (58b) does not clash with counterfactuality, i.e. it does not clash with  $p$  being taken as true in the actual CS. Hence, no infelicity arises in (51b). But, in Anderson-style scenarios, the speaker bias towards  $p$  (= 'there was oil in the tank') arising from the true QUD (58b) clashes with the speaker's discourse towards the truth of  $\neg p$  (= 'the tank was empty'). In other words, if the speaker is trying to argue for  $\neg p$ , as in (52b), or she is trying to suggest  $\neg p$  as a likely answer to a previous question, as in (10b), and she is being truthful (Maxim of Quality),

then expressing an epistemic bias towards the complementary proposition  $p$  would render her epistemic state inconsistent. It is this clash between what the speaker is arguing for or suggesting at the at-issue level and what she is indicating at the CG-management content level that leads to the infelicity of high negation in Anderson-style examples.

#### 4.3. Further predictions

The analysis just sketched derives the unacceptability of high negation in Anderson-style subjunctive conditionals not from the lack of counterfactual interpretation, but from an epistemic bias. This means that, if the proposed analysis is on the right track, the correct diagnosis concerning high negation in subjunctive conditionals is not (59) (= (11)), but (60).

- (59)  $[If_{SUBJ} [NEG_{HIGH} p], q]$  is acceptable only if interpreted counterfactually, i.e., only if  $p$  is taken to be true. (= (11))
- (60)  $[If_{SUBJ} [NEG_{HIGH} p], q]$  is acceptable only if the context is consistent with the speaker's epistemic bias towards  $p$ .

Both generalizations make the correct predictions for counterfactual and Anderson-style examples. To tease them apart, we need to test their predictions beyond such examples. We will use two further cases: (i) *Modus Tollens* and (ii) subjunctive conditionals with VERUM. The former undermines diagnosis (59) and the corresponding analysis by Ippolito and Su (2009). The latter adds further support to the generalization (60) and to the analysis in the present paper.

First, *Modus Tollens* examples like (61) also show that subjunctive conditionals can be used without entailing or presupposing counterfactuality: antecedent falsity does not follow from the subjunctive conditional in (61), since, if it did, the conclusion in (61) would feel redundant.

- (61) If John had killed the victim, he would have used a knife. But the victim was killed with a stiletto. Thus, it wasn't John who killed the victim.

Interestingly, high negation in *Modus Tollens* examples is perfectly felicitous:<sup>12</sup>

- (62) If there hadn't<sub>HIGH</sub> been some<sub>PEPI</sub> oil in the tank, the furnace would not have lit. But it did light. Thus, there was some oil in the tank.
- (63) Wenn Fritz **nicht**<sub>HIGH</sub> Frage 3 beantwortet hätte, wäre er durchgefallen. Aber er ist nicht durchgefallen. Also hat er Frage 3 beantwortet.  
'If Fritz hadn't<sub>HIGH</sub> answered question 3, he would have failed. But he didn't fail. Thus, he answered question 3.

How do the two lines of analysis fare on this case? The factive analysis predicts high negation to

<sup>12</sup> This empirical observation arose in conversations between Brian Leahy and myself.



lead to infelicity. Sentences (62)-(63) are analyzed as presupposing the truth of  $p$  (= ‘there was oil in the tank’ / ‘Hans answered Q3’) and, thus, they are wrongly predicted to make the conclusion  $p$  redundant and to lead to the same infelicity as (64). In contrast, the FALSUM-based analysis correctly predicts (62)-(63) to be felicitous, since having an epistemic bias for  $p$  and making a logical argument to convince the addressee of  $p$  are two compatible goals.

- (64) # If it hadn’t been for the fact that there was some oil in the tank, the furnace would not have lit. But it did light. Thus, there was some oil in the tank.

Second, we saw in section 3 that *really*/VERUM behaves parallel to high negation/FALSUM in polar interrogatives in that both give rise to an epistemic bias. Since the proposed analysis uses the bias arising from FALSUM as key to analyze certain interpretive effects in subjunctive conditionals, parallel effects are predicted to arise in subjunctive conditionals with VERUM. This prediction is borne out: adding *really* to an Anderson-style example leads to infelicity, as in (65), and adding it to a *Modus Tollens* example preserves felicity, as shown in (66).

- (65) Anderson-style context:
- a. # If there **really** had been sand in the tank, the furnace would have made exactly the noise that it in fact did. So, it’s likely that there was sand in the tank.
  - b. # Wenn **wirklich** Sand im Tank gewesen wäre, hätte der Ofen genau das Geräusch gemacht, das er tatsächlich gemacht hat. Also war Sand im Tank.
- (66) Modus Tollens:
- a. If there **really** had been oil in the tank, the furnace would have lit. But it didn’t light. Thus, there was no oil in the tank.
  - b. Wenn **wirklich** Öl im Tank gewesen wäre, hätte der Ofen sich entzündet. Aber er hat sich nicht entzündet. Also war kein Öl im Tank.

To sum up section 4, we have analyzed high negation in subjunctive conditional antecedents [*if not<sub>HighNeg</sub> p*] not as triggering the factive presupposition  $p$ , but as denoting FALSUM and ultimately conveying a bias towards  $p$ . Signaling a bias towards  $p$  clashes with the speaker’s attempt to argue or suggest  $\neg p$  in Anderson-style examples. In contrast, a bias towards  $p$  is perfectly compatible with the speaker’s taking  $p$  for granted in counterfactual uses and with the speaker’s trying to logically argue for  $p$  in *Modus Tollens* examples.

## 5. Conclusions and open issues

By building on Romero and Han’s (2004) and Repp’s (2013) analysis of high negation in polar interrogatives and extending it to subjunctive conditionals, we have developed a unified analysis of high negation in the two environments, with FALSUM as the key ingredient:

- (67) High negation in polar questions and in subjunctive conditional antecedents (and in declaratives) expresses the operator FALSUM.

The proposed analysis correctly derives the following effects. First, polar questions of shape  $[Q \text{ not}_{\text{High}} p?]$  convey an epistemic speaker bias towards  $p$ . Second, polar questions of shape  $[Q \text{ really } p?]$  convey an epistemic speaker bias towards  $\neg p$ . Third, subjunctive conditionals of shape  $[If \text{ not}_{\text{High}} p, q]$  convey an epistemic speaker bias towards  $p$  that makes the conditional infelicitous in Anderson-style scenarios (where the speaker argues for the antecedent,  $\neg p$ ) and felicitous in *Modus Tollens* examples (where speaker argues for the negation of the antecedent,  $p$ ). Fourth and finally, subjunctive conditionals of shape  $[If \text{ really } p, q]$  convey an epistemic speaker bias towards  $\neg p$  that makes the conditional infelicitous in Anderson-style scenarios (where the speaker argues for the antecedent,  $p$ ) and felicitous in *Modus Tollens* examples (where speaker argues for the negation of the antecedent,  $\neg p$ ).

Neither Ippolito and Su (2009) nor the present proposal say anything about high negation in the environments in (3)-(4), which we saw fall under the empirical generalization (5). Putting (5) and the new generalization (67) together leads to the disjunctive generalization (68). We leave for future research the issue of whether, and, if so, how (68) can be reduced to a unitary concept. We also leave for future research examples of high negation where downward monotonicity is not required to begin with, such as the consequent of the conditionals in (69)-(70).

(68) High negation is allowed iff it appears in a downward entailing context or it stands for FALSUM.

(69) If John had been in good company, he wouldn't<sub>High</sub> have called someone<sub>epi</sub>.

(70) Wenn Fritz dumm wäre, hätte er **nicht**<sub>High</sub> Frage 3 beantwortet.  
 If Fritz dumm were, would-have he not question 3 answered  
 'If Fritz was dumm, he would not have answered question 3.'

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# Hidden universal quantification and change of argument structure in particle-verb constructions

Antje Roßdeutscher<sup>1</sup>

*Institute for Natural Language Processing, University of Stuttgart*

**Abstract.** I propose an analysis of verb phrases called Ground Promotion constructions (cf. McIntyre 2007), or involving ‘unpredicated particles’ (cf. Levin and Sells 2009), at the syntax-semantics interface. The interface framework combines principles of Minimalist Syntax and Distributed Morphology with Discourse Representation Theory. The analysis follows the hypothesis of a parallelism between the verbal and the prepositional domain, i.e. Split-P Hypothesis, but presents a different analysis for Ground Promotion constructions than the seminal paper Svenonius (2003): A silent passive *p*-head houses a hidden universal quantifier (HUQ) in the nucleus of which the implicit figure argument is existentially bound.

## 1. Introduction

### 1.1. Introductory examples

I propose an analysis of so-called Ground Promotion constructions, cf. McIntyre (2007)). Levin and Sells (2009) call them ‘unpredicated particles’<sup>2</sup>. The constructions are compared with others built from the same prepositional and verbal roots. The central difference is that between (1a), (2a) and (2b) on the one hand and (1c), (2c) on the other.

- |                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                               |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| (1) a. <i>Er strich Farbe an eine Wand</i><br>he painted paint <sub>acc</sub> at a wall <sub>p-cs</sub><br>‘he painted paint on a wall’<br>b. $\emptyset$<br><br>c. <i>Er strich eine Wand (mit Farbe)</i><br>he painted a wall <sub>acc</sub> (with paint)<br><i>an</i><br>at.prtc.<br>‘he covered a wall with paint’ | (2) a. <i>Wein lief aus einem Fass</i><br>wine <sub>nom</sub> ran out of a barrel <sub>p-cs</sub><br>‘wine ran out of a barrel’<br>b. <i>Wein lief (aus einem Fass)</i><br>wine <sub>nom</sub> ran (out of a barrel)<br><i>aus</i><br>out.prtc.<br>‘wine ran out (of a barrel)’<br>c. <i>ein Fass lief aus</i><br>a barrel <sub>nom</sub> ran out.prtc.<br>‘a barrel emptied’ |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

<sup>1</sup>This paper developed from work in the project B4 of the long-term research-project *Incremental Specification in Context*, funded by the *Deutsche Forschungsgemeinschaft*. I wish to thank Artemis Alexiadou, Boris Haselbach, Hans Kamp, Tillmann Pross and Florian Schäfer.

<sup>2</sup>Their title is motivated by the observation that e.g. *wipe the paint off* corresponds to the predication *the paint is off*, whereas the particle in *wipe the paint-brush off* has no counterpart in *\*the paint-brush is off*.

In the (a) and (b)-examples, the figure DP, i.e. *Farbe* (paint), *Wein* ('wine'), gets structural case, (accusative or nominative) and the ground argument, i.e. *eine Wand* ('a wall'), *das Fass* ('the barrel'), is part of the PP and gets prepositional case (P-CS). In the (c)-examples the figure argument is 'demoted' — it is absent or part of a PP headed by *mit* ('with') — and the ground DP is promoted to receive structural case.

The experts agree that Ground Promotion constructions, i.e. the (c)-examples are holistic, as indicated in the translations with 'cover' or 'empty'. In terms of Aktionsart the (b)-examples are activities, the (c)-examples are accomplishment. Except for sentence aspect the "alternates" share entailments: fluid changes location: onto a surface; into an interior; from a surface; out of an interior.<sup>3</sup>

Thinking of the constructions, say (1a) vs. (1c), and (2a),(2b) vs. (2c), they are *not* simple alternations. The constructions in (1a) and (2a),(2b) describe change of location of the paint (or wine respectively) (1c) and (2c) do not (cf. (5b) and (6b)).

- (5) a. *eine Büchse Farbe an eine Wand streichen*  
 a tin of paint onto a wall paint  
 'to paint a tin of paint onto a wall'
- b. \**eine Wand aus einer Büchse anstreichen*  
 a wall out of a tin at.prtc.paint  
 'to cover a wall out of a tin of paint'

<sup>3</sup>(3) and (4) are verbal predicates antonymous to (1) and (2). N.B. The gap in (1b) is predictable. The particle *an* governs a redundant PP only if *an* has a support-reading, compare (8b) below.

- |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                              |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>(3) a. <i>Er strich Farbe von einem Pinsel</i><br/>         he wiped paint<sub>acc</sub> off a paint-brush<sub>P-CS</sub><br/>         'he wiped paint off a brush'</p> <p>b. <i>Er strich Farbe (von einem Pinsel)</i><br/>         he wiped paint<sub>acc</sub> (from a brush)<br/> <i>ab</i><br/>         off.prtc<br/>         'he wiped paint from a brush'</p> <p>c. <i>Er strich einen Pinsel ab</i><br/>         he wiped a brush<sub>acc</sub> off.prtc<br/>         'he rid the brush of paint'</p> | <p>(4) a. <i>Wasser lief in eine Wanne</i><br/>         water ran into a tub<sub>P-CS</sub><br/>         'water ran into a tub'</p> <p>b. <i>Wasser lief (in eine Wanne) ein</i><br/>         water ran (into a barrel) in.prtc<br/>         'water ran into a tub'</p> <p>c. <i>eine Wanne lief (mit Wasser) ein</i><br/>         a tub<sub>nom</sub> ran (with water) in.prtc<br/>         'a tub filled (with water)'</p> |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

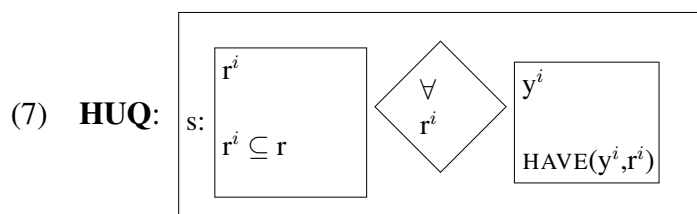
- (6) a. *eine Menge Öl war aus dem Tank in das Erdreich ausgelaufen*  
 a lot of oil was out of the tank into the soil out.ptc.run  
 ‘a lot of oil had run out of the tank into the soil’
- b. *\*der Öltank war in das Auffangbecken ausgelaufen*  
 the oil tank was into the catch basin out.ptc.run  
 ‘the oiltank had emptied into the catch basin’

(1c) and (2c) differ from (1a) and (2a), (2b) as follows: (1a),(2a) and (2b) involve *spatial* relations between the ‘eigenregion’ of the fluid and a region associated with the ground object (the surface or *at*-region of the wall or the interior of the barrel). (1c) and (2c) express *application* relations between a region and stuff: in (1c) the region (the surface of the wall) comes to stand in the application state of ‘having’ the paint that is put on it; in (2c) the barrel first stands in the application relation of having wine in and then, after the event, it does no longer.

Application makes itself felt intuitively in HAVE-paraphrases: *die Wand hat (keine) Farbe (dran)* (the wall has (no) paint on it), *der Pinsel hat (keine) Farbe (dran)* (the paint-brush has (no) paint on it), *das Fass hat (keinen) Wein (drin)* (the barrel has (no) wine in it), etc. I use the predicate HAVE for the application relation in Ground Promotion constructions like (1c) and (2c). HAVE(*y*,*r*) holds between the figure *y*, i.e. the stuff to be applied or removed, and a 2D or 3D-region *r*, i.e. surface or interior of the ground-argument.

## 1.2. Logical Form and figure demotion

The semantic relation of application as such doesn’t provide any explanation yet for why in (1c) and (2c) the ground argument (the wall, the barrel) is overtly realised in a description containing *an +die Wand* (or *aus + ein Fass*), but the figure argument is not. An explanation must be given in terms of their different Logical Forms: The interpretation of Ground Promotion construction involves *existential* quantification of the variable representing the figure argument *y*, within the scope of a *universal* quantification. I refer to this complex quantification operation as *Hidden Universal Quantification*, **HUQ**. In a nutshell — reducing it to the bare bones of its Logical Form — **HUQ** is displayed in (7).



The Logical Form is to be read as follows: For all sub-regions  $r^i$  of a region  $r$ , there exists a portion  $y^i$  of stuff to the effect that each region  $r^i$  stands in the HAVE-relation to  $y^i$ . The state variable  $s$  in (7) represents the state where each sub-region  $r^i$  is applied with stuff. Thus **HUQ** accounts for the holistic interpretation of Ground Promotion constructions:  $s$  in **HUQ** represents the result state of application in which all sub-regions of the surface of the wall have stuff in them.

### 1.3. The alternates are alternatives for production

Viewing Ground Promotion constructions with an application semantics simply as alternates to change-of-location descriptions is misleading. But their semantic kinship is hard to deny. From a point of view of production application events could in principle also be described in terms of change of location — leaving subtleties aside. Change of location descriptions differ from Ground Promotion constructions in that these constructions have **two** strictly incremental themes in the sense of Krifka (1998), namely the bounded region and the stuff that is applied or removed. The two themes are mutually dependent: the incrementality of the described events  $e^i$  manifests itself as a succession of sub-events  $e^i$  each of which involves the filling (or emptying) of a sub-region  $r^i$  with the portion of stuff  $y^i$  that end up in  $r^i$  (or its removal from it). Ignoring subtleties of truth conditions the speaker who wants to describe an incremental application or removal has the choice: either verbalise the change of state as (i) a change of location of the stuff or (ii) as a change of application state of the region.

### 1.4. Challenging data

Viewing Ground Promotion constructions as an alternative option for verbalisation isn't exactly right either, because there are many verbal constructions that exclude Ground Promotion constructions. Ground Promotion constructions are restricted. For example, there is no Ground Promotion construction (8c) that corresponds to (8a) and (8b). Neither do we find (9b) corresponding to (9a).

Moreover, the contribution of the P-elements is not always the same: in our first examples *an + eine Wand* contribute a surface and *aus + ein Fass* contribute an interior. In (10a) *ein + eine Tapete* contribute a surface but an interior in (10b). McIntyre (2007) dubs pairs like (10a) and (10b) 'fake'-alternations.



- (8) a. *Papier an eine Wand kleben*  
 paper at a wall glue  
 ‘glue paper on a wall’  
 b. *Papier (an eine Wand) ankleben*  
 paper (at a wall) at.prtc.glue  
 ‘glue paper on a wall’  
 c. *\*eine Wand (mit Papier) ankleben*  
 a wall (with paper) at.prtc.glue  
 ‘cover a wall with paper’
- (9) a. *Farbe auf eine Wand streichen*  
 paint on a wall paint  
 ‘paint paint on a wall’  
 b. *\*eine Wand (mit Farbe) aufstreichen*  
 a wall (with paint) on.prtc.paint  
 ‘cover a wall with paint’
- (10) a. *eine Tapete (mit Kleister) einstreichen*  
 a wall-paper (with glue) in.prtc.paint  
 ‘to cover a wall-paper with glue’  
 b. *Kleister in eine Tapete streichen*  
 glue in(to) a wall-paper paint  
 ‘to rub /smear glue into a wall-paper’

## 1.5. Overview of the paper

In the rest of the paper I will present a semantics construction algorithm belonging to a syntax-semantics-interface architecture that combines principles of Minimalist Syntax used in *Distributive Morphology* (DM) with *Discourse Representation Theory* (DRT) (cf. Roßdeutscher (2010), Roßdeutscher and Kamp (2010), Roßdeutscher (2014), Roßdeutscher (2012)). Section 2.1 is devoted to syntactic, section 2.2 to semantic aspects of the syntax-semantics interface.

This construction algorithm of the verb phrase of Ground Promotion constructions from their roots will account for the phenomena illustrated by the examples presented so far.

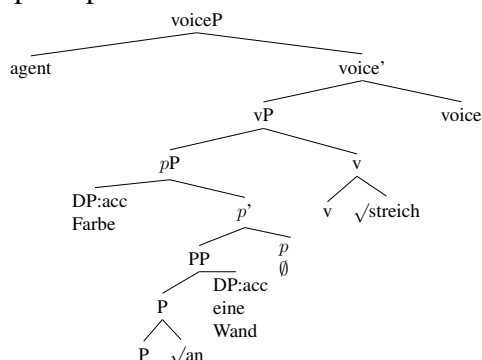
## 2. Semantics construction on the basis of word-syntax

### 2.1. Syntactic background assumptions

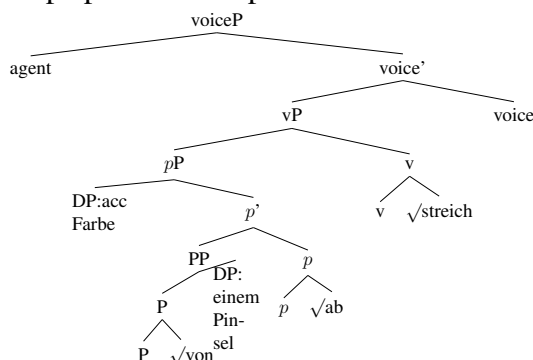
German has four syntactic construction types with prepositional roots like  $\sqrt{\text{an}}$  (at),  $\sqrt{\text{ab}}$  (off), etc. Examples and their syntactic representation are given below: Verb + PP -constructions (see (11)) *Farbe an eine Wand streichen*, particle-constructions (see (12)), *Farbe von einem Pinsel*

*abstreichen*; Ground Promotion constructions (s. (13)) *eine Wand anstreichen*, and prefix-verbs (see (14)) *einen Berg überfliegen*. A particular challenge for German presents itself in the syntactic difference between verb-particle constructions and prefix-verbs. Prefixes incorporate into the verbal head, particles don't; they are adjacent to the verb in base position and stay in situ when the verb moves in V2.

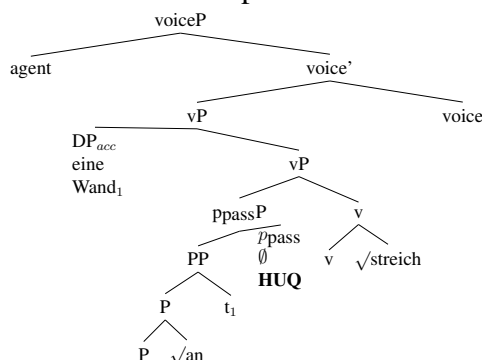
- (11) Farbe an eine Wand streichen  
'paint paint at a wall'



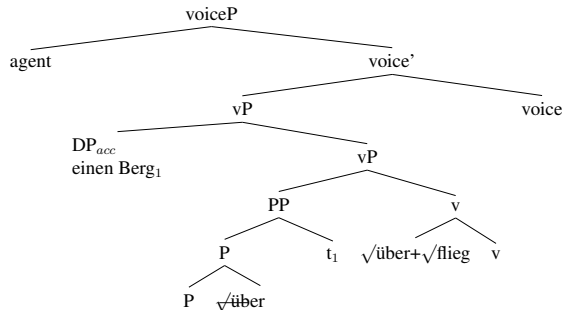
- (12) Farbe von einem Pinsel abstreichen  
'wipe paint from a paint-brush off'



- (13) eine Wand anstreichen  
'cover a wall with paint'



- (14) einen Berg überfliegen  
'to cross a mountain'



The syntactic representations follow the basic assumptions of Minimalist Syntax of phrase structure with the operations move and merge (Adger (2003)). There is only *one* syntactic engine for words and phrases. Incorporation is restricted by Head-Movement-Constraint (HMC) (cf. Baker (1988)). For extended discussion of the syntax-semantics-interface for the structures (11), (12) and (14) see (Rossdeutscher (2013a)) and Rossdeutscher (2013b)). The syntactic representations heavily rely on the Split-P Hypothesis from Svenonius (2003) and subsequent work. Crucial for the Split-P Hypothesis is the assumption of two rather than one prepositional head, *p* and *P*, in strict parallelism to the verbal domain. *p* corresponds to Voice and *P* to the Verb (cf. Kratzer (1996)), see the 'equation' (15).

$$(15) \quad \frac{p}{P} = \frac{Voice}{V} \quad \text{'}p \text{ relates to P like Voice relates to V'}$$

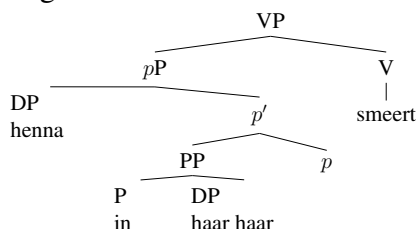
In verb-plus-PP constructions, like (11), and particle constructions with a corresponding PP, like (12)  $p$  licenses case assignments in the governed PPs. As for prefix-verbs, like (14), I explain their incorporation as a consequence of lack of  $p$ . In (11) and (12)  $p$  is an intervening projection between the P-projection and the verbal domain, in the sense of HMC (cf. Baker (1988)). In prefix-verbs we thus have an unaccusative P-projection. An identical syntactic representation has been proposed for Russian *pere*-prefix verbs by Svenonius (2004). Lack of  $p$  has a case theoretical impact: P doesn't assign case to its argument DP, the ground argument. The DP moves to vP and receives structural accusative. Here is the analogy: <einen Berg, über> in the prefix-verb (s. (14)) is like <the door, opens> (s. (19) below). The internal argument is promoted. <Farbe, an eine Wand> and <Farbe, von einem Pinsel ab>, (s. (11),(12)) are like <John, open the door>, (s. (18) below). The figure is the external argument of  $p$ ; the agent is the external argument of voice.

Finally Ground Promotion constructions like *eine Wand anstreichen* in (13) share properties both with particle verbs in (12) and prefix-verbs in (14). For one, the P-element, e.g.  $\sqrt{\text{an}}$  in *eine Wand anstreichen* does not incorporate into the verb. For two, there is no case assignment within P: word-order tells us that the ground phrase in structural accusative *eine Wand* is to the left of  $\sqrt{\text{an}}$ ;  $\sqrt{\text{an}}$ , in turn, is adjacent to the verbal kernel  $\sqrt{\text{streich}}$ . This word-order configuration is borne out under the assumption that there indeed *is* an intervening  $p$ -level, but that  $p$  is deficient with respect of case assignment.

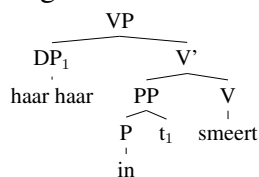
### 2.1.1. Parallelism in Split-P Hypothesis

My analysis of Ground Promotion constructions differ from the seminal analysis of Ground Promotion constructions in Svenonius (2003). The often cited example of his is the Dutch Ground Promotion construction (17). Ground Promotion is taken literal in a syntactic sense: The particle *in* is an unaccusative P (just like *open* is an unaccusative verb). The ground argument *haar haar* (her hair) is promoted, just like the internal argument *the door* is promoted, compare (19).

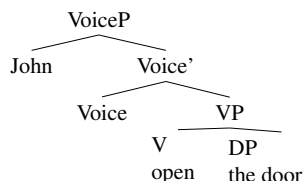
- (16) Ingrid smeert henna in haar haar  
'Ingrid smears henna into her hair'



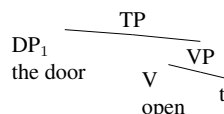
- (17) Ingrid smeert haar haar in (met henna)  
'Ingrid covers her hair (with henna)'



## (18) John opens the door



## (19) the door opens



## 2.1.2. Comparison of Svenonius' and the present analysis

My solution in (13) also follows the idea that *p* relates to P like voice relates to V. Building on the idea that *p* corresponds to voice, a *p*-head without case assignment is a 'passive' *p*-head. I owe this syntactic idea of a passive *p*-projection to Romanova (2007) from the syntactic representation of Russian prefix-verbs. In Romanova (2007) we find no word of motivation of passive *p* in semantic terms of Logical Form. But parallels in Logical Form between passive voice and passive *p* in Ground Promotion constructions, they do exist: I assume that the silent passive *p*-head is the syntactic locus of the operator of Hidden Universal Quantification **HUQ**. The binding of the figure-variable in Ground Promotion constructions is in structural analogy to binding the agent variable in passive voice. In both cases the discourse referent that enters the representation as 'external' argument in the specifier-position of voice or *p* respectively in non-passive projections, becomes existentially bound. As a syntactic consequence the passive projection lacks a specifier and the variable doesn't receive an overt description. As for the figure variables in Ground Promotion descriptions, they can be made explicit in *mit*-phrases (*with*-phrases) only; as for the agent variable, they can be made explicit by *von*-phrases (*by*-phrases). The analogy has its limitations, however. DPs governed by such *mit*-phrases in Ground Promotion constructions must be cumulative.<sup>4</sup> DPs in agentive *von*-phrases need not be.

## 2.2. Semantics construction algorithm for Ground Promotion constructions

## 2.2.1. Syntax-semantics-interface

In what follows I list principles at the syntax-semantics-interface.

- Functional heads in syntax are responsible for the introduction and predication of discourse referents of various sorts, providing 'ontological building blocks':

<sup>4</sup>The restriction will be discussed towards the end of the paper, p. 17.

- $v$  (verbalizer) introduces events:  $e$ ; —  $n$  (the nominaliser) introduces entities:  $x, y$ ; <sup>5</sup>;  
—  $p, P$  introduce states:  $s$ ; — Place introduces regions:  $r$  (sets of directed vectors in the sense of Zwarts (1997), Zwarts (2005)); — Path introduces paths:  $w$  (directed bounded or unbounded vectors). (Place and Path are subsumed to the syntactic category  $P$ .)
- Conceptual relations like CAUSE are introduced by functional layers as predications between XPs. E.g. CAUSE is introduced in  $vP$ . Merge of  $vP$  with some state introducing XP is interpreted as ‘ $e$  CAUSE  $s$ ’.
- Functional heads combined with roots also create argument slots and determine the selection restrictions on them.
- Semantic composition is given formal substance in an extension of the DRT-language (cf. Kamp et al. (2011)) with presuppositions and a  $\lambda$ -calculus for variable stores (cf. Cooper (1983)).  $\lambda$ -conversion selects the left-most variable from the store.

I will present the semantics construction in several steps, a first and preliminary step in (20) showing how the bare bones of **HUQ** in (7) with its stative interpretation come about by composition at the syntax-semantics-interface. In subsection 2.2.4 semantics construction will be continued and refined. In an interlude in subsection 2.2.3 I will discuss the restrictions on the construction under discussion and the ‘fake alternations’ as a consequence of syntactic structure and the semantics of the HAVE-relation.

### 2.2.2. Preliminary construction of $p_{pass}$ Phrase

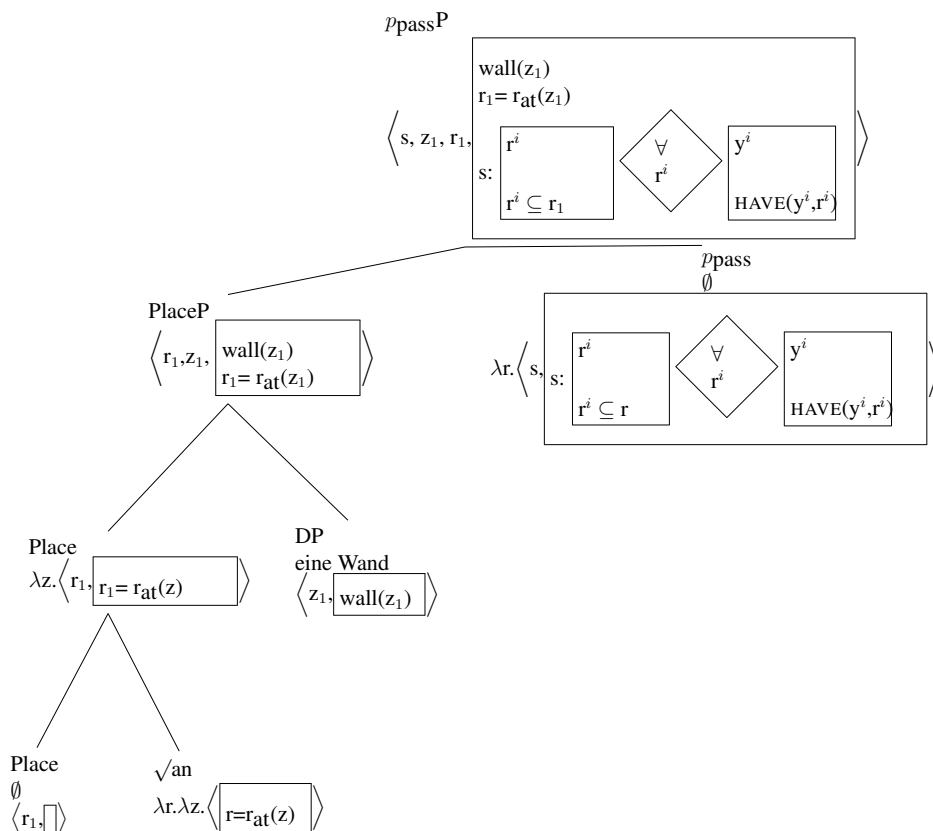
In subsection 2.2.2 I will focus on the semantics composition of the projection  $p_{pass}P$  in the tree (13). A preliminary version of the syntactic tree decorated with the DRS-based representation which builds on (13) is displayed in (20). Note that I represent the ground argument *eine Wand* as in situ, i.e. before Ground Promotion takes place.

The substructure PlaceP is semantically identical with PlaceP in verb-plus-PP constructions as in *einen Topf Farbe an eine Wand streichen* (to paint a tin of paint on a wall) (cf. Rossdeutscher (2013a)). The functional head Place introduces a region  $r_1$  which by the root  $\sqrt{\text{an}}$  becomes specified as a surface region  $r_{at}$  of some reference object  $z$ . Place, modified by  $\sqrt{\text{an}}$  has an argument-slot that becomes saturated by the DP *eine Wand* (a wall), contributing an entity (with a surface). PlaceP contributes the surface-region  $r_{at}$  of the wall  $z_1$ . That is to say: PlaceP delivers the region that the operator operates on.  $p_{pass}$  with the operator selects PlaceP, which is represented by  $\lambda$ -abstraction over a region  $r$ , and contributes the information that there is a state  $s$ , to the effect that each part of the region  $r$  HAS some stuff  $y$  on (or in) it.

<sup>5</sup>The nominaliser is not in focus in the current paper, but see Rossdeutscher (2013a), Rossdeutscher (2013b)

(20)

(preliminary)



### 2.2.3. Interlude: $p_{pass}$ , selector and selectee

The multiply decorated tree in Table 1 is meant to display the restrictions of HUQ in terms of selection. On the one hand this concerns the particle, which is selected as argument by  $p_{pass}$  and the HUQ- operator with the surface- or interior-region it operates over. On the other hand it concerns the nature of the event specified by the verbal root with which  $p_{pass}$  combines. The decoration on the tree is to be read as follows: in the vP those verbal roots found in Ground Promotion constructions are marked ‘o.k.’; those verbal kernels that are excluded from Ground Promotion constructions are marked ‘no’. At Place-level you find the prepositional elements that occur in Ground Promotion constructions, together with what kind of region they may contribute.

**The range of verbal kernels.** For instance, we find  $\sqrt{streichen}$  (‘paint’) and  $\sqrt{wischen}$  (‘wipe’) with one or more particles, the latter being productive according to Stiebels (1996) and Levin and Sells (2009). We find  $\sqrt{fahren}$  as in *die Reifen abfahren* (‘to worn out the tyres’), where driving leads to the state where the tyres have no rubber with profile on. We even find  $\sqrt{rauben}$  (‘rob’) as in

*einen Touristen ausrauben* ('to rob everything of value that tourist has with him'). But we never find  $\sqrt{\text{kleb}}$  ('glue'). There is neither *\*eine Wand mit Papier ankleben* (cf. (8c)) nor is there, say *\*ein Album mit Fotos einkleben* ('to fill an album with pictures'). The reason is semantic in nature:  $\sqrt{\text{kleb}}$  doesn't allow hidden universal quantification, because 'glue' contributes SUPPORT. SUPPORT is a force-dynamic notion (cf. Zwarts (2010)) in the sense of acting against forces like gravitation. Importantly, SUPPORT is a relation between two entities: 'glue papers on a wall' entails 'for each of the papers the wall as whole supports that paper' and not 'for each part of the wall there is a paper such that that part supports that paper'.

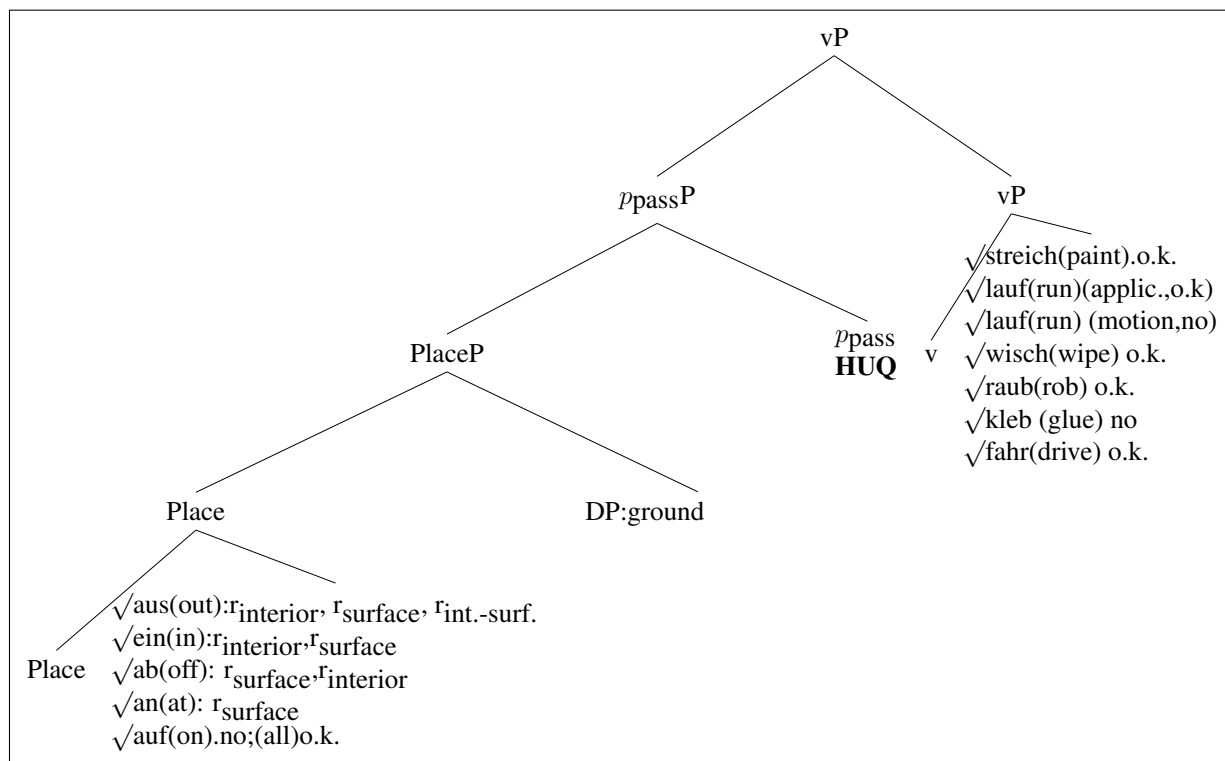
For a second instance, 'run' excludes Ground Promotion in the sense of autonomous motion. One can neither use *\*das Stadion lief aus* nor *\*das Stadion lief (mit Zuschauern) ein* intending to express that the stadium emptied or filled. But we can use the description *eine Wanne lief ein* (cf. (4c)) or *eine Wanne / ein Fass lief aus* (cf. (2c)) to express that the tub or barrel filled or emptied. The reason: The stadium isn't *applied* with people running in or out; the stadium isn't conceptualised as 'having people in'; but a tub can be described as having water in; it becomes applied with the running water.

**Range of P-elements** We have seen from  $\sqrt{\text{kleb}}$  (glue) that SUPPORT excludes hidden universal quantification over regions. But SUPPORT may as well be contributed by prepositions. German *auf* and English *on* contribute SUPPORT. And this is the reason why *\*eine Wand mit Farbe aufstreichen* (cf. (9b)) is ungrammatical; while *Farbe auf eine Wand streichen* (9a) grammatical. That, I believe, is also the reason why (21b) is ungrammatical, whereas (21a) is well-formed, an important example from Levin and Sells (2009).<sup>6</sup>

- (21) a. We smeared (the) lotion on the baby.  
 b. \*We smeared the baby on.

Structurally the operator is between vP and PP in (13). Therefore it must obey the requirements of the verb. The verb may reject the operator altogether, like 'glue' does or it might reject or accept the operator in the one or other reading, like 'run'. The operator, in turn, selects the prepositional PP that provides the quantifier with the 2D- or 3D-region, a surface or an interior, of the ground reference object it ranges over.

<sup>6</sup>Lack of space forbids me to discuss the paper in more detail. The authors take (21) as evidence for the alternation being restricted to verbs with a negative result state like 'wiping something off'. At least for German such a restriction doesn't obtain.

Table 1. **HUQ** as selector and selectee.

Comparing the selective potential of the operator which involves HAVE with genuinely spatial particles we observe that the former is a ‘generous selector’ to put it a bit figurative. You find examples of the differences in Table 2.

| Examples of ‘ <i>p<sub>pass</sub></i> selects P’:                                     | Examples of ‘ <i>p+√</i> selects P’:                                                        |
|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|
| (a) eine Tapete (mit Farbe) <b>einstreichen</b><br>(‘cover a wall-paper (with glue)’) | Kleister <b>in</b> eine Tapete (hin) <b>einstreichen</b><br>(‘paint glue into a wallpaper’) |
| (b) ein Fass <b>auslaufen</b> lassen<br>(‘empty a barrel’)                            | Wein <b>aus</b> dem Fass <b>auslaufen</b> lassen<br>(‘let wine run out of a barrel’)        |
| ein Bild <b>ausmalen</b> (‘fill <i>in</i> a picture’)                                 |                                                                                             |
| ein Backblech <b>ausstreichen</b> (‘butter a baking tin’)                             |                                                                                             |
| (c) einen Pinsel <b>abstreichen</b><br>(‘rid a brush of paint’)                       | Farbe <b>von</b> einem Pinsel <b>abstreichen</b><br>(‘wipe paint from a paint brush off’)   |
| ein Waschbecken <b>ablaufen</b> lassen (‘empty a sink’)                               |                                                                                             |
| (d) eine Wand <b>anstreichen</b> (‘cover a wall with paint’)                          | Papier <b>an</b> eine Wand <b>ankleben</b><br>(‘glue paper on a wall’)                      |
| (e) den Fußboden <b>aufwischen</b><br>(‘wipe the whole ground’)                       |                                                                                             |

Table 2. Selection restrictions of regions: ‘*p<sub>pass</sub>*’ vs. spatial particles

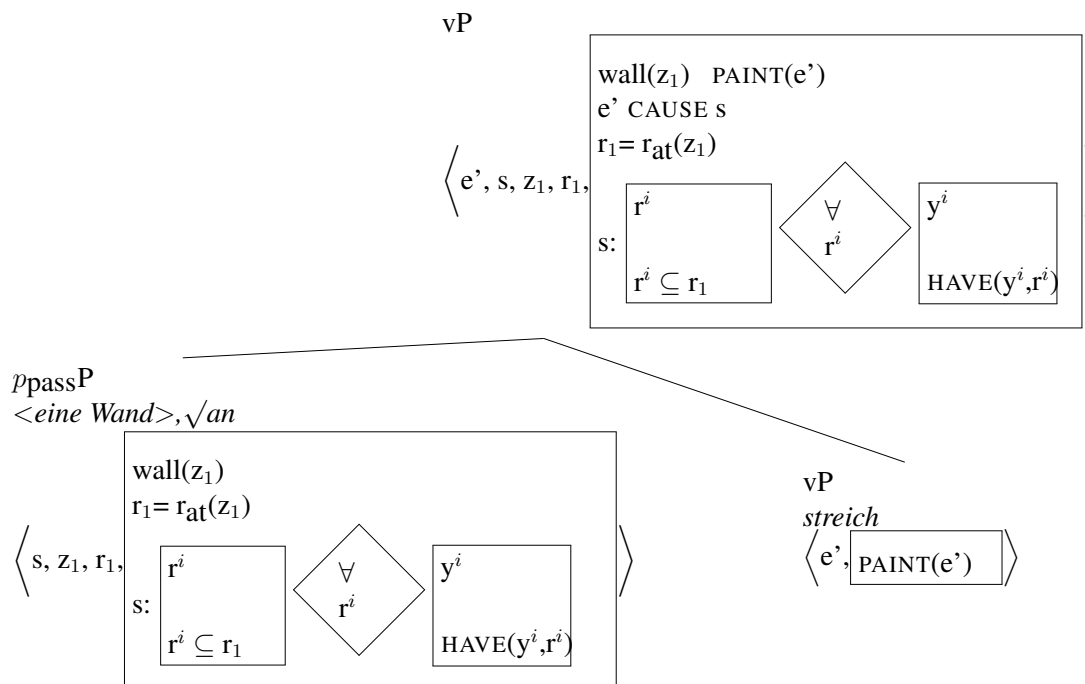


On the right hand side we have spatial particles selecting redundant PPs. The PPs exclusively contribute interior regions with the spatial particle *ein*(in); the operator in  $p_{pass}$  accepts also surfaces. The spatial particle *aus* selects for *aus*-PPs contributing interior regions, only;  $p_{pass}$  accepts interior regions, surfaces and the surface of interior regions. Spatial  $\sqrt{ab}$  selects *von*-PPs, contributing surfaces;  $p_{pass}$  accepts also interiors. *Auf* (in a reading different from engl. *on*) is selected exclusively by the operator, it contributes a surface. There is no spatial particle with the same contribution.

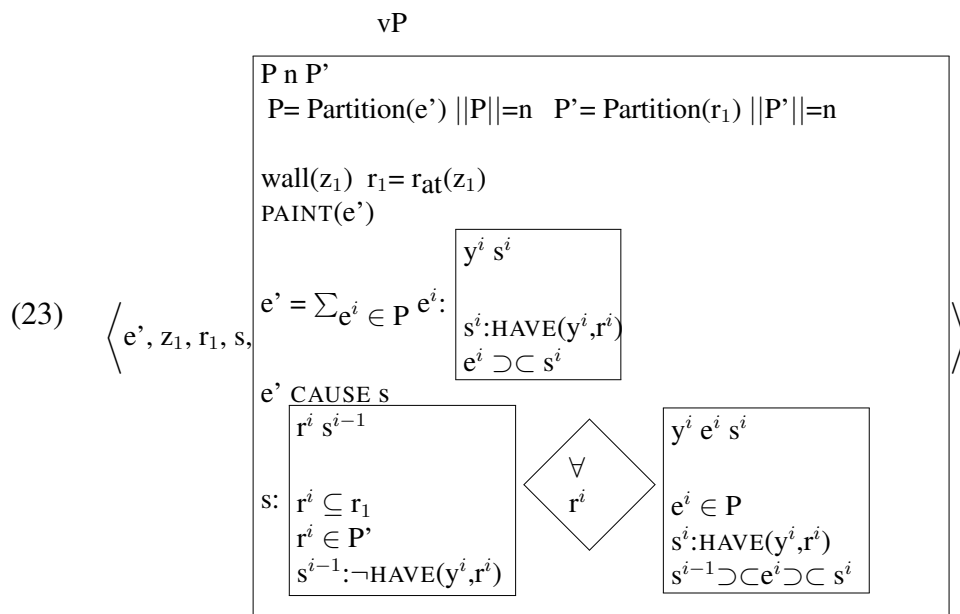
#### 2.2.4. Continuing semantics construction

We had stopped with the  $p_{pass}$ -projection on the left hand side of (22) and go one step upwards merging it with vP.

(22) (preliminary)



Merge of the prepositional projection with vP contributes the information that the painting activity brings about the state of the surface of the wall being fully applied with paint. (s. 'e' CAUSE s' in the semantic representation of upper vP.) A more refined construction yields the upper vP-representation is in (23).



bounded surface and vice versa<sup>8</sup>

The semantics construction supports the following predictions: (i) The event description is telic if the ground object DP describes a bounded region of space, s. (24a). (ii) The event description is atelic when the reference object is a bare plural contributing an unbounded set of bounded regions, s. (24b); in this case we have an iterative, distributive reading: for each bounded region there is an event *e* of ‘covering’, ‘filling’ or ‘emptying’ the region, where each *e* is of the form (23). (iii) Descriptions with ground DPs that are bare mass nouns trigger a special activity reading based on incorporation of the sortal predicate contributed by the DP. In contrast the expressions *Holz* (wood) and *Glas* (glass) provide sortal information, only. There is no way to conceptualise the description as one describing application or removal of stuff to a bounded region. But there isn’t even a clear sense what particular activity ‘wood painting’ or ‘glass wiping’ could consist of. As a consequence (24c) isn’t felicitous.

- (24) a. *eine Wand anstreichen*  
           a    wall   at.prtc.paint  
           ‘cover a wall (by painting)’  
       b. *wir haben den ganzen Tag Wände           angestrichen; Gläser abgewischt*  
           we have   the whole day walls<sub>bare.plur</sub> at.prtc.paint; glasses off.prtc.wipe  
           ‘we spent the whole day covering walls with paint; with wiping glasses clean’  
       c. *wir haben den ganzen Tag (?) Holz           angestrichen; (?) Glas*  
           we have   the whole day    wood<sub>bare.sg</sub> at.prtc.paint;       glass<sub>bare.sg</sub>  
           *abgewischt*  
           off.prtc.wipe

### 3. Summary. HUQ at its syntactic position

Summing up I would like to emphasise that I account for the lexical semantics of Ground Promotion constructions by syntactic structural assumptions. The semantic contributions of the verbal and prepositional roots and of the operator is determined by their position in sub-lexical syntax. Likewise sub-lexical syntax is determined by the semantic contribution of the roots. Recall that the HUQ-operator of *Hidden Universal Quantification* HUQ (7) and its position in syntax in (13) are the main ingredients of the analysis. The analysis at the syntax-semantics-interface allows us to explain (i) linguistic form as Logical Form in terms of variable binding; (ii) Aktionsart, i.e. accomplishments in terms of quantification; (iii) restrictions on lexical roots in terms of selection restrictions of verbal kernels on HUQ, and of HUQ on P-elements.

<sup>8</sup>I ignore the complication that a sub-region of the wall’s surface can be applied with stuff twice (just as a paragraph of a book can be read twice); see Krifka (1998) for dealing with this complication. The problem doesn’t arise with verbs of removal.

#### 4. Afterthought. Two mutually dependent incremental themes

In Ground Promotion constructions the two incremental themes, i.e. the bounded region and the implicit applicandum in the HAVE-relation, are mutually dependent in a way that is fundamentally different from the relation between figure and path in a Figure-Path-Relation discussed in Beavers (2011) and Beavers (2012). Some of Beavers' examples are (25a), (25b) and (25c).

- |      |    |                                                                                |                    |
|------|----|--------------------------------------------------------------------------------|--------------------|
| (25) | a. | (i) A ball rolled down to bottom of the hill                                   | Beavers (2011):335 |
|      |    | (ii) A litre of wine flowed from the jar to the floor (*for /in three minutes) | Beavers (2012):30  |
|      | b. | (i) Balls rolled down to the bottom of the hill                                | Beavers (2011):335 |
|      |    | (ii) Wine flowed from the jar to the floor (for/* in three minutes)            | Beavers (2012):34  |
|      | c. | (i) A ball rolled further                                                      | Beavers (2011):335 |
|      |    | (ii) A litre of wine flowed (for/* in three minutes)                           | Beavers (2012): 34 |

The events described by these motion descriptions have two kinds of participants: The moving theme and the path along which it moves. The descriptions in (25) are examples of such descriptions. Both participants can play a cumulative role and Beavers argues that the event description is telic only if both participants are quantised. (One way in which this condition can be satisfied: the theme argument is realised by the singular count DP 'a ball', and the path is given by the goal phrase 'to the floor'.) Thus (25a) is a telic description and both (25b) and (25c) are atelic.

Ground Promotion descriptions are *not* of this general form. In these constructions the figure DP (denoting the stuff that is being applied or being removed) is typically *non*-quantised (if it is present at all). Despite their non-quantised or fully absent figure constituents these descriptions are telic. The reason is as follows: these descriptions are application descriptions, not motion descriptions. Their semantics does not involve a path along which the denotation of the figure-DP is said to move.

I have analysed event descriptions with Ground Promotion descriptions as involving quantification over both sub-regions (of the regions associated with the ground-object) and portions of stuff (denoted by the DP of a *mit*-(with-) PP when such a PP is present and accommodated when there is no such constituent). But note well: conceptually this is not a case of *two* quantifications, one over regions and one over portions of stuff, but of a *single* quantification over regions (see the semantics construction above), or alternatively as quantification over pairs of a region and portions of stuff, but where each portion of the stuff is uniquely determined by the corresponding region.

In other words: the semantics of Ground Promotion constructions does *not* involve two distinct

event participants that can be separately realised by a phrase that can be either quantised or non-quantised. There is only one participant whose quantisation status is determinative of the telicity of the description and that is the ground argument. When the ground argument contributes a bounded region as the universal quantificational domain the description is telic; otherwise it is not.

In fact, quantised DPs in *mit*-PPs of Ground Promotion constructions are not felicitous. (Compare # *die Wand mit einem Topf Farbe anstreichen* (to cover a wall with a tin of paint)). The intuitive reason is that the amount of paint needed to cover the wall is fixed twice over in such a description, first as the amount of stuff in the tin and then again as the sum of all portions  $y^i$  in the pairs  $\langle y^i, r^i \rangle$  that are bound variables by the quantification contributed by  $p_{pass}$ .

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# Inverse linking and telescoping as polyadic quantification<sup>1</sup>

Manfred Sailer — Goethe University Frankfurt a.M.

**Abstract.** The paper discusses two constellations in which one quantifier is embedded inside another but where the embedded quantifier seems to outscope its embedder: inverse linking and telescoping. Four phenomena are mentioned that support that idea that the two quantifiers behave neither like the higher nor like the lower quantifier but rather display a unit-like behavior. This motivates a polyadic analysis, which will be expressed in *Lexical Resource Semantics*. Interesting predictions for so far unnoticed data on negative polarity items follow from this treatment.

**Keywords:** inverse linking, telescoping, polyadic quantifier, negative polarity items, underspecified semantics

## 1. Introduction

I will consider two constellations in which one quantifier is embedded inside another but where the embedded quantifier seems to outscope its embedder. This is the case for inverse linking (IL, (1-a)) and telescoping (TS, (1-b)). In telescoping the embedded quantifier must even take scope outside the clause in which it is contained.

- (1) a. [A representative from [every city]] supported the proposal. (**Every** > **Some**)
- b. [The picture of his<sub>i</sub> mother [that every<sub>i</sub> soldier kept wrapped in a sock]] was not much use to him<sub>i</sub>. (quoted from Sternefeld (t.a.))

Rather than assuming a wide scope for the embedded quantifier, I propose a polyadic analysis, in which the two quantifiers form one unit. I present evidence for IL, based on previous literature, and construct analogous evidence for TS. The polyadic account makes interesting predictions that are confirmed by the data and not compatible with previous approaches.

## 2. Phenomena: Inverse linking and telescoping

### 2.1. Inverse linking

I reinterpret four observations from the literature to support the idea that the quantifiers involved in an IL reading form a semantic unit rather than a sequence of quantifiers. I will first argue that the combination of the two quantifiers neither behaves like the syntactically higher one nor like the semantically higher, syntactically embedded one.

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<sup>1</sup>I am grateful for discussion and comments to the audiences of *Sinn und Bedeutung*, Göttingen, and of the *2nd European Workshop on HPSG*, Paris. All errors are mine.

Moltmann (1995) discusses the basic properties of *except*-phrases. Such phrases usually attach to universally quantified expressions, as in (2-a). They typically are not compatible with singular definites, see (2-b). Moltmann shows with the example in (2-c) that if a singular definite contains a universal quantifier in an IL reading, an *except*-phrase is possible. This shows, that the overall NP behaves like the syntactically embedded quantifier.

- (2) a. Every president except Carter hated peanuts.  
 b. \*The wife except Hillary has no political ambitions.  
 c. [The wife of [every president]] except Hillary has no political ambitions.

An analogous observation can be made for existential *there*-clauses. Such clauses show definiteness effects, i.e., definites are banned from the post verbal position, see (3). Woisetschlaeger (1983) shows with examples like (3-c) that definite NPs that embed an indefinite NP can occur in existential *there*-clauses. So, again, the overall NP behaves like the syntactically embedded NP.

- (3) a. There is [a difficult theorem] on page 433.  
 b. \*There is [the proof] on page 433.  
 c. There is [the proof of [a difficult theorem]] on page 433.

While the data on *except*-phrases and *there*-sentences suggest that the overall NP behaves like the embedded one, Champollion and Sauerland (2011) present data that show that the overall NP does not fully behave like the embedded NP either. They refer to the kind of data as *Haddock's puzzle*. They discuss the example in (4). The sentence is true in a scenario with, for example, two squares, where only one contains a circle. So, the embedded definite NP *the square* does not have a uniqueness presupposition.

- (4) [The circle in [the square]] is white.

Other data on IL show a similar effect. The correct interpretation of (5-a) is not achieved by simply saying that the syntactically embedded quantifier takes scope over the higher determiner. This reading is given in (5-b). This reading is only true if each basket contains an apple.

- (5) a. [An apple in [every basket]] is rotten.  
 b.  $\forall y(\text{basket}(y) \rightarrow \exists x(\text{apple}(x) \wedge \text{in}(y, x) \wedge \text{rotten}(x)))$



However, intuitively, the sentence is true in a scenario with various baskets, only some of which containing apples and it requires only of the apple-containing baskets that they also have a rotten apple. So, the universal quantifier is not just restricted to baskets but to baskets with apples.

The data in (4) and (5) show that, even though the syntactically embedded quantifier takes wide scope, its restrictor incorporates part of the semantic material of the syntactically higher quantifier—we only consider squares with circle and baskets with apples.

The final observation is attributed to Larson (1985). He observes that no quantifier may take intermediate scope between the two quantifiers that appear inside one NP, i.e., sentence (6) does not have a reading in which **Two** takes scope between **Some** and **Every**, though the relative scope of the other two may vary in principle. This, again, supports an approach that takes the two NP-internal quantifiers as a unit.

(6) Two policemen spy on someone from every city. (Larson 1985)

The four observations together show that the combination of the two quantifiers neither behaves like the syntactically higher quantifier nor like the syntactically lower one. In addition we find a unit-like behavior. This supports the idea, also articulated in Moltmann (1995), that the two quantifiers inside the NP behave as one unit and should be treated as a polyadic quantifier.

## 2.2. Telescoping

TS is characterized by a strong quantifier that takes scope in a higher clause. Since Rodman (1976) it had been a standard assumption that strong quantifiers cannot take scope outside their local clause. This view has been challenged recently, for example in Barker (2012). Konietzko et al. (t.a.) provide experimental evidence for the existence of TS readings in German. This wide scope can be seen if the higher clause contains a pronoun bound by the embedded quantifier, a diagnostics systematically used in Barker (2012). For ease of reference, I repeat the example from (1-b) in (7). Here the quantifier *every* is contained in a relative clause. Nonetheless the matrix clause contains a pronoun, *him*, that is bound by the universal quantifier.

(7) [The picture [that every<sub>i</sub> soldier kept]] didn't bring him<sub>i</sub> much luck.

In this section I will show that TS behaves just like IL with respect to the four environments discussed in section 2.1. I will primarily use German data for TS. The English translations of the sentences are not assigned grammaticality judgments.

*Except*-phrases in German are restricted to universals, just as in English, see (8). The definite singular is only possible under a generic reading. However, an *except* phrase can attach to a singular, non-generic definite NP in a TS-constellation. This is shown in (9).

- (8) Jede/ \*Die Präsidentenfrau außer Hillary hat keine eigenen politischen Ambitionen.  
 every/ the wife of a president except Hillary has no own political ambitions
- (9) [Die Frau, [die jeder<sub>i</sub> Präsident geheiratet hat]], außer Hillary, unterstützt ihn<sub>i</sub> ohne  
 the woman that every president married has except Hillary supports him without  
 eigene politische Ambitionen.  
 own political ambitions  
 ‘[The woman [that every<sub>i</sub> president married]], except Hillary, supports him<sub>i</sub> without own  
 political ambitions.’

When we look at existential sentences, the German equivalent of *once upon a time*-statements can be used. It shows the same definiteness effects we find for English *there* sentences, which is illustrated in (10). Just as we saw for IL, if the definite NP syntactically contains a wide-scope indefinite, even within a relative clause, the sentence is considerably better. All speakers that I consulted see a clear contrast between the version of (11) with an embedded indefinite and the version with an embedded definite—though, admittedly, some of them find the version with the embedded indefinite not completely acceptable.

- (10) Es war einmal [eine/ \*die Königin].  
 there was once a/ the queen  
 ‘Once upon a time there was a/the queen.’
- (11) Es war einmal [die Königin, [die über ein/ \*das großes Reich herrschte]].  
 there was once the queen who over a/ the big empire reigned  
 ‘Once upon a time there was the queen [that reigned a/the big empire].’

We can also present TS data analogous to the *Haddock’s puzzle* data. To do this, we embed the lower definite NP inside a relative clause. Champollion and Sauerland (2011) have actually done this in an empirical study. Subjects saw a picture and were asked to choose whether a sentence with an embedded indefinite or an embedded definite NP would be a more natural description of the picture. Their sentences looked as in (12).

- (12) a. [The circle in [the/a square]] is white. [85.5% chose *the*]  
 b. [The circle [that is in the/a square]] is white. [76.2% chose *the*]

Champollion and Sauerland (2011) found that even for the version in which the critical NP is embedded inside a relative clause, the definite determiner is strongly preferred over the indefinite. This shows that even if the definite NP occurs inside a relative clause, its uniqueness presupposition is not determined simply on the basis of clause-internal material but uniqueness is only presupposed for circle-containing squares.

In section 2.1 I showed that the restrictor of an embedded universal quantifier is also influenced by material from the embedding NP. Similar data can be found for TS. In (13) the universal quantifier occurs inside a relative clause and binds a pronoun in the matrix clause. The sentence can be truthfully uttered in a scenario where there are presidents that are not married to a woman. This shows, that the sentence does not mean: For each president, there is a unique woman that he has married and that supports him. A good paraphrase would rather be: For each president that is married to a woman, the woman that he has married supports him.

- (13) [Die Frau, [die jeder<sub>i</sub> Präsident geheiratet hat]], unterstützt ihn<sub>i</sub>.  
 the woman that every president married has supports him

Finally, let us consider data analogous to (6). In (14) there is an embedded quantifier, *jeder Popstar* ('every pop star') that binds a matrix pronoun. The matrix clause contains an additional quantificational element, *mindestens zweimal am Tag* ('at least twice a day').

- (14) [Die meisten Fans, [die jeder<sub>i</sub> Popstar hat]], hören mindestens zweimal am Tag  
 most fans that every pop star has listen-to at least twice a day  
 seinen<sub>i</sub> aktuellen Hit.  
 his current hit  
 'Most of the fans that every<sub>i</sub> pop star has, listen to his<sub>i</sub> current hit at least twice a day.'  
 a. Natural reading: **Every** > **Most** > **Two**  
 b. No reading: # **Every** > **Two** > **Most**

The most natural reading for the sentence is the one sketched in (14-a). In (14-b) I sketch a reading in which the additional quantifier takes scope between the embedded universal and the embedding quantifier, *most*. A scenario that supports this reading is quite reasonable: For each pop star there are two occasions a day during which the majority of their fans listen to their current hit. Such a reading is, however, not available for (14). This shows that for TS just as for IL, no quantifier may take intermediate scope between the telescoping quantifier and the one containing it.

The discussion so far shows that all the observations presented for IL carry over the TS. Before concluding this section, I would like to point out a restriction of TS that, as far as I know, has not been explicitly stated in the literature. While TS is possible for a quantifier that occurs inside a

relative clause, it seems to be excluded for quantifiers from clauses that depend on verbs. Barker (2012) provided the example in (15), where quantifier is inside a subject clause.

- (15) \*[That Mary seems to know every<sub>i</sub> boy] surprised his<sub>i</sub> mother.

For German my informants reject TS from inside a subject clause, as in (16-a), and from a complement clause, see (16-b). If these initial observations can be systematically confirmed, the availability of a TS reading is restricted to quantifiers from inside NPs.

- (16) a. \*[Dass jeder<sub>i</sub> Student die Prüfung bestanden hat], überrascht seine<sub>i</sub> Dozenten.  
           ‘[That every<sub>i</sub> student passed the exam] surprises his<sub>i</sub> teachers.’  
       b. \*[Dass jeder<sub>i</sub> Student die Prüfung bestanden hat], teilte ihm<sub>i</sub> die Dekanin mit.  
           ‘[That every<sub>i</sub> student passed the exam], the dean told him<sub>i</sub>.’

I argued in this section that TS readings exist but that they require the presence of a combination of two quantifiers: a syntactically embedding determiner and an embedded one. Given this constellation, TS readings show a strong relation between the embedded and the embedding quantifier.

### 3. Previous non-polyadic approaches

In this section I will briefly summarize relevant aspects of and challenges for previous approaches to IL and TS. I will look at approaches based on Quantifier Raising (QR), the analysis in Champollion and Sauerland (2011), and on continuation-based approaches.

QR is an operation that moves a quantified NP to the S-node where it takes scope (May 1977). QR is usually assumed to be clause-bounded. For IL, there are two alternatives: Either the embedded quantified NP attaches by QR to the embedding NP or it attaches to an S-node. If it attaches to the S-node, it is hard to capture the observations that show that the complex NP behaves like the embedding quantifier (*except*-phrases and *there*-sentences). The inseparability of quantifiers is also hard to derive if all quantifiers in a sentence simply attach to S.

The alternative would be to move the embedded quantifier to a high position inside the embedding NP, so called NP- (or DP-)internal QR. Heim and Kratzer (1998) reject this type of analysis based on pronoun binding. As shown in May (1985), the syntactically embedded NP can bind a pronoun in the rest of the sentence. An example of this is given in (17).

- (17) [Someone [from every<sub>i</sub> city]] despises it<sub>i</sub>. (May 1985, p. 68)

In addition to this, Champollion and Sauerland (2011) show that a classical interpretation of QR leads to the wrong readings for *Haddock's puzzle* as in (5) above.

If we assume clause-boundedness of QR, TS readings cannot be derived in principle. If clause-boundedness is not imposed, there will be overgeneration, as it might then be difficult to block QR from subject and complement clauses.

Champollion and Sauerland (2011) assume that the embedded quantified NP is moved by QR to an S node. They address *Haddock's puzzle* by assuming an intermediate accommodation of the restrictor of the syntactically embedded quantifier. This means for the examples discussed above, (4) and (5), that the uniqueness presupposition of *the square* in *the circle in the square* only applies to squares with circles and that the quantificational domain of *every basket* in *an apple in every basket* is restricted in such a way that the baskets under consideration are all apple-containing. The strength of this proposal is that it uses standard mechanisms in both syntax and semantics.

There are, however, a number of challenges for this approach. By its very outset, it runs into the problems mentioned above for approaches with QR to S, i.e., it cannot account for the observations on *except*-phrases and *there*-sentences and it is not clear how Larson's ban on intermediate scope of NP-external quantifiers should be derived. It is an open question how Champollion and Sauerland would restrict QR to extraction from relative clauses and ban it from V-dependent clauses.

Barker (2012) and Sternefeld (t.a.) present a different type of approach. They are among those who assert the importance of TS data. They use *continuations*, i.e., a mechanism to extend the scope domain of an element beyond its c-command domain. This is done in Barker (2012) by type shifting operations and in Sternefeld (ta) by *unrestrained  $\beta$ -reduction*.

Since these systems are set up in such a way that semantic scope is not tied to syntactic c-command, IL and TS readings follow directly from the standard combinatorial mechanisms. They straightforwardly account for pronoun binding in IL and TS as well. Barker (2002) shows that the inseparability of quantifiers in IL is a consequence of the way the type shifting operations work.

The approach nonetheless faces some problems. First, it is unclear how the data on *except*-phrases and *there*-sentences will be captured. Second, the quantifier restrictor interdependence, discussed here as *Haddock's puzzle*, is not addressed. Third, the type shifting operations that are required to allow for TS from relative clauses can also be used to derive TS readings from V-dependent clauses, which I have argued to be not available.

The brief literature overview in this section shows that non-polyadic analyses face problems when confronted with the strong correlation that the two quantifiers have in IL and TS. I will show in the next section that a polyadic analysis can solve these problems.

## 4. Analysis

In this section I will present polyadic semantic representations that for IL and TS and then discuss a syntax-semantics interface that allows the construction of the required polyadic representations.

### 4.1. Semantic representation

Polyadic quantification is a well-established notion in formal semantics. Keenan and Stavi (1986) and Keenan and Westerståhl (1997) provide the basic notions and examples and discuss some formal properties of polyadic quantifiers. While a monadic generalized quantifier binds one variable and has a restrictor and a scope, a polyadic quantifier typically binds more variables, may have more than one restrictor, and has a scope. The adjectives *same* and *different* are usually listed as examples of natural language expressions that require polyadic quantification for an adequate semantics. May (1985, 1989) proposes a polyadic analysis for every sentence in which more than one quantifier occurs. Moltmann (1995) argues that the data on *except*-phrases motivate a polyadic analysis. More recently de Swart and Sag (2002), Iordăchioaia (2009), and Iordăchioaia and Richter (2014) provide polyadic analyses for *Negative Concord*, i.e., for cases where several negative indefinites occur in a sentence, but the sentence receives a single-negation interpretation.

I will only look at the kind of polyadic quantifiers needed for the present purpose. Example (5) will be used for illustration. In (18) the polyadic representation is given. In this representation the two logical determiners are given in a list notation, followed by the variables they bind. Then we have a list of the respective restrictors and, finally, the scope of the polyadic quantifier.

- (18) [An apple in [every basket]] is rotten.  
 $\langle \mathbf{Every}, \mathbf{Some} \rangle \langle y, x \rangle \langle \mathbf{basket}(y), (\mathbf{apple}(x) \wedge \mathbf{in}(y, x)) \rangle \langle \mathbf{rotten}(x) \rangle$

I assume the truth conditions of the formula in (18) to be the same as those of the formula in (19). The interpretation is such that we first interpret the first determiner from the list of determiners and this takes the second determiner in its scope. What is special is that the material from the second restrictor ( $\mathbf{apple}(x) \wedge \mathbf{in}(y, x)$ ) is incorporated under an existential quantification into the restrictor of the universal quantifier. This leads to truth conditions that are the similar to those in Champollion and Sauerland (2011).

- (19)  $\mathbf{Every} y[\mathbf{basket}(y) \wedge \exists x(\mathbf{apple}(x) \wedge \mathbf{in}(y, x))] (\mathbf{Some} x[\mathbf{apple}(x) \wedge \mathbf{in}(y, x)](\mathbf{rotten}(x)))$

We can generalize from this one example to the general case and extend our semantic representation language (some version of higher-order predicate logic with generalized quantifiers) to include

this type of polyadic quantifiers. The necessary definitions are given in (20). First the syntax is introduced. Then, the semantics is given by showing the reduction to monadic quantification.

$$\begin{aligned}
 (20) \quad & \text{For determiners } Q_1, \dots, Q_n, \text{ variables } x_1, \dots, x_n, \text{ and formulae } \phi_1, \dots, \phi_n, \psi, \\
 & \langle Q_1, \dots, Q_n \rangle \langle x_1, \dots, x_n \rangle \langle \phi_1, \dots, \phi_n \rangle (\psi) \text{ is a formula, and} \\
 & \langle Q_1, \dots, Q_n \rangle \langle x_1, \dots, x_n \rangle \langle \phi_1, \dots, \phi_n \rangle (\psi) \\
 & \equiv Q_1 x_1 [\phi_1 \wedge \exists x_2 \dots \exists x_n (\phi_2 \wedge \dots \wedge \phi_n)] \\
 & \quad (Q_2 x_2 [\phi_2 \wedge \exists x_3 \dots \exists x_n (\phi_3 \wedge \dots \wedge \phi_n)] (\dots (Q_n [x_n] (\psi) \dots))
 \end{aligned}$$

The important aspect of the semantics of the polyadic quantifiers defined in (20) is that every quantifier is restricted to the existence of elements in the restrictor of the scopally lower quantifiers. The definition in (20) shows that the particular kind of polyadic quantifier needed for IL and TS is reducible to monadic quantification. Therefore, a polyadic analysis is not strictly logically necessary, but it is well motivated from the point of view of the syntax-semantics interface.

Given the semantic analysis of the sentence, we can now derive the empirical observations from section 2. There is no need to mention the *Haddock's puzzle* data again. The semantics of our polyadic quantifiers is explicitly defined in such a way as to include the restrictor of the semantically lower quantifiers in that of the scopally higher ones.

I start with *except*-phrases. *Except*-phrases can only occur with universally quantified NPs. I state the semantic representation of a sentence containing the NP *the wife of every president* in (21), together with its monadic equivalent. The monadic formula shows that the resulting quantifier has the interpretation of a universal. Thus, we correctly predict that it is compatible with *except*-phrases.

$$\begin{aligned}
 (21) \quad & [\text{The wife [of every president]}] \text{ is popular.} \\
 & \langle \mathbf{Every}, \mathbf{The} \rangle \langle x, y \rangle \langle \mathbf{president}(x), \mathbf{wife}(y, x) \rangle (\mathbf{be-popular}(y)) \\
 & \equiv \mathbf{Every } x [\mathbf{president}(x) \wedge \exists y (\mathbf{wife}(y, x))] (\mathbf{The } y [\mathbf{wife}(y, x)] (\mathbf{be-popular}(y)))
 \end{aligned}$$

The argumentation for *there*-sentences is analogous. I provide a *there*-sentence together with its polyadic representation and the monadic equivalent in (22). There are various explanation for the definiteness effects in the literature. I will pick the one from Zucchi (1995) for illustration. According to Zucchi an existential sentence is non-presuppositional, i.e., it does not presuppose the existence of the post-verbal subject. The monadic formula can be used to show that this condition is met here. The higher quantifier, **Some**, is restricted to a theorem which has a prove. The existential presupposition of the definite NP *the proof of a theorem* can then be locally accommodated. Consequently, there is no global presupposition of the post-verbal subject NP.

- (22) There is [the proof [of a theorem]] on page 423.  
 $\langle \text{Some, The} \rangle \langle x, y \rangle \langle \text{theorem}(x), \text{proof}(y, x) \rangle (\text{bo-on-p423}(y))$   
 $\equiv \text{Some } x [\text{theorem}(x) \wedge \exists y (\text{pr}(y, x))] (\text{The } y [\text{pr}(y, x)] (\text{be-on-p423}(y)))$

Let us briefly comment on Laron's observation on the inseparability of the two quantifiers in IL. Given that the polyadic quantifier is one unit, it follows directly that no quantifier that is not part of the polyadic complex can take intermediate scope between those that are part of the polyadic quantifier. I will come back to this issue in section 6, though.

So far I have only presented representations for IL. The representations for corresponding TS sentences would not be much different. For illustration I sketch the semantic representation of the sentence from (1-b) in (23).

- (23) [The picture [that every soldier kept]] didn't bring him much luck.  
 $\langle \text{Every, The} \rangle \langle x, y \rangle \langle \text{soldier}(x), (\text{pict}(y) \wedge \text{keep}(x, y)) \rangle (\text{no-luck}(y, x))$

Before closing this subsection, I would like to mention that a polyadic approach is compatible with each of the contributing quantifiers binding individual pronouns in the overall scope. In (24) I show that an unequivocally polyadic quantifier, required by the occurrence of *anderes* ('different') in the sentence, does not block binding of a pronoun.

- (24) Jeder<sub>i</sub> hat ein anderes Verständnis von seiner<sub>i</sub> Umwelt.  
 'Everyone has a different understanding of his environment.'

In this subsection I have introduced a polyadic semantic representation for IL and TS. I have shown that these representations have the right truth conditions for the phenomena presented in section 2 and that they overcome problems of earlier, non-polyadic approaches. In the next subsection I will present a system of the syntax-semantics interface that allows us to derive polyadic representations in a systematic way.

## 4.2. Syntax-semantics interface

Probably one of the most important obstacles for using polyadic quantifiers widely in linguistic analyses is that many architectures of the syntax-semantics interface do not have the possibility to derive polyadic representations directly. For example Moltmann (1995) achieves polyadic effects through pragmatic inference but not as a direct part of the compositional semantics. Similarly Champollion and Sauerland (2011) get the same truth conditions as I propose in section 4.1, but



they use a pragmatic operation of intermediate accommodation.

In contrast to these systems, there are proposals that explicitly use polyadic quantifiers. May (1985, 1989) introduces quantifier amalgamation: He assumes that all quantifiers that attach to a particular node are interpreted jointly, as a polyadic quantifier. De Swart and Sag (2002) make a very similar proposal. In their system, all dependents of a head can be amalgamated into a polyadic quantifier. Finally, Iordăchioaia (2009) and Iordăchioaia and Richter (2014) build polyadic quantification into a system of underspecified semantics. I will follow this last approach here.

I will use the system of *Lexical Resource Semantics* (LRS, Richter and Sailer 2004). LRS is based on techniques of underspecified semantics, as motivated for example in Pinkal (1996). It is typically combined with a surface-oriented syntactic analysis such as HPSG (Pollard and Sag 1994). The general idea of LRS is that words and phrases constrain the possible semantic representations of the utterance in which they occur. For example, each sentence that contains the word *basket* has as parts of its semantic representation (i) the constant **basket**, (ii) some discourse referent  $x$ , and the functional application of **basket** to  $x$ , i.e., the expression **basket**( $x$ ). At the level of an utterance, the overall semantic representation must be a formula that consists exactly of the semantic constants and operators contributed by the words. The syntactic structure and also the words may specify certain additional requirements on these overall representations but typically, these “lexical resources” do not fully specify the resulting representations.

I will illustrate the system with the example in (18). In (25) I indicate the words and phrases of the sentence and, for each of them, the semantic constants and operators as well as the constraints that they contribute. I have already commented on the contribution of the word *basket*, which is given in (25-a). The contribution of *apple* (see (25-f)) is analogous.

The determiners *every* and *an* make a more complex semantic contribution, see (25-b) and (25-h). They specify that the logical determiner must occur as an element of a possibly polyadic quantifier. The position of the determiner within this quantifier is not specified, indicated as  $i$  for *every*. The variable bound by the quantifier has to occur in the corresponding position in the list of bound variables (i.e.,  $x$  needs to be the  $i$ -th variable). The variable bound by the determiner should then occur within the corresponding restrictor as well. When the words *every* and *basket* combine, no additional elements are introduced into the semantic representation, but a constraint that **basket**( $x$ ) occur in the  $i$ -th restrictor. This is shown in (25-c).

Space prevents me from going through each line in (25), but the general idea of words contributing elements of semantic representations and phrases contributing constraints on how these may be combined should be clear.

- (25) An apple in every basket is rotten.  
 a. *basket*: **basket**( $x$ )

- b. *every*:  $\langle \dots, \mathbf{Every}^i, \dots \rangle \langle \dots, x^i, \dots \rangle \langle \dots, (\dots x \dots)^i, \dots \rangle (\dots)$
- c. *every basket*: **basket**( $x$ ) must be in the  $i$ -th restrictor (i.e., in that of *every*)
- d. *in*:  $(\dots \wedge \mathbf{in}(y, x))$
- e. *in every basket*: **in**( $y, x$ ) must not occur in the  $i$ -th restrictor
- f. *apple*: **apple**( $y$ )
- g. *apple PP*:  $(\mathbf{apple}(y) \wedge \dots \mathbf{in}(y, x) \dots)$
- h. *an*:  $\langle \dots, \mathbf{Some}^j, \dots \rangle \langle \dots, y^j, \dots \rangle \langle \dots, (\dots y \dots)^j, \dots \rangle (\dots)$
- i. *an apple PP*: **apple**( $y$ ) is in the  $j$ -th restrictor (i.e., that of *an*)
- j. *is rotten*: **rotten**( $y$ )
- k. *NP is rotten*: **rotten**( $y$ ) is in the scope of the quantifier that binds  $y$

No other expression occurs in the semantic representation

Once a sentence is completed, any semantic representation that uses exactly the contributed elements and satisfies all constraints is a potential reading. For our example we have four such readings, given in (26). There are two non-polyadic readings, (26-a) and (26-b). In these readings, **Every** and **Some** are each the only determiners in the list of determiners and  $i$  and  $j$  are both 1. For these readings, the constraints in (25) do not constraint the relative scope of the quantifiers. Thus, we derive scope ambiguity by underspecification. The formulæ in (26-c) and (26-d) show polyadic readings. Here the two quantifiers unify to form a single quantifier. However, again, the mutual order of the determiners is not specified. The IL reading is derived if **Every** is the first element ( $i = 1$ ), a surface-order reading if **Some** is first ( $j = 1$ ).

- (26)
- a. Non-polyadic: (*There is the same rotten apple in every basket.*)  
**Some**  $y[\mathbf{apple}(y) \wedge \mathbf{Every} x[\mathbf{basket}(x)](\mathbf{in}(y, x))](\mathbf{rotten}(y))$   
 $i = 1, j = 1$ ; non-identical quantifiers
  - b. Non-polyadic: (*Every basket contains a rotten apple.*)  
**Every**  $y[\mathbf{basket}(y)](\mathbf{Some} x[\mathbf{apple}(y) \wedge \mathbf{in}(y, x)](\mathbf{rotten}(y)))$   
 $i = 1, j = 1$ ; non-identical quantifiers
  - c. Polyadic: (polyadic inverse linking)  
 $\langle \mathbf{Every}, \mathbf{Some} \rangle \langle x, y \rangle \langle \mathbf{basket}(x), (\mathbf{apple}(y) \wedge \mathbf{in}(y, x)) \rangle (\mathbf{rotten}(y))$   
 $i = 1, j = 2$ ; quantifier unification
  - d. Polyadic: (polyadic surface scope order)  
 $\langle \mathbf{Some}, \mathbf{Every} \rangle \langle y, x \rangle \langle (\mathbf{apple}(y) \wedge \mathbf{in}(y, x)), \mathbf{basket}(x) \rangle (\mathbf{rotten}(y))$   
 $i = 2, j = 1$ ; quantifier unification  
 $x$  is not bound in the first restrictor!

In (26) I list four readings, non-polyadic and polyadic surface scope and inverse linking readings. The question arises whether we really need the non-polyadic readings. If we allow them, we need an additional constraint to ensure inseparability of the two quantifiers, which was one of the initial motivations for a polyadic analysis. If we exclude them, we need additional possible interpretations

for a polyadic quantifier to allow a reading where every basket must contain an apple. In section 6 I will report data that support the existence of the non-polyadic readings.

Given this situation we need an additional constraint to enforce inseparability on quantifiers from the same NP. We can do this with the constraint in (27). The constraint specifies that quantifiers that stem from the same NP may not be separated by quantifiers from outside this NP.

- (27) Dominance condition for quantifiers  
If a quantified NP  $n$  dominates another quantified NP  $m$ , then each quantifier that takes intermediate scope between  $n$  and  $m$  is also dominated by  $n$ .

For illustration, consider the hypothetical logical form of the separated reading of (6). The sentence and the relevant, unavailable reading are given in (28).

- (28) Two policemen spy on someone from every city.      # **Every** > **Two** > **Some**

In this reading, the NP *someone from every city* dominates the NP *every city*. Since *two policemen* takes scope between these two, the constraint in (27) requires that this NP be also dominated by *someone from every city*. Since this is not the case, the reading is unavailable.

Before closing this section, we need to express one further constraint. Given the polyadic analysis of TS we can maintain the clause-boundedness constraint on strong quantifiers. This constraint is formulated in (29). The constraint is formulated in such a way that clause-boundedness is ensured for strong quantifiers that occur inside a V-dependent clause.

- (29) Clause-boundedness of strong quantifiers  
If a clause is a dependent of a verb, then the clause's semantic representation contains all (strong) quantifiers that it dominates.

This constraint correctly excludes TS from subject or complement clauses (see the data in (15) and (16)). It also excludes TS from inside a relative clause if the quantifier in question is further embedded within the relative clause. Due to the complexity of such examples, it might not be easy to determine the grammaticality of such sentences, but sentence (30) does not allow for a bound interpretation of the pronoun in the matrix clause.

- (30) \*[Die Professorin, [die meint, dass jeder<sub>i</sub> Student faul ist] hat Vorurteile über ihn<sub>i</sub>].  
'The professor who thinks that every<sub>i</sub> student is lazy has prejudices about him<sub>i</sub>.'

In this section I have presented a polyadic analysis of IL and TS within the framework of LRS. I first discussed the required semantic representations and showed how the data from section 2 can be accounted for. Then I sketched the constraints introduced by each word and within the sentences. I showed how the polyadic readings can be derived. I also allowed for non-polyadic readings and stipulated a constraint to guarantee inseparability of quantifiers from the same NP even in the non-polyadic readings. Finally I introduced a clause-boundedness constraint for the scope strong quantifiers. Their clause-boundedness is restricted to V-dependent clauses. This still makes TS possible from within an NP, but excludes it from within a subject or complement clause.

### 5. Additional observation: NPI licensing

The polyadic analysis makes the right predictions also for data on negative polarity items (NPIs) within complex NPs that have not been previously reported in the literature to my knowledge. Classical NPI-licensing contexts include the scope of negation and the restrictor of a universal quantifier. An NPI is, however, not licensed inside a definite NP.

In (31-a) the underlined NPI *je* ('ever') occurs inside an extraposed relative clause that is part of a definite NP. As expected, the NPI is not licensed. In (31-b) the NP contains an additional embedded universal quantifier. The relative clause is clearly attached to the higher noun, *Name* ('name'), as is clear by the gender agreement in German. Nonetheless the NPI is now licensed.

- (31) a. \*Auf der Liste wurde [der<sub>i</sub> Name] vermerkt,  
           [der<sub>i</sub> je im Zusammenhang mit dem Skandal genannt wurde].  
           'On this list [the<sub>i</sub> name] was noted  
           [that<sub>i</sub> had ever been mentioned in connection with the scandal].'  
       b. Auf der Liste wurde [der<sub>i</sub> Name [jeder<sub>j</sub> Politikerin] vermerkt,  
           [der<sub>i</sub> je im Zusammenhang mit dem Skandal genannt wurde].  
           'On this list [the<sub>i</sub> name of every<sub>j</sub> politician] was noted  
           [that<sub>i</sub> had ever been mentioned in connection with the scandal].'

Under a non-polyadic analysis the NPI does not end up in the restrictor of the universal but in its scope, which is not an NPI-licensing position. In (32) I sketch the semantic representation of (31-b) under the polyadic analysis. Now the NPI's semantics appears as part of the restrictor list. With the simple assumption that the NPI-licensing potential of the highest determiner carry over to the entire restrictor list, we immediately account for the data.

- (32)    ⟨**Every**, **The**⟩⟨*x*, *y*⟩⟨**politician**(*x*), (**name-of**(*y*, *x*) ∧ ... **NPI** ...)⟩⟨**be-on-list**(*y*)⟩

This unit-like behavior in NPI-licensing extends to other constellations as well. A definite DP is

not a barrier for NPI licensing, whereas a universal quantifier is (see (33-a)). When a definite NP contains a universal quantifier it will, however, turn into a barrier under an IL reading, (33-b).

- (33) a. Niemand hat [dem/ \*jedem Berater] auch nur irgendetwas erzählt.  
 no one has the/ every advisor anything told  
 ‘No one told the/every advisor anything.’  
 b. \*Niemand hat [dem Berater [jedes Präsidenten]] auch nur irgendetwas erzählt.  
 ‘Noone told [the advisor of [every president]] anything.’

Finally, we know that definite NPs do not license NPIs, but the determiner *die wenigsten* (‘few’) licenses NPIs in its scope. This is shown in (34-a) and (34-b). As might be expected by now, if an NPI-licensing determiner is syntactically embedded inside the definite NP but is used in an IL reading, an NPI can be licensed. Such a constellation is given in (34-c).

- (34) a. \*[Die Biographie] enthält auch nur irgendwelche neuen Informationen.  
 ‘The biography contains any new information.’  
 b. [Die wenigsten Biographien] enthalten auch nur irgendwelche neuen Informationen.  
 ‘Few biographies contain any new information.’  
 c. [Die Biographie [der wenigsten Politiker]] enthält auch nur irgendwelche Infos.  
 ‘[The biography [of few politicians]] contains any information.’

The NPI data provide additional support for the polyadic analysis. Only this analysis captures the fact that the NPI-licensing potential of the syntactically higher determiner is replaced by that of the syntactically embedded quantifier in IL. Non-polyadic theories do not offer a similarly simple account for these data.

## 6. Intermediate modal operators (Sauerland 2005)

It is important to come back to the question of whether or not the non-polyadic readings of (5) exist at all. Sauerland (2005) acknowledges the inseparability of quantifiers from the same NP, but he shows that this does not mean that no semantic material can occur between the quantifiers. He shows with (35) that modal operators may very well occur there. The most natural interpretation of the sentence is such that there are two countries such that Mary wants to marry someone from them. In other words, there is a reading in which the modal semantics takes intermediate scope between the determiner **Two** and **Some**.

- (35) Mary wanted to marry someone from these two countries.      **Two > want > Some**

(36) Alex will [jemanden aus [jedem EU-Land]] kennen lernen.  
Alex wants to get to know someone from every EU country.

(37) Alex will [jemanden<sub>i</sub> aus [jedem EU-Land]] kennen lernen,  
[der<sub>i</sub> jemals Esperanto gelernt hat].  
'Alex wants to get to know someone from every EU country  
who has ever learned Esperanto.'

## 7. Conclusion and outlook

<sup>2</sup>Alternatively one might assume different world indices, i.e., that in (36) the noun *EU countries* can either be interpreted with respect to Alex's wish-worlds or to the real world. Under such an analysis, the polyadic reading would be sufficient.

are technically difficult for many approaches to the syntax-semantics interface, but can easily be integrated into LRS. We then saw new data on NPIs that follow directly from the polyadic analysis. Finally, rarely discussed data on intermediate scope of modal operators in IL showed that we need both a polyadic and a non-polyadic analysis for IL.

The paper addressed a number of issues, but could only scratch their surface. To get a clearer picture we would need case-by-case studies of individual determiner combinations. It is also necessary to investigate the constraints on telescoping further. Finally, the relation to other cases of polyadic quantification needs to be explored.

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# Scalar implicatures processing: slowly accepting the truth (literally)

Florian Schwarz — University of Pennsylvania

Jacopo Romoli — Ulster University

Cory Bill — CCD/Macquarie University

**Abstract.** The processing of scalar implicatures has been extensively studied in recent years (Bott and Noveck 2004; Bott et al. 2012; Breheny et al. 2006; Huang and Snedeker 2009, Chemla and Bott 2013 among others). Following the work of Bott and Noveck (2004), there has been an ongoing discussion about whether scalar implicatures are delayed in online processing. A second question, discussed more recently, is whether so-called ‘indirect’ scalar implicatures (e.g., *John didn’t always go to the movies*  $\rightsquigarrow$  *John sometimes went*) exhibit the same processing profile as the standard direct ones (e.g., *John sometimes went to the movies*  $\rightsquigarrow$  *John didn’t always go*). Cremers and Chemla (2014) argue that they do, whereas Romoli and Schwarz (2015) find the reverse pattern for indirect scalar implicatures, with slower Reaction Times associated with literal responses. In this paper, we report an experiment investigating two key questions arising from this debate: first, do Reaction Times yield uniform evidence for delayed availability of implicatures? and second, do direct and indirect scalar implicatures display comparable or distinct processing properties? Using the covered picture version of a picture matching task (Huang et al. 2013) with reaction time measures, we look both at cases where the overt picture is rejected and where it is accepted. Our results provide a negative answer to the first question: while delays for implicature responses arise for rejections (Covered picture choices), the pattern flips for acceptances (Target choices). The cross-over interaction in the results is inconsistent with attributing delayed implicature-rejections to delays in the availability of the implicature, since Target choices compatible with the implicature are faster than ones that are only compatible with a literal interpretation. This yields a very different perspective on reaction time results for implicatures. As for the second question, our results show that once acceptance vs. rejection is factored in, the general reaction time pattern is the same for indirect and direct scalar implicatures and compatible with the different results found in the literature.

**Keywords:** scalar implicatures, processing, Reaction Times

## 1. Introduction

Upon hearing a sentence like (1-a), we tend to conclude (1-b).<sup>1</sup> Similarly, and symmetrically, when somebody tells us (2-a) we typically infer (2-b). (1-b) and (2-b) are examples of ‘scalar implicatures,’ one of the most studied types of inferences that we draw from sentences.

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- (1) a. John sometimes went to the movies.  
       b.  $\sim\sim$ *John didn't always go*
- (2) a. John didn't always go to the movies.  
       b.  $\sim\sim$ *John sometimes went*

As we review in more detail below, one of the main characteristic of these inferences is that they can be suspended or cancelled. A theory of scalar implicatures therefore has to account both for how scalar implicatures arise when they do arise, and for the circumstances in which they do not arise. While this is quite generally agreed upon, the question of how exactly scalar implicatures should be derived is controversial, and a variety of theories have been proposed, which differ substantially in the mechanisms behind these inferences. It is also controversial where exactly these inferences come into play at the interface between semantics and pragmatics.<sup>2</sup> Crucially for our purposes, however, there is a solid consensus on treating the inferences in (1-b) and (2-b) uniformly as the same type of inference. While they sometimes are distinguished terminologically, e.g., by calling (1-b) 'direct' scalar implicatures and (2-b) 'indirect' ones (Chierchia 2004), this is not usually assumed to involve a difference in the mechanisms that give rise to them.

More recently, scalar implicatures have also been extensively studied in the psycholinguistic literature, where they have played a central role in efforts to try to understand how theoretical distinctions between aspects of meaning map onto actual cognitive processes in language comprehension. The focus of this work has been to understand how these inferences are processed, in particular concerning the time course of processing implicatures in comparison to 'literal' content (Bott and Noveck 2004; Bott et al. 2012; Breheny et al. 2006; Huang and Snedeker 2009, Chemla and Bott 2013; see also Chemla and Singh 2014 for a critical review). Following the seminal work of Bott and Noveck (2004), there has been an ongoing discussion about whether scalar implicatures are delayed relative to literal content in online processing. Bott and Noveck (2004) provided Reaction Time data they argued to support the existence of a delay. Various later variations of their study point in the same direction (see, for example, Bott et al. 2012, who look at speed accuracy trade-offs and Chemla and Bott 2013, who compare scalar implicatures to so called 'free choice' inferences), and Breheny et al. (2006) present self-paced reading they argue to support this interpretation as well. More recently, the issue has been investigated using the visual world paradigm, where results have been more mixed. Huang and Snedeker (2009, and subsequent work) report delays in eye movements based on the 'not all' implicature of 'some'. But various others, e.g., Grodner et al. (2010), Breheny et al. (2013), and Degen and Tanenhaus (2011), report eyetracking results which they argue show that scalar implicatures are available immediately, i.e., with no delay. There thus is a contrast in the overall findings between methodologies, as – to our knowledge – reaction time studies have consistently found delays for implicature-based responses. Such apparent differences across methodologies should be accounted for if they persist, and the studies presented here provide a new perspective on reaction time data.

<sup>2</sup>See Chierchia et al. 2012; Sauerland 2004, 2012; Geurts 2010; Schlenker 2012 among others.

Another question concerning the processing of scalar implicatures, which has only been investigated more recently, is whether indirect scalar implicatures (ISIs) exhibit the same processing profile as the standard direct ones (DSIs). Cremers and Chemla (2014) argue that they indeed yield comparable results, with faster Reaction Times (RTs) for literal responses. Romoli and Schwarz (2015), however, find the reverse pattern for indirect scalar implicatures, with **slower** RTs for literal responses. In this paper, we report on an experiment investigating two key questions arising from this debate:

- (3) a. **Question 1:** Do RTs yield uniform evidence for delayed availability of implicatures?
- b. **Question 2:** Do DSIs and ISIs display comparable or distinct processing properties?

Using the covered picture (a.k.a. Covered Box) version of a picture matching task with RTs (Huang et al., 2013), we look at two different types of responses relating to implicatures. Firstly, there are cases where an overtly shown picture is rejected based on an implicature; secondly, there are cases where an overt picture that is compatible with an implicature interpretation is accepted. The previous literature has focused on the former, in the form of ‘false’-judgments in truth-value judgment tasks, but it turns out that looking at both types of cases enhances our perspective on the time course of implicature processing substantially. To foreshadow, our results suggest a negative answer to **Question 1**: while delays for implicature responses arise when we look at rejections (Covered picture choices), the pattern flips when we look at acceptances (Target choices). The cross-over interaction in the results is inconsistent with an interpretation that attributes delayed implicature-rejections to delays in the availability of the implicature, since Target choices compatible with the implicature are **faster** than ones that are only compatible with a literal interpretation. This yields a very different perspective on reaction time results for implicatures. As for **Question 2**, our results show that once the importance of distinguishing acceptance and rejection responses is acknowledged, the general RT pattern for ISIs and DSIs is the same and compatible with both of the seemingly inconsistent results from the recent literature (Cremers and Chemla, 2014; Romoli and Schwarz, 2015).

The paper is organized as follows: in section 2, we briefly review the main characteristics of DSIs and ISIs and sketch their uniform derivation. In section 3, we discuss results from previous reaction time studies on scalar implicatures, in particular focusing on the recent contrasting results on indirect scalar implicatures mentioned above. In section 4, we report a new experiment investigating the questions in (3) and discuss the implication of its results. Section 5 concludes.

## 2. Direct and indirect scalar implicatures: characteristics and derivation

We begin by briefly reviewing the main properties of the phenomena under investigation, and sketch the uniform derivation of direct and indirect scalar implicatures that is standard in the literature. As only very general properties of these accounts will be relevant for our purposes, this

review will remain fairly superficial.<sup>3</sup> As discussed above, a sentence like (4-a) gives rise to the inference in (4-b). In parallel, a sentence like (5-a) comes with the inference in (5-b).

- (4) a. John sometimes went to the movies.  
      b.  $\leadsto$  *John didn't always go*
- (5) a. John didn't always go to the movies.  
      b.  $\leadsto$  *John sometimes went*

These inferences are not obligatorily present, but can be suspended or cancelled. For instance, (4-a) can be followed felicitously by a continuation that is incompatible with the inference (4-b).

- (6) John sometimes went to the movies. In fact, he always went!

In this regard, implicatures differ from literal, entailed content, as witnessed by the contrast between (4-b)/(5-b) and (7-b), which is a simple entailment of (7-a).<sup>4</sup> There is no way of canceling or suspending the inference in (7-b) without sounding contradictory, as illustrated in (8).

- (7) a. John and Mary went to the movies.  
      b.  $\leadsto$  *John went to the movies*
- (8) John and Mary went to the movies. #In fact, John didn't go!

A theory of scalar implicatures thus has to explain both the presence and absence of the relevant inferences in the various circumstances. The general idea behind virtually all accounts of scalar implicatures is that they arise from a comparison of the utterance made with certain alternative utterances; the latter are then inferred to be false, given certain assumptions about the speaker behaving rationally in communication.<sup>5</sup> In the cases at hand, the reasoning is as follows:

<sup>3</sup>The reader interested in more information on scalar implicatures should consult Schlenker 2012 and references therein.

<sup>4</sup>Where entailment is standardly defined as in (i):

- (i) For any sentence  $p, q$  and possible world  $w$ ,  $p$  ENTAILS  $q$  iff the following hold:  
      if  $p$  is true in  $w$  then  $q$  is true in  $w$ .

<sup>5</sup>This idea of implicatures arising from a comparison between what the speaker said and what she might have said instead goes back to the work of Grice 1975.

- (9) For any sentence A:
- a. The speaker uttered A
  - b. Alternatively, the speaker could have uttered the more informative sentence B.
  - c. The most plausible reason for not uttering B (given some additional assumptions) is that B is false (or at least taken to be false by the speaker).

One crucial question is just what set of alternative utterances B should be considered. The general answer in the literature, since Horn 1972, is that certain words like *some* and *all*, or *sometimes* and *always* are associated with one another through a scale based on entailment.<sup>6</sup> Sentences containing one of these items then can be associated with a set of alternative sentences where the original item has been replaced by alternatives from its scale. For instance, for a sentence like (10-a), the sentence in (10-b) is an alternative that results from replacing *sometimes* with *always*.

- (10) a. John **sometimes** went to the movies.  
 b. John **always** went to the movies.

Following the schema in (9), the sentence in (10-a) is compared to that in (10-b), and the hearer will reason that while the speaker said the former, she could have said the latter instead. Since (10-b) is stronger than (10-a), the hearer will conclude that (10-b) is false, i.e., infer (11).

- (11) John didn't always go to the movies.

The exact same reasoning applies to (5-a): the speaker uttered (5-a) but also must have considered (the equivalent of) (12). (12) is constructed by replacing *always* with its associates *sometimes* and which in this case is stronger than (5-a) due to negation. Again, the hearer concludes that the stronger sentence is false, i.e., infers that (12) is false. But the negation of (12) is of course equivalent to the inference in (5-b).

- (12) John didn't **sometimes** go to the movies.

All theories that we know of provide a scalar implicature algorithm based on alternatives of this sort and derive direct and indirect scalar implicatures in a unified fashion (see Chierchia et al. 2012 for discussion). In the next section, we turn to the literature on processing of scalar implicatures, focusing in particular on the comparison of the processing of direct and indirect scalar implicatures.

<sup>6</sup>For more recent and more developed theories of alternatives see Katzir 2007 and Fox and Katzir 2011.

### 3. The processing of direct and indirect scalar implicatures

In recent years, research on scalar implicatures underwent what Chemla and Singh (2014) call an ‘experimental turn.’ In particular, investigations of their processing properties have played a central role in the overall theoretical discussion. Most studies have focused on direct scalar implicatures, but some recent studies have started looking at indirect ones too. In this section, we first review the classical findings on the processing of direct scalar implicatures, and then discuss two contrasting results on indirect scalar implicatures, which in large part motivate the new experiment reported below. We primarily focus on RT studies here, but eventually the goal is to integrate results obtained with other methodologies into a more comprehensive perspective. We will come back to this briefly in the final section.

#### 3.1. The classical finding on direct scalar implicatures

Bott and Noveck (2004) found direct scalar implicatures to be associated with a delay in RTs. To sketch the gist of their result, they used sentences like (13-a), which gives rise to the direct scalar implicature in (13-b), which in turn directly conflicts with the relevant piece of common knowledge (i.e., that all elephants are mammals). Therefore, the sentence in (13-a) should be judged ‘false,’ under an inference interpretation (i.e., an interpretation that includes the inference).<sup>7</sup> As we know, however, the sentence can also be understood in a way that does not include the inference, and this reading is compatible with common knowledge (i.e., the literal meaning is equivalent to ‘some or all elephants are mammals’). Under such a reading, which we will refer to as a ‘no-inference reading’, (13-a) should then be judged ‘true.’

- (13)    a.    Some elephants are mammals.  
           b.     $\rightsquigarrow$  *Not all elephants are mammals*

The logic of Bott & Noveck’s design then is as follows: since ‘false’ responses are indicative of inference interpretations and ‘true’ responses of no-inference interpretations, measuring RTs for both types of responses should shed light on the time course of the availability of the two interpretations.<sup>8</sup> Their main finding is that false responses were slower than true ones, and they interpret this as showing that scalar implicatures are associated with a delay relative to literal meaning. Schematically, we can summarize their result as: inference > no-inference.<sup>9</sup>

<sup>7</sup>Notice that the sentence in (13-a) is generally judged to be an odd sentence, like all sentences which give rise to scalar implicatures conflicting with common knowledge (Magri 2010). This feature of the design is however shown not to be important in work replicating the main result of Bott and Noveck (2004), like that of Chemla and Bott (2013).

<sup>8</sup>There is an obvious potential concern about general difference between the time course of true and false responses, which Bott & Noveck try to address through various variants of their basic design. We will return to this issue when introducing our own study below.

<sup>9</sup>Where  $\phi > \psi$  is supposed to be read as ‘the RT associated with  $\phi$  is larger than that associated with  $\psi$ .’

One particularly relevant version of their general approach is based on training participants to respond according to one or the other possible interpretations of the sentence in question. They find that participants that were trained to respond based on the no-inference interpretation were generally faster than those trained on the inference interpretation. Parallel results have been obtained in various similar studies since (Chemla and Bott 2013; Bott et al. 2011 among others), and also for implicatures with disjunction (Chevallier et al. 2008). As already mentioned, other methodologies, such as reading times (Breheny et al. 2006) and visual world eye tracking (Huang and Snedeker 2009) have yielded comparable results as well, though some researchers have argued results from the latter method to show that implicatures are immediately available.

### 3.2. Contrasting results on indirect scalar implicatures

**Cremers and Chemla 2014** Cremers and Chemla (2014) extend Bott and Noveck's approach to indirect scalar implicatures by looking at sentences like (14-a), with the inference in (14-b), again incompatible with common knowledge.

- (14) a. Not all elephants are reptiles.  
       b.  $\leadsto$  *Some elephants are reptiles*

Overall, they argue that their findings are parallel to Bott and Noveck's results, in that training participants to respond based on an inference interpretation vs. a no-inference interpretation gives rise to the result that the inference-readings were slower than no-inference ones. That is, the inference group, responding 'false' to (14-a) was slower on average than the no-inference group, responding 'true.' Again, schematically, we could summarize their finding as: inference > no-inference.<sup>10</sup>

In sum, Bott and Noveck found that 'false' responses to sentences whose direct scalar implicature was false were slower than 'true' responses based on no-inference interpretations. Similarly, Cremers and Chemla found that 'false' responses to sentences whose indirect scalar implicature was false were slower in comparison to 'true' responses. These results are entirely in line with the general uniformity for direct and indirect scalar implicatures assumed in the literature, and with the initial interpretation by Bott and Noveck that scalar implicatures are associated with a delay.

**Romoli and Schwarz 2015** Another recent study that includes reaction time results for indirect scalar implicatures is reported in Romoli and Schwarz (2015). The more general context was

<sup>10</sup>Cremers and Chemla (2014) report two experiments. In the first one, without training, they actually found opposite results for DSIs and ISIs. That is, they found that participants were faster to answer False than True for ISIs. They argue that this outcome is the result of a confound introduced by the presence of negation.



Figure 1: Target pictures for *always* conditions from Romoli and Schwarz (2015).

a comparison between presuppositions and scalar implicatures under negation.<sup>11</sup> Rather than a direct truth-value judgment task, Romoli and Schwarz (2015) used a version of a sentence picture matching task with a covered picture (Huang et al. 2013), with both response choices and reaction time measures as dependent variables. Participants were told to select the best match for a given sentence from a set of three pictures (depicting individuals and a calendar strip with various iconic representations of activities for each day), while assuming that a) the ‘covered picture’ represented a hidden picture and b) that only one of the three pictures did indeed match the sentence. The overt pictures included a target picture that either was or was not consistent with the inference (‘Inference’ versus ‘No-Inference’ condition). The second overt picture served as a distractor. If neither of the overt pictures was considered a match, participants were instructed to click on the covered picture.

In contrast to previous studies, where different interpretations were associated with different types of responses, this setup made it possible to compare alike responses - namely acceptance responses in terms of target picture choices - based on different interpretations. For example, participants would see a sentence like (15), and evaluate it relative to target pictures such as those in Figure 1.

(15) John didn’t always go to the movies last week.

The inference picture, where the depicted character indeed went to the movies on several days, is consistent with the ‘sometimes’ implicature of ‘not always’, whereas the no-inference picture is not. Looking at RTs for target choices in both conditions thus allows for a comparison of different interpretations giving rise to the same type of response, in terms of target choices.<sup>12</sup> The results revealed RTs in the Inference condition to be significantly faster than in the No-Inference condi-

<sup>11</sup> An example of a presupposition is in (i-b) from (i-a).

- (i) a. John didn’t stop going to the movies on Wednesday.  
b.  $\leadsto$  John used to go to the movies before Wednesday

<sup>12</sup> In principle, the inference picture could also be chosen based on a literal interpretation. But if all such choices were based on a literal interpretation, we would not expect any differences between the two conditions, so given the observed reaction time differences, at least a sizable portion of responses seems to result from inference interpretations.



tion, which directly contrasts with previous findings. Somewhat less surprisingly, target choices were much more frequent in the Inference condition.<sup>13</sup> Schematically, the result from Romoli and Schwarz is: inference < no-inference.

These results are puzzling from the traditional perspective that ISIs are generated in the same way as DSIs and appear to be exactly the opposite of what Cremers and Chemla (2014) find: the literal (no-inference) responses in Romoli and Schwarz (2015) for indirect scalar implicatures were slower than implicature (inference) responses. The strong bias in the target-choice frequency for inference-based interpretations also is somewhat at odds with previous findings in comparable task settings for direct implicatures, where literal interpretations tend to be quite freely available. The question that arises is therefore what is behind these seemingly conflicting findings. They could be due to general task-related effects of various sorts. But a more particular difference between the studies concerns the types of responses that are compared. Previous reaction time studies quite generally wound up comparing ‘true’ responses to ‘false’ responses, whereas the setup of Romoli and Schwarz (2015) compared acceptance responses based on different interpretations. This raises the possibility that looking at different responses for different interpretations introduces a confound, either based on general differences between ‘true’ and ‘false’ responses, or based on differential effects for inference-based responses for acceptance and rejection responses. The experiment reported in the next section was designed to shed light on this issue.

## 4. Experiment

The present experiment extended the approach taken in Romoli and Schwarz (2015) to assess whether there indeed are processing differences between direct and indirect implicatures when we compare alike responses, as in the previous study. In order to gain a more comprehensive perspective on the impact of the covered picture methodology on the result patterns, we did not only look at target choices (acceptance judgments) based on inference and no-inference interpretations, but also at covered picture choices (rejection judgments).

### 4.1. Methods

**Materials & Procedure** We once again used the Covered picture paradigm, with both response choices and RTs as dependent variables. To simplify the task, participants were only presented with two pictures, one of which was simply black and was described as covering a hidden picture. The instructions provided a detective scenario, where information about a suspect was presented as having been extracted from intercepted communication, and the participant’s task was to decide

<sup>13</sup>The effects were parallel for the presupposition conditions looking at *stop*, where the effect was numerically even more pronounced, although there was no significant interaction in RTs between inference types. We refer the interested reader to Romoli and Schwarz (2015) for further details on *stop* as well as the larger theoretical relevance of the comparison between *always* and *stop*.

which of two potential culprits fit the provided description. It was explicitly stated that only one of the two pictures would match the description, so that the covered picture should be chosen in case the overt picture did not match the sentence. This setup was chosen to increase the chances of participants basing their responses on no-inference interpretations. First, the described source of the information remained opaque due to its nature of stemming from intercepted communication, which makes it uncertain whether the speaker of that sentence was fully informed. Secondly, the emphasis that only one picture would match the description provided by the sentence should increase target choices for no-inference pictures, assuming no-inference interpretations are in principle available but generally somewhat dispreferred.

The basic logic of the design was parallel to that of Romoli and Schwarz (2015), in that the overt target picture either was consistent with a given interpretation or not. More concretely, the sentences (a) and (b) in Figure 2 were displayed with one of the pictures in Figure 2 and a covered picture. Conditions were coded as indicated below the pictures.

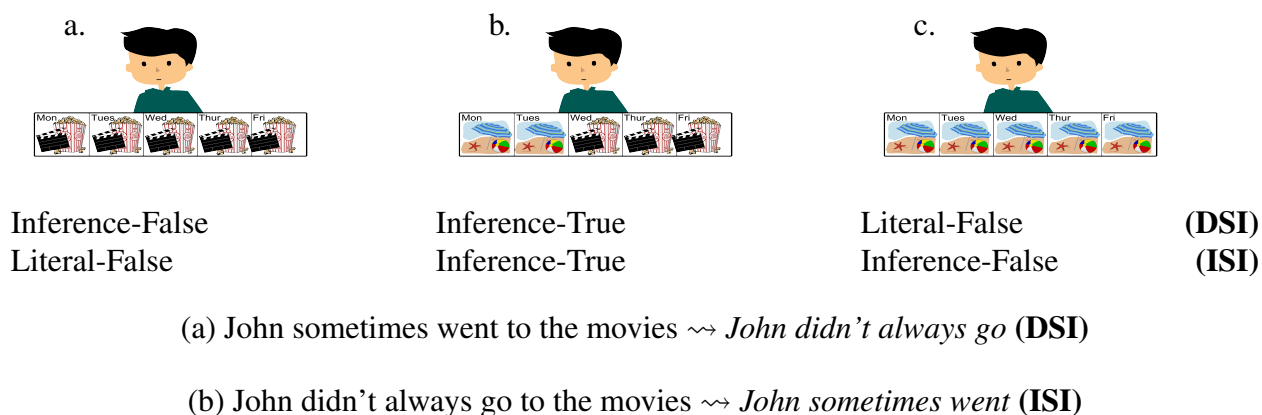
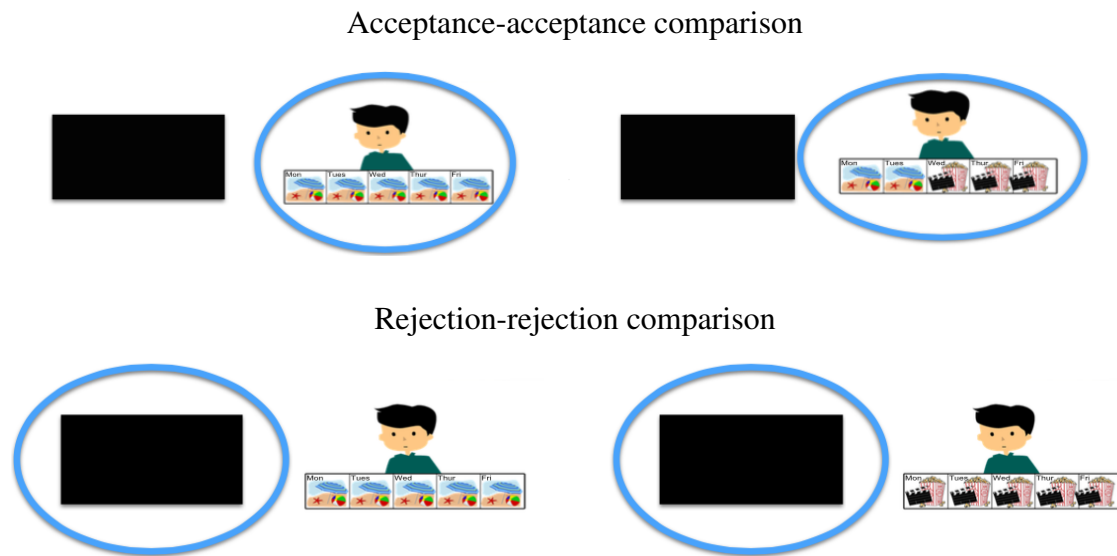


Figure 2: Target Picture versions and conditions

For the direct scalar implicature condition with *sometimes*, the picture in Figure 2a tested for literal, no-inference interpretations, as the depicted person always went to the movies. Target choices thus must be based on the no-inference interpretation. Covered picture choices for this picture in turn are indicative of inference interpretations. The picture in Figure 2b is consistent with an inference interpretation (as well as a no-inference interpretation, since it is entailed by the inference interpretation), so target choices are generally expected here. Finally, the picture in Figure 2c is inconsistent with both interpretations, as the depicted individual never went to the movies. For purposes of analysis, this design allowed us to compare both target and covered picture responses to the picture in Figure 2a to target and covered picture responses in the control conditions in Figures 2b and 2c respectively. We thus get a comparison between inference-based rejections (covered picture choices for Figure 2a) and literal meaning based rejections (covered picture choices for Figure 2c), as well as between no-inference acceptances (target choices for Figure 2a) and inference acceptances (target choices for Figure 2b). Figure 3 is a summary of the two comparisons: no-inference



John didn't always go to the movies  $\rightsquigarrow$  *John sometimes went* (ISI)

Figure 3: Acceptance-acceptance and rejection-rejection comparisons for ISI sentences

acceptance vs inference acceptance ('acceptance-acceptance' comparison) and inference-rejection versus no-inference rejection ('rejection-rejection' comparison).

Note that target choices for Figure 2b and covered picture choices for Figure 2c could in principle be based on either inference or no-inference interpretations, given the entailment relations between the two. However, to the extent that we find behavioral differences between these conditions and the relevant no-inference comparison conditions, we assume these to be due to a substantial proportion of inference interpretation-based responses in the former conditions.

The same logic applies to the ISI sentences, with different mappings onto the pictures. The picture in Figure 2c serves as a test for no-inference interpretations, as target choices are incompatible with the inference that John sometimes went to the movies. Covered picture choices for these pictures in turn must be based on inference interpretations. The picture in Figure 2b is consistent with the inference interpretation (as well as a no-inference interpretation, as for DSIs), and the picture in Figure 2a is inconsistent with either interpretation. So in the case of ISIs, Figure 2c is expected to yield a mix of target and covered picture choices, depending on the interpretation participants base their judgments on in a given trial, which can be compared to the covered picture and target choices in the respective control conditions.

| Inference Type | Inference False<br>(Figure 2a/c) | Literal False<br>(Fig 2c/a) | Inference True<br>(Fig 2b) |
|----------------|----------------------------------|-----------------------------|----------------------------|
| DSI            | 22.9                             | 0.005                       | 97.1                       |
| ISI            | 50.9                             | 0.005                       | 95.7                       |

Table 1: Target choice rates in % by condition

**Participants & Procedure** 35 undergraduate students from Macquarie University participated in the study. They saw 36 sentence picture pairs of the sort described above, with 6 items for each pairing, counterbalanced across participant groups. In addition, there was a total of 36 filler items; 18 were variants of the experimental items containing *always* without negation, paired with all three picture types to ensure that pictures such as those in Figures 2a/c were viable target choices throughout the experiment sufficiently often. There also were 6 items containing plain negation (e.g., *John didn't go to the movies last week.*), again paired with the various picture types to even out choices of types of pictures. Finally, 12 items were from another sub-experiment containing negation and *again*. At the beginning of the experiment, participants were presented with instructions laying out the detective scenario described above. They then were shown some example sentences and pictures, and did a total of 4 practice trials (none of them resembling the crucial experimental conditions) to ensure they understood the covered picture setup. Throughout this initial phase, they were free to ask any clarification questions. After this, presentation of the experimental trials began.

## 4.2. Results

Responses were coded according to whether they were based on/compatible with literal content alone (1a/2c Target response; 1c/2a-Covered Picture or based on/compatible with the implicature (1a/2c-Covered Picture; 1b/2b-Target). Target choice proportions as well as RTs (measured from the display of the sentence, which was added to the screen 800ms after the picture was first shown) were analyzed.

**Response Rates** Mean target selection rates are provided in Table 1. Accuracy in the conditions where literal and implicature interpretations are consistent (Figures 2b/c for DSIs, Figures 2a/b for ISIs) were at ceiling, as expected. Both inference and no-inference interpretations occurred with both DSIs and ISIs, but inference interpretations occurred more often with DSIs than with ISIs, as there were fewer target choices for the Inference False picture for DSIs. A planned comparison between these two conditions using a logistic regression mixed-effect model revealed this difference in implicature-response rates to be significant ( $\beta = 4.01$ ,  $SE = 0.98$ ,  $z = 4.07$ ,  $p < .001$ ).

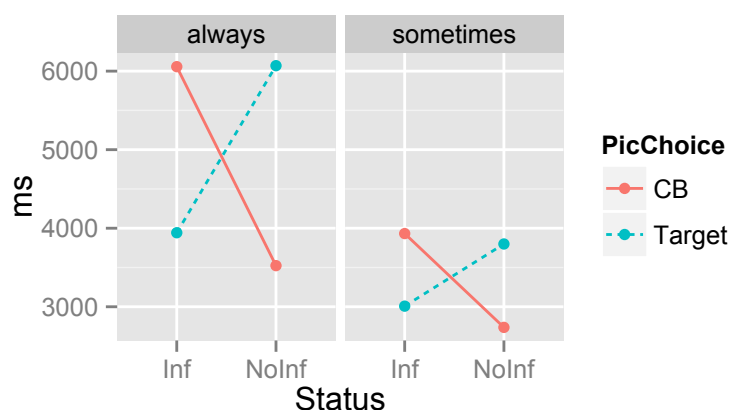


Figure 4: RTs for inference and no-inference responses by response type and implicature type.

**Reaction Times** For the purposes of analyzing response times, the trials in the Inference False condition were again categorized as inference and no-inference interpretations based on the response provided. Accurate responses in the Inference True and Literal False conditions were coded as inference and no-inference conditions respectively. The mean RTs for all conditions encoded in this manner are illustrated in Figure 4. As is apparent right away from the cross-over interaction pattern in the graph, the relation between RTs for inference and no-inference interpretations depends crucially on whether we look at acceptances in the form of target choices or rejections in the form of covered picture choices. In the former case, inference interpretations are faster than no-inference ones, while the reverse holds in the latter.

To investigate this result statistically, we analysed both the DSI and ISI subsets of data as a  $2 \times 2$  interaction design, using mixed-effect models with subjects and items as random effects, as implemented in the *lmer* function of the *lme4* package in *R* (Bates 2005). Following Barr et al. (2013), we used the maximal random effect structure that would converge, with random effect slopes for each factor, as well as the interaction. To assess whether inclusion of a given factor significantly improved the fit of the overall model, likelihood-ratio tests were performed that compared two minimally different models, one with the fixed effects factor in question and one without, while keeping the random effects structure identical (Barr et al. 2013). We report estimates, standard errors, and t-values for all models, as well as the  $\chi^2$  and *p*-value from the likelihood-ratio test for individual factors. The statistical details are summarized in Table 2. The  $2 \times 2$  interactions were highly significant for both ISIs and DSIs, as were the relevant simple effects comparing inference vs. no-inference responses by response type. Thus, schematically, what we found is in (16): inference-based rejections (Covered Picture-choices) were slower for both types of implicatures, in line with previous findings for DSIs from Bott and Noveck (2004) on, and with the findings by Cremers and Chemla (2014) for ISIs. However, looking at acceptances (Target-choices), those compatible with the implicature were faster than those only compatible with the literal meaning.

| DSI's                                | $\beta$  | $SE$   | $t$   | $\chi^2$ | $p$   |
|--------------------------------------|----------|--------|-------|----------|-------|
| <b>Interaction</b>                   | 2119.1   | 563.4  | 3.76  | 9.67     | <.01  |
| <b>Simple Effects:</b>               |          |        |       |          |       |
| Covered Picture Choices: Inf > NoInf | -1418.6  | 534.8  | -2.65 | 6.38     | <.05  |
| Target Choices: Inf < NoInf          | 666.1    | 276.5  | 2.41  | 5.42     | <.05  |
| ISI's                                |          |        |       |          |       |
| <b>Interaction</b>                   | 5902.7   | 1793.5 | 3.29  | 9.67     | <.01  |
| <b>Simple Effects:</b>               |          |        |       |          |       |
| Covered Picture Choices: Inf > NoInf | -3.302.2 | 881.6  | -3.75 | 7.80     | <.01  |
| Target Choices: Inf < NoInf          | 2197.9   | 580.2  | 3.788 | 11.734   | <.001 |

Table 2: Summary of reaction time analyses: Interaction between Response Choice and inference status and simple effects for relevant paired factor levels.

This is in line with the findings by Romoli and Schwarz (2015) for ISIs, but a novel finding for DSIs.

(16) RT patterns for Scalar Implicatures (for both DSIs and ISIs):

- a. **rejection response**  
Inference > no-inference
- b. **acceptance response**  
Inference < no-inference

#### 4.3. Discussion

Our experimental investigation aimed to answer the two questions in (17), repeated from above:

- (17) a. **Question 1:** Do RTs yield uniform evidence for delayed availability of implicatures?
- b. **Question 2:** Do DSIs and ISIs display comparable or distinct processing properties?

Our results suggest a negative answer to **Question 1**: While response times for rejection responses in the form of covered picture choices yielded the familiar pattern in line with the results from Bott and Noveck (2004) and following work on DSIs and from Cremers and Chemla (2014) on ISIs – with slower response times for inference responses than no-inference responses – response times for acceptance responses in the form of target choices gave rise to the exact opposite of that pattern,

in that inference responses were **faster** than no-inference responses. The predominant interpretation of the common result for inference-based rejections in the literature is that the calculation of implicatures involves time-consuming processing efforts, which lead to a delay in the availability of an inference interpretation. However, this fails to account for the fact that acceptance judgments are faster for pictures consistent with the inference than for ones that are not. Since both are consistent with the no-inference interpretation, which is assumed to be available more or less immediately, this type of account would expect them to be on par in terms of response times. Note furthermore that our results reconcile the apparent tension between the two previous studies on ISIs. The study in Romoli and Schwarz (2015) looked at acceptance responses in terms of target choices, and the pattern in the present results is entirely parallel to the finding reported there. At the same time, the pattern for rejection responses is parallel to that reported by Cremers and Chemla (2014). On a descriptive level, the present results thus validate both of the previous results, and contribute a new level of understanding to the role of the type of response for reaction time outcomes. As for **Question 2**, our results show that once acceptance/rejection is factored in, DSIs and ISIs yield the same pattern of RTs.

Turning to the interpretation of the present results, the question is how to account for the reverse patterns for acceptance and rejection judgments in our data. With regards to the former, the speed-up in the acceptance of implicature-compatible cases suggests that inference interpretations are available just as readily as no-inference interpretations, as pictures compatible with them are quickly identified as matches. But why are pictures that are only compatible with a literal interpretation accepted more slowly? This cannot be due to a delay in availability of the literal interpretation since a), the inference interpretation entails the literal interpretation and b), rejections of pictures based on the literal content are fast. Thus, an alternative explanation of both the acceptance and rejection patterns is called for. Our proposal for interpreting the present results starts from the observation that across all conditions, delays arise precisely in those circumstances where the two interpretations of the sentences that are in principle possible – what we have labeled the inference and no-inference interpretation – conflict with one another. For example, we find relatively slow target choice responses when the target is compatible with the no-inference interpretation but incompatible with the inference interpretation (Figure 2a for DSIs and Figure 2c for ISIs). Similarly, covered picture responses are also slow in the very same circumstances. The basic idea then is that there are opposing pressures favoring the respective interpretations, and that delays arise precisely when there is a conflict between such factors that affect the overall response. More specifically, we assume that comprehenders are generally charitable, i.e., they generally try to construe utterances in such a way that they are true of the circumstances at hand. In our case, charity can plausibly be seen as corresponding to selecting the overt picture, as that is the obvious and salient option at hand. On the other hand, it is intuitively plausible that inference interpretations for scalar implicatures are generally preferred. As anyone that has taught introductory logic can confirm, it takes some serious effort to convince students that *some*-statements are in principle compatible with universal scenarios, i.e., that *some* does NOT literally mean *some but not all*. The pressures of selecting the overt picture and the preference for scalar meanings oppose one another in precisely those conditions where we find a delay in our data. In the Literal False conditions (Fig-

ure 2a for DSIs and Fig 2c for ISIs, the principle of charity favors the Target, and the preference for scalar meanings favors the covered picture. Whether participants end up choosing the Target or the covered picture, their responses are delayed in these cases, compared to rejections (Figure 2c for DSIs and Figure 2a for ISIs) and acceptances (Figure 2b for both DSIs and ISIs) of the relevant controls. This account is similar in spirit to that by Katsos and Bishop (2011), who explain acquisition data in terms of pragmatic tolerance: from our perspective, this corresponds to claiming that the charity principle is stronger in children than the preference for implicature interpretations. Returning to the comparison between ISIs and DSIs, it is interesting that while as far as RTs are concerned, our results are comparable for ISIs and DSIs, the rate of implicature interpretations is significantly higher for DSIs. It is possible that this is simply due to complexities introduced by negation, but a more detailed explanation will have to be fleshed out in future work.

## 5. Conclusion

In this paper, we reported on the results of an experiment comparing DSIs and ISIs, looking at acceptance and rejection responses. For both DSIs and ISIs, we found that in the case of rejection, the RTs of inference responses were slower than that of no-inference ones. However, in the case of acceptance, we found the RTs associated with inference responses to be faster than those for no-inference ones. As discussed, these results are in line with the predicted uniformity of DSIs and ISIs and reconcile the apparently conflicting results in the literature on ISIs by Cremers and Chemla (2014) and Romoli and Schwarz (2015). Moreover, they challenge an interpretation of the results based on the rejection response pattern in (16-a) in terms of a general delay associated with the computation of implicatures. Such an interpretation leaves the RT pattern for acceptance responses in (16-b) unaccounted for. We proposed a different explanation encompassing both results based on two pragmatic principles, which lead to a delay when they end up conflicting with each other.

The present discussion focused on RT data. In integrating these with the more general results on scalar implicatures processing in the literature, one important question is how these RT results relate to results obtained with other methodologies. While we argue our results show that RT data for implicatures cannot be accounted for in terms of a delayed availability of implicatures, they leave open whether delays in early stages of processing as indicated by more immediate online measures do support such a notion. But at least some of the alleged evidence for delayed implicature computation has to be reconsidered in light of the present data. In ongoing work, we are extending the Covered picture paradigm to eyetracking in the visual world paradigm to collect more direct online measures on the time course of acceptance, with the goal of gaining a more comprehensive perspective on scalar implicature processing based on these different methodological approaches.<sup>14</sup>

<sup>14</sup>In other related work, a behavioral acquisition study on 4/5 year-old children and adults found indirect and direct scalar implicatures to differ, see Bill et al. (to appear). Also see Kennedy et al. (to appear) for an extension of this study to a population with Broca's Aphasia, which also exhibit different responses for the two types of implicatures. In ongoing work, we are now extending the investigation of the behavior of these populations with scalar implicatures on processing experiments.



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# “Surely that’s not a negative declarative question?” – Polar discourses in Swedish, German and English<sup>1</sup>

Heiko Seeliger – *Humboldt-Universität zu Berlin*

## Abstract.

This paper discusses questions that are declarative in form, contain a negative marker, and express epistemic speaker bias. Fronting of the negative marker in Swedish is taken as a starting point for a delineation of this type of question, termed ‘rejecting question’, against the background of theories of declarative questions. The discussion is expanded with data from German and English. I propose that rejecting questions are a type of tentative assertion without direct reference to the addressee, and that these tentative assertions express *FALSUM* focus.

**Keywords:** Negation, illocutionary force, declarative questions, biased questions, denials

## 1. Introduction

In Swedish declarative main clauses, the negative marker can optionally front to the preverbal position, cf. (2) compared to the unmarked position of the negative marker in (1). Fronted negation (FN) imposes restrictions on the utterance context that low negation does not. In other words, FN is licit in fewer linguistic contexts than low negation. To explore these contexts, let us take the English negative declarative in (3) as a starting point. With falling intonation, (3) is a negative assertion. There are very few context requirements on this assertion; it can be uttered iff the speaker thinks that its underlying proposition is true. With rising intonation, (3) is a negative declarative question (NDQ). Declarative questions (DQs) generally require that there be contextual evidence for their underlying proposition and that the speaker not act as a source for this proposition (cf. the Contingent Commitment Criterion in Gunlogson 2008:121).<sup>2</sup>

The Swedish declarative with low negation in (1) shares both of these functions, and, in addition, it can be used to ask a suggesting question, in which the speaker is interested in a positive answer but signals that she expects a negative answer for reasons of politeness. There is no obligatory disambiguation (e.g. by way of modal particles or question tags) between declarative questions and suggesting questions in Swedish. The reading as a suggesting question is the only reading that is shared between the declarative with low negation in (1) and the declarative with fronted negation in (2). If the declarative with FN is not used as a question, it is obligatorily used as a rejection, i.e. as a reaction to a previous utterance or state of affairs. If it is used to question something, it does not function as a negative declarative question, but as a rejecting question (or as a suggesting question). Crucially, even though this usage is interpreted as a question, it is still realised with falling intonation. In summary, if we set aside the shared reading as a suggesting

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<sup>2</sup> A speaker *S* is a source for *p* iff *S* is committed to *p*, and iff this commitment is not dependent on another interlocutor (Gunlogson 2008:113).

question for a moment, fronting of the negation seems to introduce a rejecting component that is not present in a declarative with low negation.

(1) *Swedish declarative with low negation*

Du vet inte svaret  
You know not the.answer

Falling intonation:

(i) Assertion: 'You don't know the answer.'

(ii) Rejection/denial: 'You don't know the answer (even though it has been said or implied that you do).'

(iii) Suggesting question: 'You wouldn't happen to know the answer (would you)?'

Rising intonation:

(iv) Declarative question: 'You don't know the answer?'

(2) *Swedish declarative with fronted negation*

Inte vet du svaret  
Not know you the.answer

Falling intonation:

(i) Rejection/denial: 'You don't know the answer (even though it has been said or implied that you do).'

(ii) Suggesting question: 'You wouldn't happen to know the answer (would you)?'

(iii) Rejecting question: 'Surely you don't know the answer?'

Rising intonation:

Not available

(3) *English negative declarative*

You do not know the answer

Falling intonation

(i) Assertion: 'You don't know the answer.'

(ii) Rejection/denial: 'You don't know the answer (even though it has been said or implied that you do).'

Rising intonation

(iii) Declarative question: 'You don't know the answer?'

The goal of this paper is to explore the nature of the different types of questions, how rejections and rejecting questions can be told apart, and what the relation is between fronting of the negation in Swedish and rejections. I will take fronted negation as a starting point from which I extend the discussion of rejecting questions to English and German as well. The paper is structured as follows: in section 2, I will explain in greater detail what is to be understood as declarative questions (in section 2.1), rejections, rejecting questions (both in section 2.2) and suggesting questions (2.3). A short overview of previous accounts of FN is given in section 3. In section 4, I show how the utterance with fronted negation in (2) systematically differs from the utterance with low negation in (1). A proposal for the meaning of rejecting questions, including questions with FN, is presented in section 5.

## 2. The interpretation of negative declaratives

### 2.1. Declarative questions and negative declarative questions

I suggested above that an English declarative with a negation and rising intonation is a negative declarative question, while a Swedish declarative with fronted negation that seems to be used as a question is not a declarative question in the same sense. To see why this would be the case, let us first explore the characteristics of declarative questions (negative or not) in English, and then compare them to the Swedish data. In the following, I will give a short overview of two theories of declarative questions – Gunlogson (2008) and Krifka (to appear) – as a background for the subsequent discussion of how (2) – the declarative with fronted negation – differs from NDQs.

Gunlogson (2008) uses commitment to propositions as a central mechanism in analysing DQs: the speaker uses a DQ to signal contingent commitment to  $p$ , which becomes actual commitment iff the addressee acts as a source for  $p$  immediately afterwards. The role of rising intonation is to signal that the speaker's commitment to  $p$  is contingent. This means that the addressee needs to be a possible source for  $p$ . Crucially, there also needs to be contextual evidence for  $p$  that has to be evident to both interlocutors. DQs usually exhibit rising intonation, but – with the help of markers like 'so' or 'I see' which make it explicit that the speaker's commitment is contingent on the addressee – can be questions even with falling intonation. Negative declarative questions function exactly alike, except that the questioned proposition contains a negation: the speaker signals contingent commitment to  $\neg p$ , which ultimately means that the addressee needs to be a possible source for  $\neg p$ .

Another analysis of DQs is proposed by Krifka (to appear), where DQs are derived with the help of a REQUEST operator that embeds speech acts. In the case of DQs, the embedded speech act is an assertion – in other words, the speaker uses a DQ with the underlying proposition  $p$  to request that the addressee assert  $p$ , as shown in (4). The REQUEST operator is introduced by the rising intonation (specifically L\* H- H%).

- (4) It's raining?  
 $p$ : 'it is raining'  
 LF: [ForceP REQUEST<sub><S,A></sub> [ForceP ASSERT [TP  $p$ ]]]

While it is not specifically mentioned by Krifka, one can assume that the requested assertion is subject to the same sincerity conditions (the speaker must believe that  $p$ , the speaker must not know that  $p$  is false etc.) as an unrequested assertion. The analysis captures the same constraint on DQs that is expressed by Gunlogson's constraint that the addressee must be a possible source for the questioned proposition, and that there be some contextual evidence for the questioned proposition since otherwise there would be no reason to assume that the addressee could fulfil the request.

Both in Gunlogson's and Krifka's proposal, it is necessary that the polarity of the asserted proposition and that of the contextual bias match: if there is contextual evidence for a negative proposition (e.g. 'it is not raining'), a negated DQ must be used (e.g. 'It is not raining?'); if there is contextual evidence for a positive proposition, a positive DQ must be used (e.g. 'It is raining?'). This follows from the fact that if there is contextual evidence for  $\neg p$  that is available to the speaker and the addressee, there is no reason to assume that the addressee will be able to act as a source for or assert  $p$ , and vice versa. The type of questioning declarative that is at issue in this article violates this constraint, no matter which framework it is derived from. I will show this in detail in section 4.1.

Since both proposals presented here derive the functional difference between declarative assertions and declarative questions from the formal difference in intonation (falling for assertions, rising for questions), it is predicted that questions with fronted negation (FNQs) behave differently from DQs, because the former are always realized with falling intonation. At the same time, it is predicted that FNQs should in most cases be functionally identical to assertions.

One of the few shared properties of declarative questions and all utterances with fronted negation, whether they are assertions or questions, is that they are root phenomena and that their illocutionary force is not compatible with disjunctions. (5) shows that DQs and FNQs cannot occur in disjunction, while (6) shows that they cannot be embedded.

- (5) a. *Disjunction of DQs*  
 \*Solen skiner eller det regnar?  
 The.sun shines or it rains  
 Only as an echo question with a reading like '(You said that either) the sun is shining or it's raining?! (But it can be overcast without rain!)'
- b. *Disjunction of FNQs*  
 \*Inte skiner solen eller inte regnar det?  
 Not shines the.sun or not rains it  
 Intended  $\approx$  'Surely the sun isn't shining or surely it's not raining?'
- (6) a. *Embedded DQ*  
 \*Peter sa att solen skiner?  
 Peter said that the.sun shines  
 'Peter said that the sun is shining?'  
 (Only as a DQ about Peter's utterance, not about whether the sun is shining)
- b. *Embedded FNQ*  
 \*Peter sa att inte skiner solen?  
 Peter said that not shines the.sun  
 Intended  $\approx$  'Peter said that surely the sun isn't shining?'  
 (Syntactic violations: no verb movement in embedded clauses allowed, no CP recursion allowed:  
 \*[CP  $\emptyset$  [C att [CP inte [C skiner<sub>i</sub> [TP ... [VP [DP solen] [V t<sub>i</sub>]]]]]])

Declarative questions will be discussed in greater detail in section 4.1, where they will also be compared to rejecting questions, to which we turn next.

## 2.2. Rejections and rejecting questions

Let us now turn to rejections and rejecting questions. Rejections are not truly new assertions of a negative proposition, they occur in non-neutral contexts, and negotiate the Common Ground (CG) status of a controversial proposition (cf. van der Sandt 1991 and Repp 2009).<sup>3</sup> This is in contrast to negative assertions, which can introduce a non-controversial, new proposition into CG in a neutral context. This is illustrated with the contrast between (7) and (8): in (7), the negative assertion is used to introduce new information that none of the interlocutors necessarily had any public commitment to. If every interlocutor accepts the negative proposition as true there is no explicit acknowledgment needed from anyone and the proposition is added to CG (cf. Farkas & Roelofsen 2012:21 on the optionality of responses to assertions). A negated utterance with fronted negation is not licit in such a neutral context (7b).

In (8), on the other hand, Mary's indirect question presupposes the proposition 'that Peter is coming'. Mary is now publically committed to this presupposed proposition, and the context is not neutral any longer, but biased in favour of this proposition. Jim can either accept it tacitly or overtly, or he has to reject it. An utterance with fronted negation *can* be used here (8b). In other words, if fronted negation occurs in non-questioning speech acts, it must occur in rejections, while low negation can occur in rejections *and* assertions.<sup>4</sup>

### (7) *Negative assertion*

Contextual evidence: neutral

Speaker's assertion:  $\neg p$

Speaker's previous belief with respect to  $\{p, \neg p\}$ : any or none<sup>5</sup>

#### a. *Low negation*

Peter ringde mig just nu. Han kommer inte till mötet.

Peter called me just now he comes not to the.meeting

#### b. *Fronted negation*

Peter ringde mig just nu. #Inte kommer han till mötet.

Peter called me just now not comes he to the.meeting

Intended for both: 'I just got a call from Peter. He isn't coming to the meeting.'

<sup>3</sup> Following Gunlogson (2008:110), I assume that a proposition  $p$  is controversial in a context  $C$  iff  $\neg p$  is a commitment of at least one but not all interlocutors, and  $p$  is not a commitment of all interlocutors.

<sup>4</sup> See section 4 for a qualification of this statement.

<sup>5</sup> For more details on speaker preference and speaker beliefs, see sections 4.3 and 5.

(8) *Rejection*Contextual evidence:  $p$ Speaker's assertion:  $\neg p$ Speaker's previous belief with respect to  $\{p, \neg p\}$ :  $\neg p$ 

Context for both (a) and (b): Mary says: 'I wonder when Peter will finally show up.'

Jim replies:

a. *Low negation*

Han kommer inte till mötet.

He comes not to the.meeting

b. *Fronted negation*

Inte kommer han till mötet.

Not comes he to the.meeting

'He isn't coming to the meeting.'

Examples of rejecting questions are given in (9). Note that low negation is not licit here (9a) unless it is combined with the modal particle 'väl'. Fronted negation can occur with or without 'väl' in a rejecting question, with no change of communicative effect. Let us first investigate the difference between (9a) *with* the modal particle and (8a), the utterance with low negation but no modal particle, since there is a formal difference to go with the functional difference. (9a) is supposed to be informative; Mary can for example react with 'Oh, OK'. (9a) is not informative; Mary cannot acknowledge that Jim told her that Peter isn't coming, because that is not what Jim has done. What Jim has done is indicate a *preference* for excluding  $p$  ('that Peter is coming to the meeting') from CG, without outright asserting  $\neg p$  like in (8a). This allows inferences about his previous belief state that will be described in greater detail in section 3.3. For the moment, note that there is no lexical or intonational difference between (8b) and (9b), so while the modal particle in (9a) may be part of the explanation of the difference between rejections and rejecting questions with low negation, it will likely not be a sufficient explanation for rejections and rejecting questions with fronted negation.

(9) *Rejecting question*Contextual evidence:  $p$ 

Speaker's assertion: none

Speaker's previous belief with respect to  $\{p, \neg p\}$ :  $\neg p$ 

Context for both (a) and (b): Mary says: 'I wonder when Peter will finally show up.'

Jim replies:

a. *Low negation*

Han kommer #(väl) inte till mötet?

He comes MP<sup>6</sup> not to the.meetingb. *Fronted negation*

Inte kommer han till mötet?

<sup>6</sup> MP stands for 'modal particle'. I will not go into detail with respect to the precise contributions or meanings of Swedish and German modal particles in this article, and instead just note when they are obligatory for a certain reading of their host sentence.



Not comes he to the.meeting  
 Intended for both: 'Surely he isn't coming to the meeting?'

For comparison, consider the English and German utterances in (10), which I propose can also be classified as rejecting questions. Like the Swedish rejecting question with low negation in (9a), these have to be lexically disambiguated from rejections – with modal particles in German, and in English with an adverb ('surely') that lexically indicates a high degree of certainty on the part of the speaker. Swedish fronted negation is 'odd', cross-linguistically, in not requiring any overt means of disambiguation between rejections and rejecting questions.

- (10) Context for both (a) and (b): Mary says: 'I wonder when Peter will finally show up.' Jim replies:
- a. Surely he's not coming to the meeting?
  - b. Er kommt #(doch wohl) nicht zum Meeting?  
 He comes MP MP not to.the meeting

### 2.3. Suggesting questions

Recall that both (1) and (2), i.e. Swedish negated declaratives both with low and with fronted negation, have a reading I labelled 'suggesting question'. These are (usually) polite questions that emphasize that the speaker does not expect an affirmative answer, similar to the English question given in (11). I call them 'suggesting' questions because the speaker is generally interested in an affirmative answer – i.e. the speaker suggests that a proposition might be true even though it is unlikely.

- (11) You wouldn't happen to know the answer (, would you?)

In English or German this reading requires the support of modal particles or modal verbs ('would' in (11)), adverbs or verbs that stress that the underlying proposition is true only by coincidence ('happen' in (11)), and/or question tags, although, with an appropriate, somewhat special intonation, negation alone can be enough, at least in German. In Swedish, the suggestion reading can be reinforced with these elements, as well, but reinforcement is much less necessary than it is in English and German. In other words, in Swedish there is no obligatory disambiguation between '*You wouldn't happen to know the answer?*' (a suggesting question with low negation) and '*You don't know the answer.*' (a declarative assertion with low negation). Since the focus of this article is on properties of fronted negation, and since the availability of the suggestion reading is a property of Swedish negation in general, the issue of how the suggesting question reading arises without the support of modalising elements or question tags will be left to further research.<sup>7</sup>

<sup>7</sup> It is the negative particle that makes the suggestion reading available, cf. (i) below: an unnegated declarative can only be understood as a declarative assertion (or question, with rising intonation, which requires contextual evidence for its underlying proposition).

(i) Du vet svaret. / ?  
 You know the.answer

### 3. Previous accounts of FN

Fronted negation (variously called ‘negative preposing’ and ‘topicalised negation’) has not received much attention in the literature so far. Usually it is only brought up as a diagnostic for the phrasal status of negation in the North Germanic languages (e.g. in Holmberg & Platzack 1995). To my knowledge, there are two different classifications of subtypes of FN, which have been proposed by Petersson (2008) and Lindström (2007). I will give a short overview of Lindström’s classification.

Lindström (2007) identifies three functional subtypes of FN: *additive*, *interrogative* and *responsive* negation. Additive negation occurs in lists of negative (but not necessarily negated) propositions; interrogative negation is Lindström’s term for all types of questioning utterances with FN (be they suggesting or rejecting); and responsive negation essentially includes every other usage that is not included in the other two categories. I will exclude additive negation from the discussion for a variety of reasons: it does not exhibit any modal effects, is entirely optionally fronted (i.e. in (12), there is no difference in meaning whether one, both or none of the negative markers are fronted), and it behaves exactly like low negation – i.e. if it occurs in questions, it only ever occurs in true NDQs. Furthermore, the negative particle is stressed in cases of additive negation and unstressed in cases of interrogative and responsive negation. I assume that there is a different mechanism of fronting underlying additive negation, but set this issue aside for now (cf. Østbø Munch 2013:241 for a syntactic analysis along these lines).

(12) *Additive negation*

Han kom inte till mötet igår och inte kom han idag heller.  
 He came not to the meeting yesterday and not came he today either  
 ‘He didn’t come to the meeting yesterday and neither did he come today.’

I hope to show that it is not possible to draw a strict division between the other two types, as discussed in sections 4 and 5.

Two recent articles, Brandtler & Håkansson (2012, 2014), have focused exclusively on fronted negation. They propose an analysis that boils down to FN associating with a contrastively focused element in the sentence. In particular, they make the claim that a rejection with FN is always functionally identical to a sentence with the contrastively focused element in a cleft. That this is not always the case can be shown with example (8b), which is repeated below. There is no contrastive focus in (8b), therefore all cleft paraphrases fail.

(8) b. *Fronted negation*

Inte kommer han till mötet.

---

= ‘You know the answer. / ?’

≠ ‘You happen to know the answer?’

≠ ‘Do you happen to know the answer?’

- Not comes he to the.meeting  
'He isn't coming to the meeting.'
- ≠ Det är inte HAN som kommer till mötet  
It is not he REL.PR comes to the.meeting  
'It's not HIM that is coming to the meeting.'
- ≠ Det är inte till MÖTET som han kommer  
It is not to the.meeting REL.PR he comes  
'It's not to the MEETING that he's coming.'

A similar approach has been proposed by Zeijlstra (2013) – here, fronted negation is analysed as the result of a process of partial topicalisation of a contrastively focussed constituent, which faces the same problem as Brandtler & Håkansson's approach: while it is certainly possible for fronted negation to be associated with contrastive focus lower in the sentence, it is not required.

#### 4. A close look at declarative vs rejecting questions

This section widens the scope from fronted negation in order to give a detailed overview of the various ways in which declarative questions and rejecting questions differ. There are three main differences to discuss: context conditions (discussed in section 4.1), licencing of polarity items (discussed in section 4.2), and expression of speaker beliefs (discussed in section 4.3).

##### 4.1. Context conditions on declarative questions and on rejecting questions

As has been mentioned in section 2.1, DQs require contextual evidence that is of the same polarity as that of the questioned proposition. This is illustrated with Swedish DQs in the (a) and (b) examples of (13) and (14). The context with contextual evidence for  $\neg p$  in (13) allows NDQs (13b), but no PDQs (13a), while the context with contextual evidence for  $p$  in (14) allows PDQs (14a), but no NDQs (14b). (13c) through (13f) show what has been mentioned already: in a context that licences NDQs, rejecting questions are not licit. Rejecting questions are licenced if there is contextual evidence for  $p$ , cf. (14c) through (14f).

- (13) *Evidence for  $\neg p$ : licencing of NDQs, anti-licencing of PDQs and rejecting questions*  
Context: Peter is sitting in a windowless room. Mary comes in with a closed, dry umbrella.  
Peter says:
- a. *Positive declarative question*  
#Det regnar?  
It rains
  - b. *Negative declarative question*  
Det regnar inte?  
It rains not
  - c. *Rejecting question with fronted negation*  
#Inte regnar det?  
Not rains it

- d. *Rejecting question with 'väl'*  
#Det regnar väl inte?  
It rains MP not

- e. *English rejecting question*  
#Surely it's not raining?
  - f. *German rejecting question*  
#Es regnet doch wohl nicht?  
It rains MP MP not
- (14) *Evidence for p: licencing of PDQs and rejecting questions, anti-licencing of NDQs*  
Context: Peter is sitting in a windowless room. Mary comes in dripping wet.  
Peter says:
- a. *Positive declarative question*  
Det regnar?  
It rains
  - b. *Negative declarative question*  
#Det regnar inte?  
It rains not
  - c. *Rejecting question with fronted negation*  
Inte regnar det?  
Not rains it
  - d. *Rejecting question with 'väl'*  
Det regnar väl inte?  
It rains MP not
  - e. *English rejecting question*  
?Surely it's not raining?
  - f. *German rejecting question*  
Es regnet doch wohl nicht?  
It rains MP MP not

#### 4.2. Polarity items

Fronted negation does not anti-licence positive polarity items (PPIs) and does not licence negative polarity items (NPIs). (15a) gives an example of a PPI occurring in the scope of FN; (15b) shows an NPI failing to be licenced by FN.

- (15) a. *PPIs in FN questions: redan ('already')*  
Context: Peter and Mary are at a cake eating contest.  
Mary: 'I don't know if I'm going to be able to finish this whole cake.'  
Peter replies:  
Inte tänker du ge upp redan<sup>PPI</sup>?  
Not want you give up already  
'Surely you don't want to give up already?'

- b. *NPIs in FN questions: någonsin ('ever')*  
 Context: Peter and Mary are about to travel to Greenland.  
 Mary: 'It will be nice to see Greenland again.'  
 Peter replies:  
 \*Inte har du någonsin<sup>NPI</sup> varit på Grönland?  
 Not have you ever been on Greenland  
 'Surely you haven't ever been to Greenland?'

(16) shows that normal negative declarative questions anti-licence PPIs (16a) and licence NPIs (16b).

- (16) a. *PPIs in NDQs: redan ('already')*  
 Context: Peter and Mary are at a cake eating contest.  
 Mary: 'It's too early to give up.'  
 Peter replies:  
 \*Du tänker inte ge upp redan<sup>PPI</sup>?  
 You want not give up already  
 'You don't want to give up already?'
- b. *NPIs in NDQs: någonsin ('ever')*  
 Context: Peter and Mary are about to travel to Greenland.  
 Mary: 'It will be nice to finally see Greenland.'  
 Peter replies:  
 Du har inte någonsin<sup>NPI</sup> varit på Grönland?  
 You have not ever been on Greenland  
 'You haven't ever been to Greenland?'

This pattern is reminiscent of the difference in PI licencing between polar questions with outer negation (ONPQs) and polar questions with inner negation (INPQs), as described for English by Romero & Han (2004). German examples are given in (17). This difference has been analysed by Romero & Han (2004) as resulting from the scopal interaction between negation and the VERUM operator, which is used to express that the speaker is sure that *p* should be added to CG (first proposed by Höhle 1992), and by Romero (2014) as resulting from FALSUM occurring in ONPQs (FALSUM being an operator used to express that *p* should not be added to CG – proposed by Repp (2009), who also discusses PI licencing under negation and FALSUM). LFs of the sentences in (17) are given in (18).

- (17) a. *Ambiguous negative polar question*  
 Ist Peter nicht in der Schule?  
 Is Peter not in the school  
 Reading 1: 'Is it the case that Peter is not at school?'  
 Reading 2: 'Is it not the case that Peter is at school?'

- b. *PPI in negative polar question: only outer negation reading is available*  
 Ist Peter nicht schon<sup>PPI</sup> in der Schule?  
 Is Peter not already in the school  
 Reading 1: \*‘Is it the case that Peter is not already at school?’  
 Reading 2: ‘Is it not the case that Peter is already at school?’
- c. *NPI in negative polar question: only inner negation reading is available*  
 Hat Peter nicht [alle Tassen im Schrank]<sup>NPI</sup>?  
 Has Peter not all cups in the cupboard  
 Reading 1: ‘Is it the case that Peter is not quite right in the head?’  
 Reading 2: \*‘Is it not the case that Peter is quite right in the head?’
- (18) (17a), reading 1; (17c): [CP Q [ NEG [TP ... \*PPI/NPI ...]]  
 (17a), reading 2; (17b): [CP Q [ FALSUM [TP ... PPI/\*NPI ...]]

I will continue the discussion of NPQs in the following section on speaker beliefs. Returning to rejecting questions, consider (19), which gives a German example of a PPI occurring directly below negation in a rejecting question. The same goes for English ‘surely not’ questions, cf. (20). This seems to suggest that negation shows unorthodox PI licensing behaviour in rejecting questions cross-linguistically.

- (19) Context: there is contextual evidence that Peter is at school earlier than normal. Mary says:  
 Peter ist doch wohl nicht schon<sup>PPI</sup> in der Schule?  
 Peter is MP MP not already in the school  
 ‘Surely Peter isn’t at school already?’

- (20) Surely you wouldn’t [rather be]<sup>PPI</sup> somewhere<sup>PPI</sup> else?

#### 4.3. Speaker beliefs

Rejecting questions allow inferences about the speaker’s previous beliefs and her willingness to accept the questioned proposition that declarative questions do not (at least in the absence of incredulity intonation or extralinguistic cues like e.g. facial expression). In (21a), the only conclusion that can be drawn about Peter’s previous belief state is that he did not know that it was raining. This is because he chooses to ask a question at all; if he had previously been sure that it was raining, there would be no reason for him to ask a question. There is no reason to believe that he is unwilling to accept that it is raining (in the absence of incredulity intonation), or that he would prefer the present state of affairs to be such that it is not raining (outside of any world knowledge biases to that effect).

In (21b), the same inference that Peter did not know that it was raining can be drawn, but in addition to that, it can be inferred that – at the very least – he would prefer  $\neg p$  over  $p$ . Even stronger inferences can (but do not have to) be drawn, namely that he was committed to  $\neg p$ , and possibly even that he refuses to believe  $p$ . Questions with FN can even border on the rhetorical in

the sense that the speaker seems to all but presuppose one of two answers (namely  $\neg p$ ), but compared to a negated declarative with low negation, falling intonation, and no modal particles (21c), there is still at least a pretence on the part of the speaker of being willing to be overruled (note that (21c), without any other accompanying speech acts – e.g. a preceding 'Why are you wet?' – is bizarrely uncooperative).<sup>8</sup>

(21) *Contextual evidence for p (=14)*

Context: Peter is sitting in a windowless room. Mary comes in dripping wet.

Peter says:

- a. *Positive declarative question*  
Det regnar?  
It rains  
'It's raining?'
- b. *Rejecting question with FN*  
Inte regnar det?  
Not rains it  
 $\approx$ 'Surely it's not raining?'
- c. *Negative declarative assertion*  
#Det regnar inte.  
It rains not  
'It's not raining.'

Inferences about the speaker's belief state can be made explicit. In the following, we compare reactions to Peter's utterances in (21) above. In particular, we want to see if it is possible to presuppose or double-check surprise on the part of Peter after his questions in (21). In (22a), a wh-question about the reason for Peter's surprise is asked – that he was surprised is therefore presupposed. This is strange after a positive declarative question, but fine after a question with fronted negation. (22b) shows that, while Peter can be asked whether he is surprised after he uttered a PDQ, this question must be neutral and must not contain 'verkligen' ('really'), which I propose expresses VERUM focus and therefore double-checks whether to add the proposition 'that Peter was surprised' to CG (cf. Romero & Han 2004 on English 'really'). Since this proposition is not inferable from the context of Peter asking a PDQ, it cannot be double-checked very well. Conversely, double-checking whether to add 'Peter is surprised that it is raining' is fine after an FNQ, since an FNQ introduces this speaker-oriented bias.

(22) *Reactions to (21)*

- a. *Presupposing that the speaker of (21) is surprised*  
Varför överraskar dig det?  
Why surprises you that  
'Why does that surprise you?'

<sup>8</sup> Questions with FN cannot be true rhetorical questions, however, since polar rhetorical questions differ in polarity between their form (e.g. 'After all, is it raining?' – positive) and their meaning (e.g. 'It is not raining.' – negative), while questions with FN, if they are taken to be assertions, are still negated assertions.



- OK after rejecting question  
Marked after PDQ
- b. *Double-checking whether the speaker of (21) is surprised*  
Överraskar dig det verkligen?  
Surprises you that really  
'Does that really surprise you?'  
OK after rejecting question  
Marked after PDQ

Let us come back to the comparison between rejecting questions and ONPQs begun in the previous section. Although both of these question types fail to anti-licence PPIs, they seem to be exact opposites in terms of speaker expectation and contextual evidence requirements. Consider (17b) and (19), repeated here as (23), and their contextual parameters given in (24). An ONPQ requires that the speaker believe that a positive proposition is true in the face of absence of evidence for it, while a rejecting question requires that the speaker believe that a positive proposition is false in the face of evidence for it.

- (23) a. *Rejecting question*  
Peter ist doch wohl nicht schon<sup>PPI</sup> in der Schule?  
Peter is MP MP not already in the school  
'Surely Peter isn't at school already?'
- b. *Polar question with outer negation*  
Ist Peter nicht schon<sup>PPI</sup> in der Schule?  
Is Peter not already in the school  
'Isn't Peter already at school?'
- (24) a. *Rejecting question (23a):*  
*p*: 'Peter is already at school'  
Speaker believes  $\neg p$   
There must be contextual evidence for *p* (see section 4.1)
- b. *ONPQ (23b):*  
*p*: 'Peter is already at school'  
Speaker believes *p*  
There must be no contextual evidence for *p* (cf. Büring & Gunlogson 2000)

The epistemic bias of ONPQs can also be made explicit in responses to them, in which questioning the speaker's beliefs is fine after an ONPQ (25a), but presumptuous after a PPQ (25b).

- (25) a. Mary: Isn't Peter already at school?  
Jim: It's 7 o'clock. Did you really think he'd be at school already?
- b. Mary: Is Peter already at school?  
Jim: It's 7 o'clock. ??Did you really think he'd be at school already?

## 5. The meaning of rejecting questions

Let us take declarative questions as a foundation for the analysis. To reiterate: the negation in DQs is propositional, and therefore anti-licences PPIs. DQs are assertions, but directly involve the addressee in a way that non-questions do not. This can be modelled by assuming contingent commitment, following Gunlogson (2008), or by way of the REQUEST operator, following Krifka (to appear) – the important point is that this addressee reference explains why DQs are illicit if the addressee is asked to assert something that is not compatible with contextual evidence. The meaning of a declarative question (containing negation) is given in (26).

(26) *Declarative question:*

[<sub>ForceP</sub> REQUEST<sub><S,A></sub> [<sub>ForceP</sub> ASSERT ... [<sub>CP</sub> V ... [<sub>TP</sub> NEG [<sub>TP</sub> ... \*PPI/NPI ...]]]]

Rejections or denials with fronted negation (and rejections in general) contain FALSUM. The speaker is asserting (unconditionally) that a proposition  $p$ , which needs to be sourced by the addressee (hence explaining why assertions with fronted negation cannot be regular negated assertions of new material), should not be part of CG. FALSUM allows PPIs to occur in its scope, since there is no negation at the propositional level. The definition of FALSUM and the meaning of a rejection (no matter the surface position of negation) are given in (27) and (28).  $\text{Epi}_x(w)$  is the set of worlds that conform to  $x$ 's knowledge in  $w$ , and  $\text{Conv}_x(w')$  is the set of worlds that conform to  $x$ 's conversational goals in  $w'$ .

(27)  $[[\text{FALSUM}]]^x = \lambda p_{\langle s,t \rangle} \lambda w. \forall w' \in \text{Epi}_x(w) [\forall w'' \in \text{Conv}_x(w') [p \notin \text{CG}_{w''}]]$

(28) *Rejection/denial:*

[<sub>ForceP</sub> ASSERT [<sub>ForceP</sub> FALSUM ... [<sub>CP</sub> V ... [<sub>TP</sub> ... PPI/\*NPI ...]]]]

The meaning of rejecting questions cannot be identical to (28) because, among other reasons, rejecting questions are never informative. But if we simply assume the above meaning, except embedded under another CG management operator that yields a question-like interpretation, namely REQUEST, we encounter the problem that the addressee cannot be reasonably expected to assert FALSUM( $p$ ) in the contexts in which FNQs are licit (because the addressee can be actually committed to  $p$  prior to the rejecting question). This arguably incorrect meaning is illustrated in (29).

(29) *Rejecting question (problematic meaning):*

#[<sub>ForceP</sub> REQUEST<sub><S,A></sub> [<sub>ForceP</sub> ASSERT [<sub>ForceP</sub> FALSUM ... [<sub>CP</sub> V ... [<sub>TP</sub> ... PPI/\*NPI ...]]]]

In general, since rejections and rejecting questions are so close in meaning and, in Swedish, in form, it would be desirable to have minimal difference between the meaning of rejecting questions and (28), i.e. the meaning of rejections. I propose that this minimal difference hinges on the ASSERT operator. Rejections are actual, unconditional speech acts: as soon as a rejection is uttered, the speaker has excluded  $p$  from CG. Rejecting questions on the other hand are conditional speech acts: the speaker does not fully commit to excluding  $p$  from CG unless further

conditions are met. I use  $\text{ASSERT}_{\text{tentative}}$  as a name for this modified speech act operator in (30), with the caveat that the resulting utterance is not a tentative assertion in the sense of Farkas & Roelofsen (2012), i.e. it is not a declarative question / rising declarative.

(30) *Rejecting question:*

[ForceP  $\text{ASSERT}_{\text{tentative}}$  [ForceP  $\text{FALSUM}$  ... [CP V ... [TP ... PPI/\*NPI ...]]]]

Tentative or contingent commitment in this sense must not strictly be dependent upon the addressee (as it is assumed by Gunlogson 2008), because otherwise the previously discussed problem arises that in a context that licences a rejecting question, the addressee is usually not a possible source for  $\text{FALSUM}(p)$ . Instead, what contingent commitment does in rejecting questions is to restrict future discourse moves. In particular, the speaker makes it impossible for herself to insist on the truth of  $\text{FALSUM}(p)$  – if the addressee insists on  $p$ , the speaker must yield (cf. (31b), as opposed to the actual rejection in (31a)). The meaning of a rejecting question can be paraphrased as ‘I will reject  $p$  unless I am given a reason not to reject it (and if given that reason, I will accept being overruled)’. Furthermore, we have to assume that if no reason is given,  $p$  will not actually be rejected, because the speaker of a rejecting question cannot be held accountable for the truth of  $\text{FALSUM}(p)$  if it later turns out that  $p$  is true, as illustrated by (32). In other words, the CG status of  $p$  remains unclear after a rejecting question until and unless some interlocutor sources either  $p$  or  $\neg p$ .

- (31) a. Mary: I wonder when Peter will show up.  
       Jim: Peter is not coming to the meeting.  
       Mary: Yes, he IS.  
       Jim: Oh, OK. / No, he ISN'T.
- b. Mary: I wonder when Peter will show up.  
       Jim: Surely Peter's not coming to the meeting?  
       Mary: Yes, he IS.  
       Jim: Oh, OK. / #No, he ISN'T.
- (32) Mary: I wonder when Peter will show up.  
       Jim: Surely Peter's not coming to the meeting?  
       Mary: I don't actually know. I just assumed he was coming.  
       *Later, Peter enters the room.*  
       Mary: ??Hey Jim, you were wrong.

Another reason why direct addressee-reference should be absent from the meaning of rejecting questions is that in certain contexts, rejecting questions are licit even if the addressee is not a better source for either  $p$  or  $\neg p$  than the speaker, cf. (33). The core pragmatic effect of rejecting questions seems to be that the speaker indicates that she would prefer to exclude  $p$  from CG, but is not certain enough to actually exclude it. It is *possible* for the addressee to clear up the issue of whether  $p$  should be in CG or not, but the only necessary reaction that is needed from the addressee is an acknowledgment of the speaker's wish to exclude  $p$  from CG (i.e. in (33), Peter has to at least indicate his own ignorance).

- (33) Mary and Peter are in a windowless room and both ignorant of the weather, but there is the sound of raindrops on the roof.  
 Mary says:  
 Es regnet doch wohl nicht?  
 It rains MP MP not  
 ≈ 'Surely it's not raining?'

For the Swedish data, the question arises how the two ASSERT operators are encoded if there is no intonational or lexical difference whatsoever between Swedish FNQs and rejections. Falling declaratives that are understood as questions (e.g. 'You got a haircut.') face the same problem, which is solved by Gunlogson (2008) by assuming that the context in such a case all but requires the speaker's commitment to be contingent (i.e. the speaker almost certainly cannot intend to inform someone that they got a haircut, which gives rise to the pragmatic effect of the speaker seeking confirmation). This route is not available for rejecting questions with fronted negation because the speaker *can* intend to inform someone e.g. that Peter is not coming to the meeting. I will therefore have to assume that in Swedish there is some yet to be found intonational difference between rejections with fronted negation and rejecting questions which is not the same as that between declarative assertions and DQs (i.e. a final rise), but still sufficient to signal that the speaker is not performing an outright rejection. Further research is required on this issue.

Another question that remains unanswered is the precise syntactic process of fronting of the negative marker in Swedish, in particular with respect to the difference between fronted negation as discussed in this article and additive negation in the sense mentioned in section 3, which almost certainly does not express *FALSUM*. Furthermore, an analysis of the interaction of negation and modal particles is required, because while Swedish low negation can be used in actual rejections, it requires the support of the modal particle 'väl' to be used in rejecting questions – if intonation is sufficient to disambiguate rejections from rejecting questions in the case of fronted negation, as postulated above, it should also be sufficient for the same task in the case of low negation, which it is not. Since modal particles are also required to produce a rejecting question reading in German, they will have to be taken into account more explicitly.

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# Using Tautologies and Contradictions\*

Todd Snider — *Cornell University*

**Abstract.** Tautologies are necessarily true, contradictions necessarily false, and so one might expect neither of them to be conversationally useful. Since at least Grice 1975, however, felicitous uses of tautologies have been noted. In this paper, I present an analysis of felicitous uses of tautologies and contradictions where each gives rise to an implication. For tautologies, this implication is a specific conversational implicature, an uncontrollability implicature; for contradictions it is part of the literal content, a contextual restriction that arises as a result of the process of semantic interpretation. I argue that other accounts of these phenomena have not been sufficiently general.

**Keywords:** tautology, contradiction, conversational implicature, at-issue, vagueness

## 1. Introduction

Tautologies and contradictions have long been thought to be well understood. Tautologies have been much discussed in the literature, especially regarding the question of whether to account for nominal tautologies—those with a repeated noun phrase, like *Boys will be boys*—in the semantics (Wierzbicka 1987, 1988) or pragmatics (Levinson 1983; Ward and Hirschberg 1991) or both (Fraser 1988; Gibbs Jr. and McCarrell 1990; Bulhof and Gimbel 2001, 2004), and how. Of these accounts, none provide a unified analysis which captures the uses of different shapes of tautologies by means of a single mechanism. Contradictions have also garnered some attention (Ripley 2011; Sauerland 2011; Cobreros, Egré, Ripley, and van Rooij 2012; Alxatib, Pagin, and Sauerland 2013), though there too only some of the relevant phenomena have been addressed. In this paper, I present general analyses for tautologies and contradictions.

### 1.1. The puzzle

In this paper, I examine felicitous uses of tautologies and contradictions such as those in (1) and (2), respectively.<sup>1</sup>

- |     |    |                                       |                                   |
|-----|----|---------------------------------------|-----------------------------------|
| (1) | a. | I'll be there if I'll be there.       | <i>propositional, conditional</i> |
|     | b. | Either I'll like him or I won't.      | <i>propositional, disjunctive</i> |
|     | c. | Hubert is Hubert.                     | <i>nominal, equative</i>          |
| (2) | a. | Janice is smart, but she isn't smart. | <i>propositional, conjunctive</i> |
|     | b. | If Peter is there, he won't be there. | <i>propositional, conditional</i> |
|     | c. | Kevin isn't Kevin.                    | <i>nominal, equative</i>          |

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<sup>1</sup>Most of the literature focuses on nominal tautologies like *Boys will be boys*, but some argue that these aren't equative constructions—and in fact that English has no equative constructions—, and so are not truly tautologies (Moro 1997; Adger and Ramchand 2003, among others; see Heycock and Kroch 1999; Heycock 2012 for the opposite view). Instead, I will focus on propositional tautologies (and contradictions), which aren't subject to this critique.

The prominent theory of assertion developed in Stalnaker 1974, 1978 lists as principles of non-defective conversation that a proposition asserted should be compatible with at least some of the worlds in the context set (lest it be “self-defeating”) and that it should not be true in all worlds in the context set (lest it be “something that is already done”), the result of these two conditions being that “a proposition asserted is always true in some but not all of the possible worlds in the context set”. Contradictions, being necessarily false, violate the first condition of this principle: they denote no worlds, and so will denote no worlds in any context set. Rather than being informative, they are overinformative; intersecting a context set with the (empty set of) worlds denoted by a contradiction yields an empty context set: the absurd state. Tautologies, on the other hand, being necessarily true, violate the second condition: they denote all worlds, so will denote the entirety of any context set. Rather than being informative, they are uninformative; intersecting a context set with the (entire universe of) worlds denoted by a tautology yields an unchanged context set.

Considering that neither tautologies nor contradictions are informative in the normal way, we might expect them not to be conversationally useful—but there are felicitous uses, as seen above. And if both were to be useful, we might expect them to behave in the same way—but in fact they don’t, as we’ll see shortly. I’ll show that tautologies and contradictions each give rise to an implication.<sup>2</sup> For tautologies, this implication is a particular conversational implicature, an uncontrollability implicature. For contradictions, this implication is actually part of the literal content, a result of the process of semantic interpretation.

## 2. Tautologies

### 2.1. Data

For looking at the behavior of tautologies, we’ll focus primarily on one example, (3). Though not all tautologies are conditionals, the story is basically the same across different shapes of tautologies, and I’ll highlight some noteworthy differences along the way.

[Antoine has been pestering Cheryl all week, asking her if she’ll be at his party on Saturday night. After the twentieth time he’s asked her, she responds:]

- (3) I’ll be there if I’ll be there.

In this context, Cheryl is using (3) to politely absolve herself of responsibility for her actions, to discharge any obligation to attend or (at least) to answer about her attendance. She’s saying that her attendance is beyond her control—call this an uncontrollability implication: an implication that the proposition is beyond the control of at least the speaker. She is (politely) refusing to answer Antoine’s question, in a sense saying only that she can’t answer his question; we might even be tempted to paraphrase (3) as *Stop asking!*, but this is a secondary implication, derived from it being beyond her control. (I’ll defend this claim in a moment.) The question arises, then: where do we see this uncontrollability implication, and where does it come from?

<sup>2</sup>I use *implication* in the Tonhauser, Beaver, Roberts, and Simons (2013: 70) sense, intended to be neutral about the nature of the inferred information (entailment, presupposition, conventional implicature, etc.), not to be confused with *implicature*. You can think of an implication as a ‘proposition conveyed to the hearer’.

This uncontrollability implication isn't solely a consequence of (3)'s future tense or first person, as one might think; in fact, we see the same implication arise with third person uses in the past, present, and future:

- (4) A: While you were away, the cat broke your lamp.  
B: If it broke, it broke.
- (5) A: While you were away, the cat knocked over your lamp, and (now) it's broken.  
B: If it's broken, it's broken.
- (6) A: What happens if, while you're away, your cat breaks your lamp?  
B: If it breaks, it breaks.

In all of these cases, the lamp owner (B) expresses a lack of control over the lamp's (present or future) state. In all of these cases, the speaker means something like *There's nothing I/anyone can do about it (now)*. These examples also demonstrate this implication's tendency to be understood as describing not just the control of the speaker, but of everyone. Note that this happens whether the lamp's being broken is known (as in (4) and (5)) or unknown (as in (6)), so this is truly an implication about (un)controllability, not (a lack of) knowledge.

The felicity of an utterance of a tautology is tied to the availability of this uncontrollability implication. We return here to the invitation context of (3):

- (7) # It's entirely up to me. I'll be there if I'll be there.
- (8) # Nothing could possibly stop me. I'll be there if I'll be there.

Cheryl's explicitly claiming control over her decision makes the utterance bizarre, as we can see in (7–8). Denying her control, though, is felicitous:

- (9)  $\left\{ \begin{array}{l} \text{It's out of my hands.} \\ \text{It's beyond my control.} \end{array} \right\}$  I'll be there if I'll be there.
- (10) I'll be there if I'll be there, (but)  $\left\{ \begin{array}{l} \text{It's out of my hands.} \\ \text{It's beyond my control.} \end{array} \right\}$

We don't get the same behavior, though, for the *Stop asking* paraphrase mentioned above.

- (11) Nothing could possibly stop me. Stop asking.
- (12) It's out of my hands. Stop asking.

We can felicitously combine *Stop asking* with the explicit claim on control, while we can't do the same with tautologies (as demonstrated in (7–8)). This fits with my characterization of this meaning as secondary and contextual—being derived from the uncontrollability implication—as it behaves differently from the tautology itself.

Importantly, the uncontrollability implication is sensitive not just to the speaker's control, but also to other agents' and even non-agents' influence over the relevant events. Mentioning other influences can make an utterance of a tautology infelicitous:



- (13) a. # I'm not sure I can handle it. It's up to my doctor. I'll be there if I'll be there.  
 b. I'm not sure I can handle it. It's up to my doctor. I'll be there if she says it's okay.
- (14) a. # It depends on the weather. I'll be there if I'll be there.  
 b. It depends on the weather. I'll be there if it's not raining.

In (13a), Cheryl's attendance is up to her doctor, and uttering the tautology is infelicitous. Contrast (13a) with the much more natural (13b), which replaces the conditional's antecedent with the relevant determining influence. Similarly, (14a) conditions Cheryl's attendance on a known influence other than herself—here not any agent's behavior, but nature—and here too the tautology is infelicitous. The more natural (14b) replaces the antecedent with the relevant condition, and is felicitous in the same context. Importantly, in these cases, knowing about the conditions on Cheryl's attendance renders the utterance of a tautology infelicitous, even if those conditions are themselves out of the speaker's control. We can see this effect scale with the amount of knowledge one has about the influences on the relevant state of affairs:

[Your interview went well, I heard. Did you get the job?]

- (15) a. I'll get it if I get it.  
 b. It's up to the hiring manager, Dennis. I'll get it if I get it.  
 c. ? It depends on the hiring manager, Dennis. I'll get it if I get it.  
 d. ?/# It depends on whether the hiring manager, Dennis, likes me enough. I'll get it if I get it.  
 e. # It depends on whether the hiring manager, Dennis, thinks I'm tall enough. I'll get it if I get it.  
 f. ## It depends on whether the hiring manager, Dennis, is taller than me. I'll get it if I get it.

In general, there are any number of reasons why a person might or might not be hired, leaving the uninformed candidate free to utter (15a). If the candidate knows that her hiring depends on the personal whims of one person, as in (15d), uttering the tautology is a bit marked but possible—there might be any number of factors determining Dennis's decision, and those factors remain unknown. By the time the candidate knows precisely the determining criterion, as in (15f),—even if she doesn't know the truth or falsity of the matter, if Dennis's height isn't known—the tautology can't be uttered felicitously. In short, the more that's known about the determining factors, the less felicitous the tautology.

Because they express uncontrollability, tautologies tend to convey a sense of finality—they close a line of questioning. In fact, we usually see them in response to a question, or discourse-final:<sup>3</sup>

- (16) PINKSTON: People look at you and say, 'You're 16 years old. What the heck could you possibly know about singing the blues?'  
 LANG: To me, music is music. (CBS Sunday Morning, 1997)

<sup>3</sup>Both examples from COCA (Davies 2008–).

- (17) Traylor warns, “In the end, however hard I work for you, whatever strings I can pull, the buyer’ll either like the product – or he won’t.” (Inc. magazine, 2003)

In a framework like Roberts’s (1996) Question Under Discussion (QUD) model, we can think of tautologies as marking the current QUD-addressing strategy as unanswerable, leading to a shift in strategy or topic.

In looking at the felicitous uses of tautologies, we can also observe that they are subject to the typical conversational norms that we might expect, such as relevance. For instance, even though all tautologies denote the same set of worlds, not just any tautology is felicitous in a given situation. In the context of (3), where *I’ll be there if I’ll be there* is felicitous, the equally tautologous *Walruses live in Spain if walruses live in Spain* isn’t. (Neither walruses nor Spain are relevant to the context, and so can’t lead to the right implication.) Similarly, if the form of a tautology imposes any conversational restrictions, a felicitous use of that tautology must still conform to those restrictions. For example, it is well known that disjunctive utterances are only felicitous when both disjuncts are possible<sup>4</sup> (Simons 1999, 2001). This explains the felicity of (18) and the infelicity of (19) in the same context as (3).

- (18) Either I’ll be there or I won’t.  
 (19) # Either I’ve been invited or I haven’t.

Both disjuncts of (18) are possible in the context, and so (18) is felicitous. This is not the case for (19), on the other hand, whose first disjunct is entailed (and whose second disjunct is obviously false) in the context.

It’s worth noting also that the use of tautologies, and specifically their use to convey uncontrollability, is not just a quirk of English, but is in fact documented in a variety of languages. Conversationally-useful felicitous tautologies have been identified in Korean (Kwon 2009), Japanese (Okamoto 1991, 1993), Cantonese (Wong 2006), Colloquial Jordanian Arabic (Farghal 1992), and Dutch (Bulhof and Gimbel 2004) and these all fit the pattern described here. Considering the diversity of the languages that exhibit this phenomenon, it seems that the conveyance of uncontrollability is a fact about tautologies broadly, not about the conventions or particularities of any specific language.

## 2.2. Analysis

This uncontrollability implication is the core contribution of felicitous uses of tautologies, but what type of content is it? I’ll show in this next section that this uncontrollability implication is in fact a Gricean conversational implicature. As described by Grice (1975), conversational implicatures have four features: cancelability, strengthenability, nondetachability, and calculability. With the not-insignificant caveat that these features are imperfect as diagnostic tools (Sadock 1978; Simons

<sup>4</sup>That is, when each disjunct denotes a proposition which, when intersected with the context set, is non-empty.

2012)—confounded by the tautological nature of our examples—, we’ll see how far we can get by looking at these features.

As we already saw in (7–8), the implication carried by tautologies isn’t explicitly cancelable. (We can understand this infelicity if the only non-trivial content is conveyed by the implication, and so canceling it leaves an uncooperative discourse move.) Strengthening, on the other hand, is possible, as we saw in (9–10). We can test for nondetachability<sup>5</sup> as in (20), replacing *I’ll be there* with a synonymous phrase.<sup>6</sup>

- (20) [Same context:]
- a. If I’m there, I’m there.
  - b. If I can make it, I can make it.

We see in these examples that the uncontrollability implication isn’t carried specifically by the particular forms used in (3), but by the (trivial) content conveyed by the utterance as a whole. This implication, then, is nondetachable; taken in addition to its strengthenability, this supports the claim that the uncontrollability implication is a conversational implicature.

The Gricean calculation which derives the conversationally implicated content from an utterance’s literal content is ultimately the most important factor in demonstrating that an implication is indeed an implicature. These stories come down to two parts: first, we motivate the reasoning about additional content, using Gricean maxims and the literal content of the utterance; second, we derive the additional content from the literal, using general reasoning and deductions about speaker intentions. I’ll now address each step in turn.

Motivating the reasoning process is straightforward, assuming the cooperativity of the speaker (as all Gricean calculations do). Let’s return to (3) in particular, for concreteness. Cheryl said something (whose literal content was) trivially true. She knew Antoine would know it was necessarily true (and she knew he would know that she had, and so forth). But considering that she said something (and didn’t obviously ignore the question or flaunt the maxims), Cheryl must have meant to say something about her attendance.<sup>7</sup> This is the motivation for the reasoning process: Cheryl intended to say something, but the literal content isn’t it, so what is?

The second part of the calculation is deriving the uncontrollability implication from the literal tautology. Given Grice’s Quantity (or Horn’s Q-principle), Cheryl would have said the strongest

<sup>5</sup>As a reminder, content is detachable if it’s tied to a particular form, rather than its content.

<sup>6</sup>We maintain here the form of the tautology, such that all of the examples in (20) are conditionals, but note that we can even get the same meaning with a disjunction like *Either I’ll be there or I won’t*.

<sup>7</sup>One might argue that this is counterintuitive, as it might seem that in some sense Cheryl is *refusing* to say anything (real/useful) about her attendance: she’s refusing to answer the question! But importantly she isn’t just ignoring the question or remaining silent, and the literal content at least bears upon her attendance; she doesn’t respond by talking about her favorite ice cream flavor, after all. It seems to me that, in some real sense, Cheryl is in fact addressing the question, even if only by saying that she can’t answer it.

possible thing, being as informative as possible. She wanted to say something about her attendance, but was unable to say anything stronger than (3), that being the weakest possible utterance; she wasn't willing to endorse any of the possible alternatives—in particular, here, the alternative antecedents to the conditional.<sup>8</sup> (That a calculability story should make use of alternatives is not unusual; we can think of this as an extension of the way alternatives are used for the calculation of scalar implicatures.) If there are no possible combinations of states of affairs that would make the consequent true—the information encoded in the alternative conditional antecedents—beyond setting the value of that proposition directly, then that proposition must be independent of external influences. The hearer can further note that this independence is relative to the speaker's belief state, and then reason that the proposition is at least beyond the speaker's influence (or at least her knowledge about her influence). From a literally tautological statement, then, we can derive the repeated proposition's independence, or at least being beyond the control of the speaker.

We can see from this derivation why it is that we see the behavior observed above. A felicitous tautology's calculation involves understanding the alternatives (here, alternative antecedents) as unendorsable; in (13a) and (14a), context shows the alternatives to be perfectly endorsable, rendering a tautology infelicitous. That no antecedents are relevant is used to derive the causal independence of the proposition, which explains why the more that's known about the influencing factors, the less felicitous a tautology is, as we saw in (15).

We've demonstrated, then, that tautologies trigger a consistent conversational implicature, namely the uncontrollability of the repeated proposition. This uncontrollability implicature is present across all shapes of tautologies, with only minor differences from the propositional conditional tautology explored in depth here. Different shapes are subject to different restrictions, like the relevance restriction on disjunctive tautologies noted in (18–19). Additionally, nominal tautologies invoke some contextual feature of the referent, as causal independence can be understood as a property of propositions but not of individuals; beyond this contextual feature, though, both the behavior and the calculation are the same as above.

### 3. Contradictions

#### 3.1. Data

As we saw in (2), contradictions come in a number of shapes. And, just as we did with tautologies, in addressing contradictions we'll focus primarily on a single example, (21), proposing a unified analysis across the different shapes contradictions can take.

<sup>8</sup>Like Ward and Hirschberg 1991, this analysis makes use of alternatives, things which the speaker could have said but chose not to. Under Ward and Hirschberg's (1991) analysis, however, it is a particular alternative deemed most relevant to the situation at hand which is noticeably not said, and this alternative varies from context to context; how that specific most relevant proposition is identified is unclear. In this analysis, it is not any single alternative, but rather the entire set of possible alternatives, which is noticeably not said. That is to say, the hearer can use the knowledge that the speaker chose the strictly weakest utterance to make inferences about the speaker's beliefs about the world.

[Janice is at the top of her class at a prep school in Manhattan, which she commutes to from Brooklyn. Felicia is talking to Tracy about her.]

Felicia: Did you hear about Janice? Yesterday after school, she accidentally took the bus to Yonkers!

Tracy: Really? Isn't she valedictorian?

(21) Felicia: Janice is smart, but she's not smart.

In this context, Felicia is using (21) to say that Janice is smart in one sense, but not smart in another. The implication<sup>9</sup> is that the interpretations of *smart* are non-identical. Here, we might paraphrase Felicia as saying *Janice is book-smart but not street-smart*. Note, though, that that particular paraphrase is contextually-cued; not every occurrence of the sentence in (21) need carry that same interpretation. For example, consider the same contradiction in a different context:

[Gustavo and Alexandra have been hiking for a week, led by their very capable nature guide, Janice.]

Gustavo: You'll never believe it! Janice told me she failed out of high school.

Alexandra: Really? But she's so knowledgeable about these woods, and such a good guide!

(22) Gustavo: Janice is smart, but she's not smart.

We can't paraphrase (22) the same way as (21); in this context, Janice isn't book-smart, but (something like) hiking-smart—in fact she's explicitly *not* book-smart. In both uses, however, Janice is understood to be smart in some sense but not smart in another.

In (21), we understand each instance of *smart* differently. Indeed, this phenomenon has been noted before: "What we are doing in making [a contradiction] informationally useful is reinterpreting in different ways distinct occurrences of [the repeated predicate]" (Chierchia 2013: 53).<sup>10</sup> But when does this arise, and why and how?

This non-identity implication is at play whether the contradiction is presented as a single (complex) utterance, as in (21), or split across utterances, as in (23):

- (23) a. Tracy: Your friend Janice is the smart one, right?
- b. Felicia: Yeah, she's smart.
- c. Tracy: I heard she took the bus to Yonkers yesterday. What happened?
- d. Felicia: Well, she's not smart.

Here, too, we understand the second *smart* as being different from the first, in exactly the same way as we do in (21).<sup>11</sup>

<sup>9</sup>Here, again, I remain neutral for now as to the nature of this inference.

<sup>10</sup>Chierchia brings this up in discussing *It rains and it doesn't rain*, arguing for his distinction between G-trivial and L-trivial sentences.

<sup>11</sup>One could also interpret Felicia as retracting her first assertion as she makes her second—and such an interpretation is more easily available here than in the single utterance in (21)—but one needn't interpret Felicia as retracting

We can interpret these repeated predicates non-identically because they exhibit a sort of vagueness, being amenable to multiple interpretations. Importantly, I don't refer here to the sort of vagueness that we see (especially) in gradable adjectives like *tall*—usually captured with reference to a comparison class, or a threshold on a scale—, but rather to a *minimal kind of vagueness* that is exhibited by a wide variety of lexical items. Indeed, non-gradable adjectives, nouns, and even verbs exhibit a particular sort of vagueness that makes them sensitive to context (Kamp and Partee 1995; Barker 2006). For example, consider the felicitous uses of the contradiction in (24).

(24) Javier drives a truck, but he doesn't drive a truck.

We can interpret the second occurrence of either the verb *drive* or the noun *truck*—cued by intonation—as meaning something different from the first. If *drive* is focused, we might understand Javier to drive especially slowly or otherwise substandardly; if *truck* is focused, we might understand Javier's truck to be miniature in size or perhaps painted some unusual (and unappealing) color. These interpretations needn't draw on the sort of vagueness that is typically ascribed to gradable adjectives, rather they rely on this certain minimal vagueness shared by a variety of lexical categories.<sup>12</sup>

Contradictions are sensitive to context not only in how a particular repeated predicate is interpreted, but also in which contradictions are felicitous in which contexts. Like tautologies, even though all contradictions denote the same worlds (namely none of them), not just any contradiction is felicitous in any context.

[Janice is at the top of her class at a prep school in Manhattan, which she commutes to from Brooklyn. Felicia is talking to Tracy about her.]

Felicia: Did you hear about Janice? Yesterday after school, she accidentally took the bus to Yonkers!

Tracy: Really? Isn't she valedictorian?

(25) # Felicia: Janice is tall, but she isn't tall.

(26) # Felicia: Javier drives a truck, but he doesn't drive a truck.

Neither (25) nor (26) are felicitous in the context of (21), even though we can easily imagine other contexts in which they might be uttered felicitously. It's not just the contradictory nature of the sentence but also the contextually-relevant referents and predicates which allow a contradiction to be used felicitously.

Following the same strategy as with tautologies, we can also try to cancel or strengthen the non-identity implication conveyed by a contradiction.

her previous statement to make the discourse in (23) coherent. Felicia can be understood to be contradicting herself (to the same extent as in (21)), not correcting herself.

<sup>12</sup>One can think about this minimal kind of vagueness along the same lines as assignment-sensitivity (Cumming 2008), but not just for names. The same way a name (e.g., Paderewski) can be understood differently in different contexts, we might understand *drive* or *truck* differently in different uses; if we follow Cumming, we might do so with variables.

- (27) Janice is smart, but she's not smart. #In fact, she's (not) smart in all senses of the term.  
 (28) Janice is smart, but she's not smart. #I don't mean to say that she's (not) smart in some way.

These follow-ups are inconsistent; here the speaker contradicts herself in a way that can't be salvaged by differently interpreting anything. The non-identity implication can't be explicitly canceled, then.

- (29) ? Janice is smart, but she's not smart. She's smart in one sense, but not in another.  
 (30) Janice is smart, but she's not smart. She's book-smart, but not street-smart.

The follow-up in (29) is odd, if not outright infelicitous, as it seems redundant. What else, after all, could the speaker have meant by the first sentence? In contrast, the contextually-specified version in (30) is perfectly felicitous. While felicitous, however, it's not additional content: it's an elaboration. We can make this distinction explicit:

- (31) Janice is smart, but she's not smart. That is, she's book-smart but not street-smart.  
 (32) # Janice is smart, but she's not smart, and (also) she's book-smart but not street-smart.

(31) uses *that is* to explicitly mark an elaborative follow-up, and it's this version which is felicitous. (32), on the other hand, which explicitly marks itself as asserting additional content, is infelicitous. One can elaborate a contradiction, specifying the intended interpretations of the vague predicates, but this isn't the same as strengthening the non-identity implication. Neither canceling nor strengthening are felicitous.

We can look at nondetachability, as well, to see whether the non-identity implication is conveyed by a particular word or phrase as opposed to the (form of the) proposition itself.

- (33) # Janice is smart, but she's not intelligent.  
 (34) # Janice is clever, but she's not smart.

These versions aren't felicitous in (21)'s context, but they may also be flawed tests for nondetachability. They have only partial replacement, and so involve differentiating among meanings of *smart*, *intelligent*, and *clever*. More parallel replacement, though, is also infelicitous in this context.

- (35) # Janice is intelligent, but she's not intelligent.  
 (36) # Janice is clever, but she's not clever.

These no longer involve differentiating between the meanings of different words, but the range of meanings that these near-synonyms cover doesn't seem to include the book-smart/street-smart distinction that the context requires.

This non-identity implication, then, displays none of the features of conversational implicature. And, indeed, there can be no suitable Gricean calculation: the naïve Gricean story would include

a contradictory literal meaning with a ‘repairing’ inference, but Gricean conversation implicatures *add* content, they don’t *modify* it. Even with some additional content, this naïve analysis would still leave the contradictory literal content unchanged—and thus still denoting no worlds, leading to the absurd state. The requirement that the interpretations of each predicate be different is not some additional content alongside the literal content; rather, it must be part of the literal content itself. We can see this more closely by using a diagnostic from Tonhauser 2011 to test for at-issueness (as defined in Simons, Tonhauser, Beaver, and Roberts 2010).<sup>13</sup>

- (21) A: Janice is smart, but she’s not smart.
- (37) a. # Yes, that’s true, she’s both smart and not smart in the same sense.  
 b. # No, that’s not true, she’s not both smart and not smart in the same sense.  
 c. Yes, that’s true, she’s smart in one sense but not in another sense.  
 d. No, that’s not true, it’s not the case that she’s smart in one sense but not in another sense.

The responses in (37a) and (37b), which target the (naïvely hypothesized) literal contradiction as the at-issue content (to later be ‘repaired’ by the intervening non-identity implication), are infelicitous; this is evidence that the literal contradiction is not the at-issue content.<sup>14</sup> The responses in (37c) and (37d), on the other hand, target the non-identity-restricted content as potentially at-issue, and it’s these examples which are felicitous. This is evidence that the non-identity implication is part of the at-issue contribution of a (felicitously uttered) contradiction.

### 3.2. Towards an analysis

How should we understand this non-identity implication as being part of the literal content of the utterance of a contradiction? How does it arise? It is not obvious that any lexical items trigger this implication, the only candidates being the repeated predicates—but of course not all repeated predicates trigger such an implication, an idea we’ll return to in a moment. The way we understand this non-identity implication will be an extension of how we analyze the minimal sort of vagueness described above. We might use a contextual parameter for interpreting various words,<sup>15</sup> we might use variables<sup>16</sup>—there are a number of possible implementations. In this section I’ll describe and motivate the features needed for any successful implementation.

In general, when there are repeated predicates in a sentence, different combinations of interpretations become available. Take, for instance, the elliptical<sup>17</sup> non-contradictory example (38):

<sup>13</sup>This is just one diagnostic, Tonhauser’s # 1b: *Assent/dissent with positive continuation*, but all of the diagnostics return similar results. For space reasons, I present only this single illustrative example.

<sup>14</sup>Indeed, as I’ll show in the next section, by this point in the interpretive process it’s no longer part of the content at all.

<sup>15</sup>Though, as we’ve seen above, this will be required for not just gradable adjectives, but also nouns, verbs, etc. This method requires a non-trivial complication of the logical form for most words in most sentences, even where it seems unimportant.

<sup>16</sup>A la assignment sensitivity (Cumming 2008), as described briefly in footnote 12.

<sup>17</sup>I assume here that (38) has a logical form like that of *Janice is smart and Tracy is smart (too)*. This version would



(38) Janice is smart, and so is Tracy.

Upon hearing a sentence like (38), one normally understands Janice and Trace to be the same sort of smart: we have a preference for identical interpretations of repeated predicates, even though—as we have seen—a hearer can interpret *smart* in more than one way, and (38)’s two instances can each be interpreted in more than one way. This preference for identical interpretations need not be surprising; we can think of this interpretation resolution as similar to anaphora resolution, which displays a similar bias.<sup>18</sup> Despite the bias, though, a range of interpretations are available; we can elaborate on (38) in a number of ways which demonstrate the intended interpretation.

- |      |    |                                                 |                               |
|------|----|-------------------------------------------------|-------------------------------|
| (39) | a. | They’re both book-smart.                        | (identical, specific)         |
|      | b. | Janice is book-smart and Tracy is street-smart. | (non-identical, specific)     |
|      | c. | They’re both smart in the same way.             | (identical, non-specific)     |
|      | d. | (But) They’re both smart in different ways.     | (non-identical, non-specific) |

We can classify the interpretations of (38) (and their associated elaborations) as being identical—having the same interpretation for each occurrence of *smart*—or non-identical. And, as we can see in (39), both identical and non-identical interpretations are available for (38).

With a contradiction, though, not all of the interpretations available to a sentence like (38) are possible.

(21) Janice is smart, but she’s not smart.

A hearer must rule out the identical interpretations for a contradiction, as those would all lead to the absurd state. In (21), for instance, one can’t understand Janice to be both smart and not smart in the same sense (no matter which sense of *smart* is intended). After ruling out the contradictory identical interpretations, the possible interpretations that remain aren’t contradictory at all: they are as informative as a prototypical assertion.

Importantly, though, note that all of the remaining interpretations are non-identical ones, exactly those interpretations which speakers disprefer. This explains why sentences like (21) feel contradictory, even though they end up being interpreted informatively. The move to such globally-dispreferred interpretations is marked, even when there are no ‘better’ interpretations available. It likely also explains the intonation pattern that sometimes accompanies contradictions, which helps to facilitate the move to dispreferred interpretations (again parallel to anaphora).

be more straightforward, but is dispreferred in favor of its elliptical counterpart, presumably for phonological reasons.

<sup>18</sup>For example, consider the anaphora in (i):

- (i) Frank lives with Nikolai. He has a cat, and he loves to knit.

Hearers frequently interpret the two *hes* in (i) to refer to the same person. There is some variability in whether people take each to refer to Frank (possibly the subject of the discourse) or to Nikolai (the most recent referent), but in general they are taken to be coreferential. This is a bias, not a rule, and indeed other interpretations are available (especially with intonational or deictic help), but we’ll see this is the case with (38) as well.

This ruling-out of interpretations is our non-identity implication in action, but we can see here that it's not a restriction inferred through conversational principles, nor triggered by a particular word, rather it's part of the process of semantic interpretation itself, which excludes impossible belief-states. There are any number of possible ways to implement this sort of interpretive process, but any successful one will have the mechanisms to: (i) represent the different possible interpretations for sentences like (21) and (38), (ii) model the preference for identical interpretations (e.g., with a salience list) without eliminating dispreferred interpretations, and (iii) eliminate absurd combinations like those ruled out in (21). With these three pieces in place, we can account both for the biased interpretations for a sentence like (38) as well as for the particular behavior of contradictions like (21).

#### 4. Discussion

Tautologies trigger a consistent conversational implicature—an uncontrollability implicature—which describes the repeated proposition as being beyond the control or influence of (at least) the speaker. Despite the literal content's unformativity—and in fact, partially *because* of the Gricean reasoning triggered by that unformativity—tautologies manage to be conversationally useful by means of this implicature. Contradictions, meanwhile, require non-identical interpretations of the repeated predicate, those multiple interpretations made possible by the minimal sort of vagueness possessed by not just adjectives, but also nouns and verbs. That these interpretations are non-identical is part of the literal content of the contradiction, as absurd assignments are ruled out by the process of semantic interpretation. What's left after such assignments are ruled out is informative in just the same way that canonical assertions are informative.

Before concluding, there are further issues that I'd like to touch upon. What has been proposed here clarifies the behavior of tautologies and contradictions, but it also bears on other debates in the literature. For the remainder of the paper, I'll address two such issues: an additional kind of contextually-entailed truths, namely restatements, and a potentially-different class of contradictions, namely borderline contradictions.

##### 4.1. Tautologies and restatements

In looking at tautologies, it makes sense to contrast them with restatements, another kind of contextually-entailed truth. By restatements, I mean assertions of content that was previously asserted;<sup>19</sup> that content, then, will already be in the common ground. Both tautologies and restatements leave an unchanged context set—they both denote all worlds in the context set—but they behave differently in conversations; consider the discourse in (40):

<sup>19</sup>For the purposes of this discussion, I exclude assertions entailed by context but which were not themselves previously asserted. For example, *John has a car* probably entails *John has a steering wheel*, but asserting the latter in the context of (40) wouldn't have the same discourse effect as the restatement in (40d).

- (40) a. Sue: We have to get to the party. Who do we know that has a car?  
 b. Bill: John has a car.  
 c. Andy: Mary has a car, but it's in the shop.  
 d. Bill: John has a car.

Restatements like (40d) serve to return attention to something already known (here, that John has a car). In (40d), Bill is bringing John (back) up as a viable means to get to the party; information-structurally, we can think of this as suggesting a strategy for addressing the domain goal. (Importantly, even though this strategy was raised in (40b), it wasn't rejected, withdrawn, or otherwise prevented from entering the common ground before being raised again in (40d).) This restatement conveys nothing about the uncontrollability of John's having a car—no uncontrollability implicature is triggered—and tautologies don't have this attention-focusing function.

Because they behave differently in conversations, we should want to be able to differentiate between tautologies and restatements semantically to explain their behavior. One straightforward way to do so is to note that, while both tautologies and restatements denote the entirety of the context set, tautologies further denote every world beyond the context set as well: the distinction lies only beyond the context set. The desire to maintain this distinction, then, is an argument in favor of theories of update which don't relativize assertions to the context set prior to update, e.g., Murray 2014. In contrast, theories of update which relativize assertions to the context set collapse the distinction between tautologies and restatements (cf. AnderBois, Brasoveanu, and Henderson 2011).

#### 4.2. Borderline contradictions

There has been a good deal of discussion surrounding what have been called "borderline contradictions" since at least Ripley 2011. Perhaps the most standard example is in (41):

- (41) John is tall and not tall. (Alxatib et al. 2013: 1)

Just as we have seen above, this sort of sentence seems like it should be straightforwardly false (as it is self-contradictory), but people do use and accept them in some cases. Under the analysis presented here, we can explain the felicitous uses of (41) just as we did with other contradictions: each instance of *tall* is interpreted differently. Here, because *tall* operates on a single scale (namely, that of height) these different interpretations boil down to different thresholds on a single scale. For (41) to be felicitous and true, there must be two thresholds on this scale,  $x$  and  $y$ , such that John's height exceeds  $x$  but not  $y$ . For example, given the right context, (41) can be interpreted as meaning that John is tall for a high school student but not tall for a high school basketball player.

Rather than different thresholds, the literature on borderline contradictions has argued that (41) is acceptable in virtue of the vagueness of a single threshold: the threshold is vague, so it's not clear whether *tall* is true or false of John. In other words, John is at the borderline of the threshold of

tallness. This is argued to be the reason that, if told that 5'11" is the height for a Western man to be tall,<sup>20</sup> people will more readily accept the contradiction in (42a) than the one in (42b).

- (42) a. A 5'11" tall man is and isn't tall. (Alxatib et al. 2013: 4)  
 b. A 6'4" tall man is and isn't tall. (Alxatib et al. 2013: 5)

Judgments like these about borderline contradictions (Alxatib and Pelletier 2011; Sauerland 2011; Cobreros et al. 2012; Alxatib et al. 2013) have led linguists and philosophers engaged in this topic to propose additional machinery, such as fuzzy, strict, and tolerant logics.

The proposal described in §3 can account for the different responses to the contradictions in (42). It needn't be vagueness about a single threshold that leads a hearer to affirm a contradiction; instead, having access to different contextual thresholds—one of which is met, the other not—is enough to make a sentence like (41) true. This predicts the difference in acceptability between (42a) and (42b): the taller someone is, the fewer contextually-relevant thresholds that person can fail to meet.

Instead of creating additional machinery to explain the felicitous uses of contradictions like (41–42), I argue that these cases should be handled by the same processes that explain the felicitous contradictions like those we've seen in (21) and (24), repeated here for convenience.

- (21) Janice is smart, but she's not smart.  
 (24) Javier drives a truck, but he doesn't drive a truck.

The machinery built to handle the contradictions in (41–42) hinges on a particular feature of the gradable adjective *tall*, namely the threshold it makes reference to. Restricting the explanation in this way, though, fails to capture the felicitous uses of contradictions that don't have such threshold-sensitive predicates. (24), as discussed in §3, involves understanding different interpretations of either the verb *drive* or the noun *truck*; verbs and nouns aren't usually thought to be sensitive to thresholds or scales, and so would require an entirely different explanation than the one argued to explain (41–42).

Along similar lines, we can reject the potential argument that the difference between the contradictions focused on here (like (21)) and borderline contradictions is that (21)'s *smart* is multidimensional (Sassoon 2013)<sup>21</sup> while *tall* is not.<sup>22</sup> The proposal put forward here accounts for contradictions that have access to multiple scales (as in (21)), those that have access to multiple

<sup>20</sup>This stipulation from Alxatib et al. 2013, based on a previous experiment in Alxatib and Pelletier 2011.

<sup>21</sup>Multidimensional adjectives are those which operate on more than one scale. For example, one can be *healthy* in terms of cholesterol or blood pressure, and neither implies the other; similarly, one can be *rich* in investments or in friends, and neither implies the other. In contrast, a unidimensional adjective like *tall* operates on a single scale. One can be *tall* for a middle-schooler or *tall* for an NBA player, but the former will imply the latter (if both are felicitously applicable); because they are both on the same scale, one threshold must surpass the other (unless they're identical). See Sassoon 2013 for an in-depth look at multidimensional adjectives.

<sup>22</sup>In fact, Ripley's (2011) prototypical borderline example involves not *tall* but *rich*, itself a multidimensional adjective (see previous footnote). Even if it weren't, however, there are good reasons to prefer a unified account.

thresholds on a single scale (as in (41)), and those that have access to neither (as in (24)), all in a unified fashion.

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# Presupposed Ignorance and Exhaustification

Benjamin Spector — Institut Jean Nicod, CNRS-ENS-EHESS

Yasutada Sudo — University College London

**Abstract.** This paper investigates the interactions between presuppositions and scalar implicatures. We start our discussion with a previously undiscussed puzzle which we call *presupposed ignorance* and offer a preliminary account of it. We then claim that certain types of interactions between presuppositions and scalar implicatures, namely those involving Strawson-decreasing presupposition triggers and weak scalar items, can be understood as special cases of presupposed ignorance. But we also point out that this cannot be the whole story, as it runs into problem with examples involving Strawson-increasing presupposition triggers with weak scalar items. To counter this problem, we propose that the mechanism of scalar strengthening, namely the exhaustivity operator (*EXH*), interacts with the mechanism responsible for presupposed ignorance in an intricate manner, thereby giving rise to the complex empirical patterns we observe.

**Keywords:** Presupposition, Scalar implicature, Presupposed ignorance, Exhaustification

## 1. Introduction

This paper investigates the intricate interactions between presuppositions and scalar implicatures in sentences like the following.

- (1) a. John is aware that some of the students smoke.
- b. John is unaware that some of the students smoke.

These sentences contain a factive presupposition trigger (*(un)aware*) and a scalar item (*some*). In the present paper, we will attempt to answer the following simple question: what kind of scalar inferences do these sentences trigger? However, our answers will turn out to be rather complex. On the one hand, as previously observed by Sharvit and Gajewski (2008) and Gajewski and Sharvit (2012), (1b) has a reading that presupposes that some but not all of the students smoke (as we will see later, our theory derives a weaker inference, which we argue can be strengthened by means of a separate mechanism). On the other hand, we observe that (1a), specifically when *some* is stressed, has a reading that presupposes that all of the students smoke. We will furthermore observe that this is only one of several possible readings for (1a), and that prosody plays an important role in determining the perceived presuppositions of a sentence such as (1a).

This rather complex empirical picture forces our theory to have a certain degree of complexity as well. We will posit two different mechanisms for scalar inferences. One of them is based on a previously unnoticed puzzle, which we call *presupposed ignorance*, which we discuss in the next section. We claim in Section 3 that the scalar inferences that sentences like (1b) have are part of the larger phenomenon of presupposed ignorance. We, however, point out in Section 4 that



the scalar inferences of sentences like (1a) are not amenable to the same explanation. We will offer a solution that makes use of an exhaustivity operator (*EXH*). By assuming that *EXH* is a presupposition hole with respect to negated alternatives, and that it applies before the mechanism responsible for presupposed ignorance applies, we will account for the scalar inferences that both of the above sentences may have.

## 2. Presupposed Ignorance

We will illustrate the problem of presupposed ignorance using the additive presupposition trigger *too*. It is standardly assumed that it triggers an additive presupposition without affecting the assertive content of the sentence it occurs in. More concretely, *John, too, PRED* asserts that John PRED and presupposes that another salient individual (called the ‘antecedent’) PRED. This straightforwardly explains the contrast below.

- (2) Mary will go to Yale.  
 a. John, too, will go to an Ivy League university.  
 b. #John, too, will go to Harvard.

Now, against this backdrop, consider (3), which is infelicitous.

- (3) Mary will go to Yale. #John, too, will go to Yale or Harvard.

The unacceptability of this example is not straightforwardly explained by the standard view. That is, since *Mary will go to Yale* entails that Mary will go to Yale or Harvard, *Mary* should be able to serve as a good antecedent for *too* in the second sentence.

We suggest that what goes wrong in the second sentence of (3) is that it involves additional inferences, which we call *presupposed ignorance inferences*, to the effect that it must not be known whether the individual which served as an antecedent (in this case, Mary) will go to Yale nor whether will go to Harvard. These inferences clash with the asserted content of the first sentence, which explains the infelicity of (3). In fact, if the first sentence is changed to a disjunctive sentence, the examples become felicitous, as demonstrated by (4).

- (4) Mary will go to Yale or Harvard. John, too, will go to Yale or Harvard.

Presupposed ignorance inferences are not limited to presuppositions triggered by additive particles. For instance, they arise with factive predicates like *unaware*, as shown by (5). As we will explain later on, it is crucial that the presupposition trigger here is negative, or more precisely, Strawson-decreasing.<sup>1</sup>

<sup>1</sup>A function  $f$  from propositions to propositions is Strawson-decreasing if the following holds: for any two (bivalent) propositions  $\phi$  and  $\psi$  such that  $\phi$  entails  $\psi$ , for every world  $w$  such that both  $f(\phi)(w) \neq \#$  and  $f(\psi)(w) \neq \#$ , if  $f(\psi)(w) = 1$ , then  $f(\phi)(w) = 1$ . This definition can easily be generalized to functions applying to the denotations

- (5) Mary will go to Yale. #But John is unaware that she will go to Yale or Harvard.

Furthermore, other ‘ignorance inducing items’ besides disjunction give rise to similar inferences.<sup>2</sup>

- (6) a. Mary has three children. #John, too, has at least two children.  
b. Context: it is common knowledge that Mary has three children  
John is unaware that Mary has at least two children.

Compare the above examples with items that do not trigger ignorance, as in (7) and (8) (although the contrasts might not be very sharp, as they sometimes do give rise to ignorance inferences).

- (7) a. Mary will go to Yale. John, too, will go to one of the Ivy League universities.  
b. Mary has three children. John, too, has more than one child.  
c. Berlin is freezing. Göttingen, too, is cold.
- (8) a. Context: It is common knowledge that Mary has three children.  
John is unaware that Mary has more than one child.  
b. Context: It is common knowledge that Mary will go to Yale.  
John is unaware that Mary will go to an Ivy League university.

Here, we suggest a preliminary account of presupposed ignorance inferences. The most crucial aspect of our analysis is that presupposed ignorance involves reference to alternatives. More specifically, we posit the following principle

- (9) **Presupposed Ignorance Principle (PIP):**  
 $\phi_p$  is infelicitous in context  $c$  if  $\phi_p$  has an alternative  $\psi_q$  such that  
 a.  $q$  is not weaker than  $p$ ; and  
 b.  $c$  satisfies  $q$  ( $= q$  is common knowledge in  $c$ ).  
 (where  $\phi_p$  is a sentence  $\phi$  whose presupposition is  $p$ )

Let us apply this to the example (3) (‘Mary will go to Yale. #John, too, will go to Yale or Harvard’). It is assumed that disjunction ‘A or B’ generally has three alternatives: ‘A’, ‘B’, and ‘A and B’ (Sauerland, 2004). Thus, the second sentence of the example has the following three alternatives.

of expressions which have a non-propositional type ending in  $t$ .

<sup>2</sup>One might find the examples in (6) not so bad. Roughly put, if the current topic of the conversation is about who has more than one child, the examples seem more acceptable, but a sense of infelicity does arise if the question under discussion is about how many children every person has. In fact, similar contextual tricks render the above example (3) acceptable. Specifically, if one changes the example slightly, e.g. with Oxford and Cambridge, one might find it more or less acceptable, especially in a context where we are interested in finding out who will go to Oxbridge. We claim that these observations are in fact not incompatible with the analysis to be developed below, if the contextual effects on alternatives are taken into consideration. But as this is orthogonal to our main point, we will not dwell on this issue any further here. See Fox and Katzir (2011) for relevant discussion. What is important for us is the contrasts between (6) and (7) and (8)

- (10) a. John, too, will go to Yale.  
 b. John, too, will go to Harvard.  
 c. John, too, will go to Yale and Harvard.

What are the presuppositions of these alternatives? Assuming that the antecedent is fixed to Mary, they presuppose the following, respectively.

- (11) a. Mary will go to Yale.  
 b. Mary will go to Harvard.  
 c. Mary will go to Yale and Harvard.

Since these presuppositions are stronger than the presupposition of the uttered sentence (i.e. that Mary will go to Yale or Harvard), the PIP entails that the sentence in question is infelicitous if any of the following is the case.

- (12) a. It is common knowledge that Mary will go to Yale.  
 b. It is common knowledge that Mary will go to Harvard.  
 c. It is common knowledge that Mary will go to Yale and Harvard.

In other words, the sentence is only felicitous if the following are all true.

- (13) a. It is not common knowledge that Mary will go to Yale.  
 b. It is not common knowledge that Mary will go to Harvard.  
 c. It is not common knowledge that Mary will go to Yale and Harvard.

These are the presupposed ignorance inferences. As mentioned above, the infelicity of (3) is explained by the fact that (13a) clashes with what the first sentence asserts.

We can account for the additional examples mentioned above using the PIP, but as this is routine, we will leave this task to the reader (for cases involving *at least n*, the alternatives need to be of the form *exactly m* and *at least m*).

Arguably, the way the PIP is formulated is rather *ad hoc* at this moment. In particular, its connection with the type of inference called ‘anti-presuppositions’ should be investigated further (Percus, 2006, 2010; Sauerland, 2008). We will essentially leave this important issue for further research, as our main interest here is the interactions between presuppositions and scalar implicatures.<sup>3</sup>

<sup>3</sup>However, it is worth remarking that the PIP and the standard mechanism that generates anti-presuppositions, called *Maximize Presupposition* (Heim, 1991) are distinct and that the latter does not generate presupposed ignorance inferences. One common formulation of Maximize Presupposition is as follows (another version uses contextual equivalence instead of mutual Strawson-entailment, but this difference is inconsequential for the point we are making here).

(i) *Maximize Presupposition*  
 $\phi_p$  is infelicitous in context  $c$  if  $\phi_p$  has an alternative  $\psi_q$  such that:

In what follows, we discuss two separate cases, i.e. (1a) and (1b), in turn. First, we will focus on examples like (1b) which involve Strawson-decreasing presupposition triggers like *unaware*, and argue that the observed inference can be understood as a presupposed ignorance inference. However, in the subsequent section, we will see that the PIP makes wrong (or, to be more precise, incomplete) predictions for examples like (1a) that involve Strawson-increasing presupposition triggers like *aware*. We will argue that such examples involve the mechanism responsible for scalar implicatures, namely the exhaustivity operator *EXH*. With independently motivated auxiliary assumptions about *EXH*, we can explain the role of prosody in the complex patterns we observe.

### 3. Strawson-Decreasing Contexts

Consider the following example involving the factive presupposition trigger *unaware* and a scalar item *some*, repeated from (1b).

- (14) John is unaware that some of the students smoke.

Throughout the paper, we will concentrate on the narrow scope reading of *some*, relative to *unaware* (a narrow-scope reading would be forced by using *most* instead of *some*, which would yield a similar scalar inference but does not create a similar scopal ambiguity). Under this reading, as previously pointed out by Sharvit and Gajewski (2008) and Gajewski and Sharvit (2012), the most natural interpretation seems to involve a scalar implicature *only in the presupposition*. That is, the assertion is simply the negation of ‘John believes that there are some students who smoke’, without any scalar implicature, while the presupposition is that some but not all of the students smoke, with a scalar implicature. In fact, the sentence is infelicitous if it is known that all of the students smoke.

The key feature of the above example is the Strawson-decreasing presupposition trigger *unaware*, which is negative in the assertion but the positive in the presupposition, and analogous observations can be made across weak scalar items like *some* occurring in the scope of Strawson-decreasing operators.

Gajewski & Sharvit claim that this observation can be used to adjudicate between certain theoretical views on scalar implicature. In particular, they argue that it is problematic for purely pragmatic views on scalar implicature computation, and also for a kind of grammatical theory that makes use of the exhaustivity operator (*EXH*). Furthermore, they put forward an analysis based on Chierchia’s (2004) grammatical theory of scalar implicature coupled with a multi-dimensional theory

- 
- a.  $\phi_p$  and  $\psi_q$  Strawson-entail each other; and
  - b.  $q$  asymmetrically entails  $p$ ; and
  - c.  $c$  satisfies  $q$ .

- (ii) Sentence  $S$  Strawson-entails sentence  $S'$  iff for all worlds  $w$ ,  $\llbracket S \rrbracket^w = 1$  and  $\llbracket S' \rrbracket^w \neq 0$ .

Essentially the PIP is Maximize Presupposition without the first clause. This is essential for generating presupposed ignorance inferences, since (3) does not Strawson-entail (or contextually entail) its alternatives in (10). So Maximize Presupposition yields no inferences for (3).

of presupposition in the style of Karttunen and Peters (1979). We think that their conclusions are too strong, and also that the analysis they suggest runs into empirical problems, but for reasons of space, we will not delve into these points here (see a much longer version of the present paper, Spector and Sudo 2014). Instead, we make the following simple claim here: the scalar inference observed for (14) can be understood as a presupposed ignorance inference.

Here is how our account works for (14). We assume that (14) has (15) as its alternative.

(15) John is unaware that all of the students smoke.

Because this alternative has a stronger presupposition to the effect that all of the students smoke, the PIP states that (14) is infelicitous if it is common knowledge that all of the students smoke.

Notice that this inference is weaker than what one might perceive (and what Gajewski & Sharvit ascribe to (14)). That is, what we predict has negation above ‘it is commonly known that’, while (14) might sound as presupposing that not all of the students smoke. But this is not a bad prediction, as the sentence is actually felicitous in a context where it is not common knowledge that not all of the students smoke, provided that it is also not common knowledge that all of the students smoke (i.e. it is not common knowledge whether all of the students smoke), as in the following example.

(16) (CONTEXT: We know some of the students smoke, but don’t know whether all do.)  
Prof. Jones knows nothing about the students. He’s unaware that some of the students smoke, for example.

Nonetheless, the stronger presupposition that not all of the students smoke seems to be the one we often perceive, especially out of the blue. To explain this, we adopt the proposal of Chemla (2008), which spells an explicit pragmatic mechanism whereby anti-presuppositions of the form  $\neg CG(p)$  can be strengthened into  $CG(\neg p)$  (where  $CG$  stands for ‘it is common knowledge that’).

To conclude, the PIP explains in our view the scalar inferences triggered in Strawson-decreasing contexts. However, as we will now see, it runs into a problem with examples involving Strawson-increasing elements.

#### 4. Strawson-Increasing Contexts

We illustrate the problem of Strawson-increasing operators with the positive counterpart of (14), given in (17).

(17) John is aware that some of the students smoke.

Unlike (14), (17) can be quite naturally used in contexts where it is common knowledge that all of the students smoke (again, one can use *most* to force the narrow scope reading), as illustrated by

(18).

- (18) A: All of the students are smokers in this department! Do professors know this?  
 B: Well, Prof. Jones is aware that some of the students smoke.

Notice that the relevant reading is different from the embedded SI reading, which assert that John believes that some but not all of the students and presupposes the same thing. This would be infelicitous in (18). Also, it is also not the case that there is no scalar implicature in (18). Rather, the assertion triggers the scalar implicature that Prof. Jones does not know all of the students smoke. Furthermore, even if it is granted that scalar implicatures are optional, there still is a stark contrast in acceptability between (14) and (17) in contexts where it is common knowledge that all of the students smoke.

This observation is problematic for the PIP.<sup>4</sup> In fact, what the PIP predicts is the same presupposed ignorance inference as we derived for (14). Specifically, the relevant alternative *John is aware that all of the students smoke* presupposes that all of the students smoke, which is stronger than the presupposition of (17). Thus it is wrongly predicted that the example in (18) should be infelicitous.

In order to solve this problem, we postulate a different scalar strengthening mechanism: the **exhaustivity operator (EXH)** (Groenendijk and Stokhof, 1984; Chierchia, 2006; Chierchia et al., 2012; Fox, 2007; van Rooij and Schulz, 2004; Spector, 2003, 2007).<sup>5</sup> Here we use Fox's operator as defined in (19) (though nothing here hinges on choosing this definition rather than one based on Groenendijk and Stokhof's 1984 original proposal – see Spector 2014)

- (19)  $\llbracket EXH_{Alt} \phi \rrbracket^w = \llbracket \phi \rrbracket^w = 1 \wedge \forall \psi \in Alt[IE_{(\phi, Alt)}(\psi) \Rightarrow \llbracket \psi \rrbracket^w = 0]$ ,  
 Where *Alt* denotes a set of propositions (the alternatives of  $\phi$ ), and  $IE_{(\phi, Alt)}(\psi)$  stands for 'ψ is innocently excludable given φ' and *Alt* in the sense of Fox (2007),<sup>6</sup> i.e.  
 $\psi \in \bigcap \{ A \subseteq Alt \mid A \text{ is a maximal set such that } \{ \neg p \mid p \in A' \} \cup \{ \phi \} \text{ is consistent} \}.$

The above definition of *EXH*, however, does not say what happens when  $\phi$  and  $\psi$  have presuppositions. Here we claim that *EXH* is a presupposition hole for the negated alternatives. In other words, a sentence of the form '*EXH*( $\phi_p$ )' presupposes *p* and all the presuppositions of the negated alternatives. We think that this is conceptually appealing, given that negation is a presupposition

<sup>4</sup>It is also problematic for Gajewski & Sharvit's account, as nothing in their account of presuppositional scalar inferences is sensitive to monotonicity in the assertive dimension. See Spector and Sudo (2014) for detailed discussion on this.

<sup>5</sup>We leave it open whether our account could be reformulated in terms of pragmatic approach to scalar implicatures (in which case *EXH* should be viewed as a shortcut for Gricean reasoning, as in van Rooij and Schulz 2004; Spector 2003, 2007). Thus, what we claim here does not necessarily motivate a grammatical view of scalar implicature computation (contrary to what Gajewski & Sharvit conclude from their observation on Strawson-decreasing examples).

<sup>6</sup>The notion of innocent excludability is necessary to account for disjunction (and other ignorance inducing items like *at least n*), but for other cases involving scalar items like *some* vs. *all*, it amounts to the same thing as 'non-weaker than'.

hole and *EXH* is essentially a type of negation. Here is a formal rendering of this idea in a trivalent theory of presupposition.

$$(20) \quad \llbracket \mathbf{EXH}_{Alt} \phi \rrbracket^w = \begin{cases} 1 & \text{iff } \llbracket \phi \rrbracket^w = 1 \wedge \forall \psi \in Alt[IE_{(\phi, Alt)}(\psi) \Rightarrow \llbracket \psi \rrbracket^w = 0] \\ 0 & \text{iff } \llbracket \phi \rrbracket^w = 0 \vee \exists \psi \in Alt[IE_{(\phi, Alt)}(\psi) \wedge \llbracket \psi \rrbracket^w = 1] \\ & \quad \wedge \neg \exists \psi_q \in Alt[IE_{(\phi, Alt)}(\psi) \wedge \llbracket \psi \rrbracket^w = \#] \\ \# & \text{iff } \llbracket \phi \rrbracket^w = \# \vee \exists \psi \in Alt[IE_{(\phi, Alt)}(\psi) \wedge \llbracket \psi \rrbracket^w = \#] \end{cases}$$

For technical reasons, we need to be careful about the notion of consistency behind the definition of innocent excludability, given that in a trivalent framework there are several natural but distinct possible definitions of familiar logical notions such as consistency and logical consequence. We assume that a set of (possibly trivalent) propositions is consistent if there is a world in which every member of the set is true.<sup>7</sup>

With this definition of *EXH*, we can account for the reading of (17) that we are after. That is, due to the innocently excludable alternative *John is aware that all of the students smoke*, which presupposes that all of the students smoke, the entire sentence inherits this presupposition. Consequently, the sentence presupposes that all of the students smoke.

But what about the PIP? In order for our account to work, the following assumption is necessary: the PIP applies after *EXH*. If so, for our example (17), the input to the PIP already presupposes that all of the students smoke, and it does not have an alternative with a stronger presupposition. Consequently, the application of the PIP is vacuous, and no presupposed ignorance inference is predicted. This explains why (18) is felicitous.

A nice feature of the present account is that with certain natural auxiliary assumptions, it explains a number of additional facts.

Firstly, under the relevant reading of (17), it is natural to give focus prominence on *some*. This can be understood as due to the focus sensitivity of *EXH*.

Secondly, we observe that a very similar reading arises with an overt *only* in the matrix clause, as in (21). CAPITALISATION indicates a prosodic prominence in the following examples.

(21) John is only aware that SOME of the students smoke.

*EXH* and *only* are often said to have a number of interpretive commonalities, including focus sensitivity. Furthermore, it can be demonstrated independently that *only* is a presupposition hole with

<sup>7</sup>Another logically possible notion of consistency states that a set of propositions is consistent\* iff there is a world in which none of the members is false. These two notions differ in a trivalent setting. See Spector and Sudo (2014) for extensive discussion of a theory that makes use of consistency\*, which we argue has empirical drawbacks.

respect to negated alternatives, just like *EXH* under our view. The following example illustrates this point.

- (22) Of these three boys, only John went back to London.

That is, this sentence presupposes that all of the three students came from London and were not in London at the relevant time, which are presuppositional inferences triggered by *went back*. These similarities between *EXH* and *only* naturally fall out under our analysis.

Thirdly, we observe that prosodic prominence on the scalar item *some* is somewhat marked in a Strawson-decreasing context, as illustrated by in (14), unlike what is observed in (17). Furthermore, *only* cannot be inserted in the matrix clause in (14) if construed as associated with *some*.

- (23) a. \*John is unaware that SOME of the students smoke.  
b. \*John is only unaware that SOME of the students smoke.

These data can be explained in terms of a ban against vacuous applications of *EXH* and *only*: these operators give rise to infelicity if they fail to exclude any alternative. Let us see how this constraint accounts for (23). Consider (23b) first. Notice that due to the negative operator *unaware*, the argument of *only* (called the *prejacent*) ‘John is unaware that some of the students smoke’ entails its alternative ‘John is unaware that all of the students smoke’, provided that the latter does not suffer from presupposition failure. Recall that *only* is a presupposition hole, so if the latter were to be negated, its presupposition ought to be satisfied, but then it cannot be negated, because its assertive content is entailed by the prejacent. Consequently, the application of *only* here cannot negate anything and hence is vacuous, which leads to infelicity. We explain the unacceptability of (23a) in the same manner, with the additional assumption that focus marking on *some* tends to correlate with the presence of *EXH*. Then, on the assumption that *EXH* is subject to the same constraint against vacuous uses, the marked character of (23b) is explained. Furthermore, as predicted by this account, with a high scalar item *all*, the contrast between *unaware* and *aware* flips.

- (24) a. \*John is (only) aware that ALL of the students smoke.  
b. John is (only) unaware that ALL of the students smoke.

To state the relevant constraints on *EXH* and *only* more succinctly, applications of these operators result in infelicity if the prejacent Strawson-entails all of its alternatives.

Fourthly, it should be remarked that without focus-marking on *some* (or on a constituent that includes *some*), there can be no *EXH* associating with *some* (or with a constituent that includes *some*), and as a result (17) is predicted to trigger the same presupposed ignorance inference as (14). Consider the example in (25) with focus prominence on the matrix subject, which induces de-accenting of the following material.



(25) Only JOHN is aware that some of the students smoke.

We observe that this example indeed triggers the same presupposed ignorance inference as (14), i.e. it is not common knowledge that all of the students smoke – as with (14), this can be strengthened into an inference that not all of the students smoke (which is the presupposition that Gajewski and Sharvit’s 2012 proposal associates with such a sentence).

Before closing, since we have introduced a second mechanism, *EXH*, let us come back to our first example of presupposed ignorance, (3). Notice in particular that such disjunctive sentences have scalar implicatures generated by the conjunctive alternative. In order to see this clearly, let us consider the following variant of the example.

- (26) a. Mary speaks French but not German. #John, too, speaks French or German.  
b. Mary speaks French or German. John, too, speaks French or German.

Clearly, the second sentence of (26b) implicates that John does not speak both languages, which we would like to generate with *EXH*.

Interestingly, however, it turns out that this cannot be done if *EXH* is applied above *too*. Here is why. With this scope relation, the sole alternative of ‘John, too, speaks French or German’ that can be negated by *EXH* would be the following conjunctive alternative.

(27) John, too, speaks French and German.

This sentence presupposes that Mary speaks both French and German. Thus, the second sentence of (27) already has a strong presupposition, and hence the PIP is vacuous, because all of the alternatives relevant for the PIP, namely the sentences in (28), presuppose the same thing.

- (28) a. *EXH*(John, too, speaks French)  
b. *EXH*(John, too, speaks German)  
c. *EXH*(John, too, French and German)

Although the strong presupposition accounts for the infelicity of (26a), it also rules out the acceptable example (26b). Furthermore, it wrongly predicts the following to be felicitous.

(29) Mary speaks French and German. #John, too, speaks French or German.

In addition, we do not generate presupposed ignorance inferences.

It turns out that the correct inferences are predicted if *too* takes scope over *EXH*. If this is the case, the presupposition of the second sentence of (26a) would be that Mary only speaks one of the two languages. This seems to be on the right track given the observations so far. Furthermore, we

obtain the correct presupposed ignorance inferences. Specifically, the alternatives relevant for the PIP are the following.

- (30)    a.    *too*(*EXH*(John speaks French))  
           b.    *too*(*EXH*(John speaks German))  
           c.    *too*(*EXH*(John speaks French and German))

These presuppose the following respectively (with Mary being the antecedent).

- (31)    a.    Mary speaks French and not German.  
           b.    Mary speaks German and not French.  
           c.    Mary speaks French and German.

Since these presuppositions are all non-weaker than the presupposition of the second sentence of (26a), we derive the following presupposed ignorance inferences.

- (32)    a.    It is not commonly known that Mary speaks French but not German.  
           b.    It is not commonly known that Mary speaks German but not French.  
           c.    It is not commonly known that Mary speaks French and German.

What we cannot explain at this moment is why this scope relation is the only one that is available. If this is due to a general constraint regarding the relative scope of *EXH* and *too*, we expect the following to be infelicitous as well:

- (33)    Mary read all of the books. John, too, read some of them.

It is not clear to us whether this is felicitous or not, and we may need to gather more data about such cases. Note that there is no difficulty in explaining why (34) is felicitous, if we assume that the scale  $\langle \text{cold, freezing} \rangle$  is only optionally activated, as we have already noticed (cf. our comments regarding (7c)).

- (34)    Berlin is freezing. Göttingen, too, is cold.

However, it seems to us that not only is (34) felicitous, it can actually give rise to the implicature that it is not freezing in Göttingen. To generate this implicature, we would need to assume that *EXH* has been inserted in the second sentence, but then, in order for the PIP not to rule out the sentence, *EXH* must scope over *too* in this case (contrary to (29), for which we assumed that *EXH* cannot scope over *too*). We leave this issue to further research.

## 5. Conclusions

In this paper, we saw that two types of inferences can be generated by scalar items in presuppositional environments. On the one hand, in the scope of a Strawson-decreasing operator like *unaware*, as in (14), a weak scalar item like *some* generates the presupposed ignorance inference that it is not common knowledge that the presupposition of the alternative with a strong scalar item like *all* obtains. We explained this by means of the PIP. On the other hand, in the scope of a Strawson-increasing operator like *aware*, as in (17), a weak scalar item can generate a stronger presupposition by inheriting the presupposition of the alternative with strong scalar item (although it can also have a similar reading as in the Strawson-decreasing case, typically when the scalar item is de-accented). We attributed this to the presupposition projection properties of the operator *EXH*, namely the fact that *EXH* is a hole for presuppositions. On the assumption that *EXH* applies before the PIP does, it makes the application of the PIP vacuous in Strawson-increasing environments (cases like (17)).

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# Slovenian Imperatives: You Can't Always Embed What You Want!<sup>1</sup>

Adrian Stegovec — *University of Connecticut*

Magdalena Kaufmann — *University of Connecticut*

**Abstract.** Slovenian has been argued to embed imperatives more freely than other languages do. We argue that the phenomenon is subject to semantic and pragmatic constraints that have been overlooked in the previous literature and that shed light on the semantics of imperatives in general.

**Keywords:** imperatives, speech reports, indexical shift, relative clauses, performative modality

## 1. Introduction

Most languages distinguish at least declarative, interrogative, and imperative sentences, which can be understood as sentential form types that are each associated with a particular canonical function (Sadock and Zwicky 1985). Declaratives and interrogatives are standardly recognized as having embedded counterparts. In contrast, the markers characteristic of imperatives (typically, specific verbal morphology or clause type particles) were traditionally seen as unable to appear in embedded environments (Sadock and Zwicky 1985; Han 2000, among many others). The concern was thus to analyze imperatives in a way that ensures their inability to participate in the composition of larger expressions. Over the past 10 to 15 years, a flurry of counterexamples have made their way into the literature, resulting in the current view that embedded imperatives exist, if restricted in various ways. Embedded imperatives have been reported among others for Korean (Portner 2007; Pak et al. 2008), Japanese (Oshima 2006; Schwager 2006), Old Scandinavian (Rögnvaldsson 1998), Colloquial German (Schwager 2006; Kaufmann and Poschmann 2013), Slovenian (Sheppard and Golden 2002; Dvořák 2005; Rus 2005), Ancient Greek (Medeiros 2013), Mbyá (Thomas 2012), and even English (Crnič and Trinh 2009). Much of this literature focuses on proving genuine embedding of imperatives, without much attention to details of interpretation or semantic/pragmatic restrictions. In this paper, we investigate embedded imperatives in Slovenian. We argue that even this language, which has been claimed to be outstandingly permissive in its embedding of imperatives, displays particular semantic and pragmatic restrictions, which are revealing regarding the semantics of imperative clauses in general. We begin with a brief illustration of the relevant morphosyntactic properties of Slovenian imperatives in Section 2 and follow it by an in-depth discussion of their occurrence in speech reports in Section 3. Section 4 introduces the analysis for imperatives we will draw on and modifies it to account for the Slovenian data. Section 5 briefly discusses imperatives in relative clauses in Slovenian. In Section 6, we conclude with some considerations of general implications and further questions.

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| <i>poslušati</i> (= 'to listen') | singular          | dual                  | plural                |
|----------------------------------|-------------------|-----------------------|-----------------------|
| 1st person                       | ***               | poslušá- <b>j</b> -va | poslušá- <b>j</b> -mo |
| 2nd person                       | poslušá- <b>j</b> | poslušá- <b>j</b> -ta | poslušá- <b>j</b> -te |
| 3rd person                       | ***               | ***                   | ***                   |

Table 1: Slovenian imperative paradigm

## 2. The case of Slovenian

Slovenian has a dedicated morphological imperative verb form, which is inflected for number and person (illustrated in Table 1).<sup>2</sup> The possibility for Slovenian imperatives to appear in embedded environments was noted already by Sheppard and Golden (2002), Rus (2005), and Dvořák (2005), who focus on the fact as such and relevant syntactic/morphological restrictions (cf. also Dvořák and Zimmermann 2008), identifying various types of subordinate clauses which can contain imperative morphology, specifically reported speech complements (cf. (1)) and relative clauses (cf. (2)).<sup>3</sup>

- (1) Mama je rekla, da pospravi sobo!  
 mom is said.FEM.SG that tidy up.IMP.2P.SG room.ACC  
 'Mom said that you should tidy up your room!'
- (2) Na mizi je kozarec vina, ki ga daj mami.  
 on table.LOC is glass wine.GEN which it.ACC give.IMP.2P.SG mom.DAT  
 'The glass of wine which you should give to mom is on the table.'

To the best of our knowledge, distinctions in number and person do not directly influence the types of environments in which embedded imperative forms can occur. For the remainder of the paper, we focus on second person singular forms, and we first turn to imperatives in reported speech.

## 3. Imperatives embedded in reported speech

### 3.1. Evidence for proper embedding

Slovenian imperatives can of course also occur as instances of direct speech, but it is easy to show that they are not confined to such quotational uses. Firstly, imperatives are embedded with the complementizer '*da*' (= 'that'), which also introduces embedded finite declarative clauses, but not

<sup>2</sup>Apart from the imperative verb forms presented in Table 1, some Slovenian verbs rely on suppletion to form imperatives (i.e. '*greš*' = GO.2P.SG vs. '*pojdi*' = GO.IMP.2P.SG). These forms mark agreement with the subject in the same way morphologically and have the same distribution as regular forms, matching the paradigm in Table 1.

<sup>3</sup>They also list imperative morphology in embedded interrogatives, but ignore intricacies of their interpretation, which prompt us to set these cases aside for the moment. See Stegovec (2014) for a first discussion.

direct quotations. Secondly, embedded imperative clauses allow for extraction, for example via wh-question formation (cf. (3)) or focus movement (cf. (4)).

- (3) Koga<sub>i</sub> sem rekel, da pokliči t<sub>i</sub>?  
 whom did say.MASC.SG, that call.IMP.2P.SG  
 Who did I say that you should call?
- (4) Markota<sub>i</sub> sem rekel, da pokliči t<sub>i</sub>!  
 Marko.ACC did say.MASC.SG, that call.IMP.2P.SG  
 It was *Marko* that I said you should call!

Importantly, for a report with an embedded imperative to be felicitous and true, the original utterance need not have been an imperative clause: an utterance of (5a), which contains a modal verb, can be faithfully reported with (5b).

- (5) a. Peter bi moral poslušati.  
 Peter would should.MASC.SG listen.INF  
 'Peter should listen.'
- b. Rekel je, da poslušaj!  
 said.MASC.SG is that listen.IMP.2P.SG  
 'He said that you should listen.'

The above examples show that Slovenian imperative morphology can occur in complement clauses transparent for syntactic operations, and when the original utterance is not an imperative. Therefore, imperative forms can occur genuinely syntactically embedded in non-quotational reports.

### 3.2. Interpretive properties of imperatives in main clauses and speech reports

Main-clause second person (2P) imperatives typically serve the speaker to direct the addressee to behave in a certain way. Even though no subject needs to be realized overtly in the imperatives of any of the languages mentioned here, they are understood as having a second person subject (technically, it is often assumed to be realized as an overt or covert 2P pronoun).<sup>4</sup> In view of their dependence on various parameters of the utterance context, imperatives seem to be multiply indexical. Their occurrence in speech reports is interesting, as the latter will normally involve more than one context, and indexical expressions are *prima facie* expected to depend on the actual context only (Kaplan 1989). In the simplest case of a speech report, the actual utterance serves to

<sup>4</sup>In this paper, we ignore quantificational subjects which appear to be third person morphosyntactically but acquire certain traits of second person in imperative clauses, cf. Kaufmann (2012); Zanuttini et al. (2012).

report what was going on in a previous communication. More generally, we assume that speech reports are to be understood as involving a sequence of contexts  $c_1, \dots, c_{@}$ , where  $c_1$  is the original context that is reported in  $c_2$ , etc., and  $c_{@}$  is the actual context. For a single level of embedding, which is what we will focus on in this paper, we have  $c_2 = c_{@}$ . We use  $S_i$  and  $A_i$  for speaker and addressee in context  $c_i$  (analogously for further parameters). As a (one-level) speech report involves two contexts with possibly different parameters, we have to determine which of them is relevant to the interpretation of the embedded imperative. For the canonical case of a directive imperative, this raises the following questions: (i) Who is directing, the actual speaker  $S_{@}$ , or the original speaker  $S_1$ ? (ii) Who is being directed, the actual addressee  $A_{@}$ , or the addressee in the original context  $A_1$ ? And, finally: (iii) does the utterance describe a previous directive speech act, and/or is it itself directive in any sense? Before looking at Slovenian, we briefly present the results for Korean as the first language for which the interpretation of embedded imperatives has been studied in detail. From Pak et al. (2008) and Zanuttini et al. (2012), we gather that in Korean all aspects of the imperative meaning must be interpreted against the original context  $c_1$ , cf. (6).

- (6) ku salam-i inho-eykey [swuni-lul towacwu-**la**]-ko malhayss-ta.  
 that person-NOM inho-DAT [swuni-ACC help-IMP]-COMP said-DC  
 'He told Inho to help Swuni.' (Pak et al. 2008, 170)

In its context  $c_{@}$ , an utterance of (6) describes a previous context  $c_1$  in which whoever 'he' refers to in  $c_{@}$  was the speaker ( $= S_1$ ) and directed his addressee Inho ( $= A_1$ ) to help Swuni (by saying something like 'Help Swuni!', for example). In  $c_{@}$ , however,  $S_{@}$  is asserting a description of this to  $A_{@}$ . So, all aspects of the imperative meaning (the speaker issuing a direction, the addressee being directed, and the directive speech act itself), are anchored to the respective parameters of  $c_1$ . Pak et al. (2008) conclude that embedded imperatives constitute a case of shifted indexicality (Schlenker 2003). In the following, we will see that things pan out differently in Slovenian.

### 3.3. Imperatives in reported speech in Slovenian

Turning back to Slovenian, let us look at prototypical cases of imperative embedding in reported speech, as illustrated in (7). As in Korean, the embedded imperative reports a non-assertive speech act of the original speaker  $S_1$  in the original context  $c_1$ . But crucially, unlike in Korean, the person who is supposed to do something (here, help) is not the original addressee  $A_1$ , but the actual addressee  $A_{@}$  — apparently, the imperative subject is interpreted against the actual context  $c_{@}$ .

- (7) Žare<sub>1</sub> ⇒ Jure<sub>2</sub>: Marko<sub>3</sub> je rekel Petru<sub>4</sub>, da mu<sub>3,4,k</sub> pomagaj<sub>2</sub>.  
 Marko.NOM is said Peter.DAT that him.DAT help.IMP.2P.SG  
 'Marko said to Peter that you ( $= A_{@}$ ) should help him.'  
 (reporting  $c_1$ , Marko ⇒ Peter, e.g.: 'Jure should really help me/you/Goga.')



The person whose future behavior the original utterance in  $c_1$  is aiming to influence is the actual addressee  $A_{@}$ , who, as indicated by the setting for (7), need not have been present in  $c_1$ . In such a case, the speech act in the original context does not meet Searle's (1969) definition of a directive speech act as an attempt to influence the future behavior of the addressee. Thus, we might wonder if, despite their syntactically embedded status (cf. Section 3.1), cases like (7) are in some sense pragmatically transparent in that the apparent reports themselves constitute directive speech acts in the actual context  $c_{@}$ . Or, if utterances of sentences like (7) are indeed genuinely descriptive, we might wonder about the status of the morphological forms standardly classified as imperatives in traditional grammars of Slovenian. Despite their similarity to the imperatives of other languages in main clauses, they might be more general expressions of prioritizing (i.e., deontic, bouletic, and teleological) modality, as suggested by the English translations in terms of 'you should'. In the following, we will show that neither assumption fits our Slovenian data. On the one hand, even in the absence of the referent of the imperative subject, the speech act in the original context  $c_1$  has to have been non-assertoric in some sense, while the one in  $c_{@}$  can constitute a report of, or, as in (3), a question about, what happened in  $c_1$ . On the other hand, the use of imperatives in speech reports is subject to specific restrictions on the settings of both the original and the actual context; they jointly correspond to the properties generally associated with main clause imperatives. We take this to confirm the genuinely imperative nature of the respective morphological forms in Slovenian. In the following, we discuss a series of properties the sequence of utterance contexts needs to have in order for a report with an embedded imperative to be felicitous and truthful.

### 3.4. Properties of context sequences for Slovenian imperatives

In this section, we show that the use of morphological imperatives in speech reports in Slovenian is not as flexible as suggested by the previous literature. The restrictions that we discuss target the epistemic commitments of the participants of the two contexts and the participant constellations of the two contexts.

#### 3.4.1. Distancing as a test for (non-)assertiveness

Main clause imperatives are typically used for directive speech acts, which means in particular that they publicly commit their speaker to wanting the addressee to make the prejacent true. Yet, upon closer inspection, imperatives need not be used for directive speech acts like orders or commands, but can also be used for wishes, concessions, or speaker-disinterested advice as in (8).

- (8) A: How do I get to the station?  
 B: Take a left at the next intersection, then go straight.

While not genuinely directive, such imperative utterances are still non-assertoric in that they do not provide neutral descriptions of the current state of affairs, as witnessed by the markedness of following them up by *'that's (not) true'*. Moreover, even in a case like (8), where the speaker does not have any specific preferences as to whether the prejacent is made true, he or she cannot explicitly state a preference for the negation of the prejacent, consider (9a) (Kaufmann 2012; Condoravdi and Lauer 2012). No such problem results in the absence of the imperative, cf. (9b). We henceforth refer to follow-ups like *'but I don't want you to'* as instances of *distancing*.

- (9) a. #Take a left at the next intersection, but I don't want you to do that.  
 b. The best thing for you is to take a left at the intersection, but I don't want you to.

When looking at Slovenian imperative reports, distancing can be used to show that not the speech act in the actual, but the one in the original context has to be non-assertoric in the relevant sense.<sup>5</sup> A report with an embedded imperative is faithful only if the speech act in the original context  $c_1$  carries the hallmark of a speech act carried out with an imperative: if  $S_1$  distanced himself from a statement of deontic necessity as in (10a), then the utterance cannot be reported faithfully with an imperative (cf. (10b)), but a *modal+infinitive* construction works (cf. (10c)). Similarly, using an imperative to report is inconsistent when at the same time reporting that the speaker distanced himself from a deontic necessity statement uttered in  $c_1$  (cf. (11)).<sup>6</sup> In contrast, distancing by the actual speaker  $S_{@}$  in  $c_{@}$  does not affect the use of imperatives in speech reports (cf. (12)).

- (10) a. George bi te moral poslušati, ampak jaz tega nočem.  
 George would you.ACC should listen.INF but I that not want.3P.SG  
 'George should listen to you, but I don't want that.' [=  $c_1$ ]  
 b. #Paul mi je rekel, da me poslušaj!  
 Paul me.DAT is said that me.ACC listen.IMP.2P.SG  
 c. Paul mi je rekel, da me moraš poslušati.  
 Paul me.DAT is said that me.ACC must/should.2P.SG listen.INF  
 'Paul said to me that you should listen to me.' [=  $c_{@}$ ]  
 (11) #Paul said to me that LISTEN.IMP.2P.SG to me, but he added that he didn't want you to do it.  
 (12)  $c_1$ : Paul  $\Rightarrow$  John: George should really listen to you!  
 $c_{@}$ : John  $\Rightarrow$  George: Paul said to me that LISTEN.IMP.2P.SG to me, but I don't want that.

Distancing provides evidence that a non-assertoric, imperative-like speech act has to have taken place in  $c_1$ , while the speech act in  $c_{@}$  can be genuinely assertive, describing what happened in  $c_1$ .

<sup>5</sup>The notion of non-assertoric speech acts is similar to the notion of performative modality, cf. Ninan (2005).

<sup>6</sup>For reasons of space, we sometimes list only the English translations of the Slovenian examples and indicate where the morphological imperative form appears in the original.

### 3.4.2. Possible action

While distancing suggests that the core properties of an imperative-like speech act have to hold in the original context, the actual context also needs to have specific properties in order for the imperative report to be felicitous. Consider the following sequence of events:

- (13)  $c_1$ : John says to George and Paul in Berlin: *Ringo should take a plane to London tomorrow!*  
 $c_{@}$ : next day, George calls Ringo on the cell phone, knowing that Paul talked to Ringo right after  $c_1$ : *John said that GO/FLY.<sub>IMP,2P,SG</sub> to London today. So, where are you?*

The report in (13) is felicitous if George assumes that Ringo has not yet gone to London and would still be able to make it there on the same day; as far as George knows, Ringo may or may not be planning to satisfy the imperative. (13) is infelicitous if George knows that Ringo is already in London or on his way there (e.g., because Ringo failed to switch off his cell-phone and George can overhear the relevant announcements when he calls him). It is also infelicitous if George knows that Ringo has failed to satisfy the imperative (e.g., because he has boarded a plane to Tokyo instead). Judgments are somewhat delicate and deserve more careful testing, but the relevant restriction seems to be for  $S_{@}$  to believe that both the prejacent of the imperative and its negation are still choosable courses of action.<sup>7</sup>

### 3.4.3. Participant constellations

The use of imperatives in speech reports is also constrained by how the participants of the two contexts relate to each other. Given the interpretation of the subject, 2P imperatives can only be used to report contexts in which a preference is expressed regarding the behavior of the person who is then the addressee in the actual context (*mutatis mutandis* for the other forms in Table 1). But surprisingly, not all constellations in which the person supposed to do something is the addressee of the report are felicitous. The canonical cases of embedded imperatives  $P!$  in reported speech involve an utterance by  $S_1$  to  $A_1$  which conveys that  $A_{@}$  must carry out  $P$ . The speech act is in a sense ‘proxied’ from  $S_1$  to  $A_{@}$  through  $S_{@}$  (the *proxy*). We refer to such cases as *proxy constellations*, illustrated in (14). Importantly, the proxy need not be  $A_1$ ;  $S_{@}$  can also have been an eavesdropper in  $c_1$  (henceforth  $E_1$ ) — a person who overhears  $c_1$  —, who then speaks in  $c_{@}$  (cf. (15)).

<sup>7</sup>Ultimately, this restriction could be too strong. More carefully construed examples will be needed to decide whether  $S_{@}$  has to believe they are both choosable or if it is sufficient that  $S_{@}$  holds it possible that they are both choosable. Another type of restriction can be excluded, though:  $S_1$  need not be known to still endorse his imperative. The report in (13) can be acceptable if George follows it up with ‘*but I don’t know if John still cares about it*’, or also if John was assassinated between  $c_1$  and  $c_{@}$ . This might be problematic for an account in terms of directive commitments as proposed by Thomas (2012).

- (14)  $c_1$ : Paul  $\Rightarrow$  **John**: *George should really listen to you!*  
 $c_{@}$ : **John**  $\Rightarrow$  George: *Paul said to me that LISTEN<sub>.IMP.2P.SG</sub> to me!*
- (15)  $c_1$ : Paul  $\Rightarrow$  **George**: *Ringo should really listen to John!*  
 $c_{@}$ : **John**  $\Rightarrow$  Ringo: *Paul said to George that LISTEN<sub>.IMP.2P.SG</sub> to me!*

The second group of person constellations which allow imperatives in embedded contexts are cases where a directive speech act is re-iterated. These are constellations where: (i)  $S_1 = S_{@}$  and  $A_1 = A_{@}$  (cf. (16)), (ii) constellations where only  $A_1 = A_{@}$ , which means that  $S_{@}$  can have been an eavesdropper  $E_1$  (cf. (17)), and (iii) constellations where  $S_1 = S_{@}$  but  $A_1 \neq A_{@}$  (cf. (18)). We refer to these as *re-iteration constellations*.

- (16)  $c_1$ : Paul  $\Rightarrow$  John: *You should really listen to me!*  
 $c_{@}$ : Paul  $\Rightarrow$  John: *I said to you that LISTEN<sub>.IMP.2P.SG</sub> to me!*
- (17)  $c_1$ : Paul  $\Rightarrow$  **George**: *You should really listen to John!*  
 $c_{@}$ : John  $\Rightarrow$  **George**: *Paul said to you that LISTEN<sub>.IMP.2P.SG</sub> to me!*
- (18)  $c_1$ : **Paul**  $\Rightarrow$  George: *John should really listen to me!*  
 $c_{@}$ : **Paul**  $\Rightarrow$  John: *I said to him that LISTEN<sub>.IMP.2P.SG</sub> to me!*

But not all superficially similar constellations allow imperative embedding. In (19), the roles of speaker and addressee get reversed and reporting with an imperative is impossible. An unacceptable case with three participants is found in (20), where  $S_{@}$  is  $E_1$ . Apparently, it is generally impossible to revert an imperative back to the original speaker. In all such cases, using a modal+infinitive construction is fine (shown for (19)).

- (19)  $c_1$ : **Paul**  $\Rightarrow$  John: *I should really listen to you!*  
 $c_{@}$ : John  $\Rightarrow$  **Paul**: *#You said to me that LISTEN<sub>.IMP.2P.SG</sub> to me!*  
 a. #Rekel si mi, da me poslušaj!  
     said are.2P.SG me.DAT that me.ACC listen.IMP.2P.SG  
 b. Rekel si mi, da me moraš poslušati.  
     said are.2P.SG me.DAT that me.ACC must/should.2P.SG listen.INF  
     ‘You said to me that you should listen to me.’ [=  $c_{@}$ ]
- (20)  $c_1$ : **Paul**  $\Rightarrow$  George: *I should really listen to John!*  
 $c_{@}$ : John  $\Rightarrow$  **Paul**: *#You said to him that LISTEN<sub>.IMP.2P.SG</sub> to me!*

Also, re-iteration is infelicitous if  $S_1$  is also  $A_1$ , so that the utterance in  $c_1$  involves a self-imposition of a particular course of events (cf. (21) in contrast to (18)).

- (21)  $c_1$ : **Paul**  $\Rightarrow$  **Paul**: *John should really listen to me!*  
 $c_{@}$ : **Paul**  $\Rightarrow$  John: *#I said to myself that LISTEN<sub>.IMP.2P.SG</sub> to me!*

The examples in (19–21) show that the participant constellations of  $c_1$  and  $c_{@}$  influence whether a necessity for  $A_{@}$  expressed in  $c_1$  can be reported with an imperative in  $c_{@}$ . Crucially, in (19–21) imperative verb forms corresponding to the constellation are available and suitable matrix predicates that can select imperatives are used/available. We conclude that the restrictions observed here must be semantic.

#### 4. Towards an analysis of imperatives in speech reports in Slovenian

In the literature, there is less consensus regarding the interpretation of imperatives than the one of declaratives and interrogatives. While some connection with prioritizing modality and directive speech acts is generally acknowledged, opinions differ in what exactly the relations are and what kind of semantic object should be assigned to an imperative clause. In this paper, we cannot offer a detailed discussion of the proposals that are currently available (see Han 2011; Charlow 2014). Instead, we adopt Kaufmann's (2012) analysis, which offers a few immediate advantages for covering the Slovenian data. In Section 4.1 we introduce her account (in a slightly updated version presented as Kaufmann 2014) and apply it towards an analysis of imperatives in reported speech in Slovenian in Section 4.2.

##### 4.1. Contexts for performative modals and imperatives

Kaufmann (2012) argues that the at-issue content of a simple 2P imperative clause ' $\phi$ !' is a modalized proposition which can be paraphrased as 'you should  $\phi$ .' She compares imperatives to declaratives with modal verbs, which can also be used to give orders, advice, permissions, or the like (*performative modals*) rather than describe the state of affairs with respect to what is permissible (*descriptive modals*). For modal verbs, this difference is often taken to be a matter of contextual constellations rather than semantic interpretation. Since imperatives cannot be used descriptively, Kaufmann (2012) proposes that they can only be used felicitously in contexts that would result in a performative use of a modal verb. The restriction is implemented in terms of presuppositions triggered by the imperative. Her analysis is promising for the treatment of embedded imperatives in Slovenian for a couple of reasons. Firstly, an account that interprets imperatives as propositions can easily be extended to their occurrences in complements of speech reports and restrictive relative clauses. This is less clear for accounts in terms of To-Do-Lists (e.g. Portner 2007), action terms (e.g. Barker 2010), or speech acts (Krifka 2014). Secondly, the specific semantics that assimilates  $\phi$ ! to 'you should  $\phi$ ' (analogously for the other morphological forms and corresponding 'should' sentences) fits well with the observation that this is the most natural paraphrase when trying to render embedded imperatives in English. Thirdly, the specific batch of requirements on the context imposed by the imperative's presuppositions proves promising in accounting for the semantic restrictions on when an imperative can serve as a faithful report or when it can occur in a restrictive relative clause (cf. Section 5). Kaufmann's at-issue semantics for modal expressions follows Kratzer (2012). Modal verbs are interpreted with respect to a contextually salient *modal*

base  $f$  (specifying the relevant facts) and *ordering source*  $g$  (specifying criteria for comparing them, e.g. rules, preferences, ...). This allows us to determine, for each world of evaluation  $w$  which worlds are accessible qua being optimal according to  $f$  and  $g$  as applied to  $w$ .<sup>8</sup> Imperatives contain a covert operator  $OP_{Imp}$  that is interpreted like '*must*'.<sup>9</sup>

- (22) a.  $u \leq_{g(w)} v$  iff  $\{p \in g(w) \mid p(v) = 1\} \subseteq \{p \in g(w) \mid p(u) = 1\}$   
 b.  $wR^{f,g}u$  iff  $u \in \bigcap f(w)$  and  $\forall v \in \bigcap f(w)[v \leq_{g(w)} u \rightarrow u \leq_{g(w)} v]$ .  
 c.  $\llbracket must \rrbracket^c = \llbracket OP_{Imp} \rrbracket^c = \lambda w. \lambda p. \forall w' [wR^{f,g}w' \rightarrow p(w') = 1]$

Contexts are understood as septuples (cf. (23a)), *practical contexts* for specific agents are singled out as in (23b), and the salient modality can further enjoy a special status (cf. 23c).

- (23) a. A *context* is a septuple  $c = \langle S, A, w, CS, \Pi, f, g \rangle$ , where  $S_c$  is the speaker,  $A_c$  is the addressee,  $w_c$  is the world in which the context is situated,  $CS_c$  is the *context set* (the set of possible worlds compatible with mutual joint belief for purposes of ongoing conversation of all actual participants, Stalnaker 1978),  $\Pi_c$  is the *question under discussion* (following Roberts 1996), represented as a possibly trivial partition of  $CS_c$ ;  $f_c$  is the salient modal base, and  $g_c$  is the salient ordering source.  
 b. A context  $c$  is  $\alpha$ -*practical* iff  
 (i)  $\Pi_c$  is a decision problem for  $\alpha$ : written  $\Pi_{c,\alpha}^\Delta$  (each cell: a future course of events that  $\alpha$  could choose);  
 (ii)  $g_c$  is prioritizing (specifies rules, preferences, or goals).  
 c. A context  $c$  has *decisive modality* iff  $c$  is  $\alpha$ -practical for some agent  $\alpha$  and  $CS_c$  entails that  $f_c$  and  $g_c$  jointly characterize the modality considered relevant to resolve  $\Pi_{c,\alpha}^\Delta$ .

We do not offer a definition of what it means for  $f$  and  $g$  to jointly characterize the decisive modality, but we follow Kaufmann and Kaufmann (2012) in assuming it entails at least the following:

- (24) a. If  $\alpha$  is  $S$  or  $A$ , then for any  $q \in \Pi_{c,\alpha}^\Delta$ ,  $\alpha$  tries to find out if  $\Box^{f,g}q$ .  
 b. If  $\alpha$  is  $S$  or  $A$ , then  $\alpha$  will try to realize  $q$  if  $\alpha$  believes that  $\Box^{f,g}q$ .  
 c. If  $S$  (or  $A$ ) believes that  $\Box^{f,g}q$ , then it is not the case that  $S$  (or  $A$ ) wants that  $\neg q$

An imperative ' $OP_{Imp}$  (you)  $P$ ' in its context  $c$  pragmatically presupposes:<sup>10</sup>

<sup>8</sup>Throughout, we assume that a set of optimal worlds can always be reached from every world compatible with the modal base (Lewis's *Limit Assumption*).

<sup>9</sup>Kaufmann mostly ignores the distinction between weak and strong necessity, and we follow her in this. But see in particular Medeiros (2013).

<sup>10</sup>To presuppose something is to take it for granted, or at least to act as if one takes it for granted, as background information — as common ground among the participants in the conversation [*i.e.*, *entailed by CS*].', (Stalnaker 2002, p. 701).

- (25) a. *EpistemicAuthority*( $c$ ):  $S_c$  has perfect knowledge of  $f_c$  and  $g_c$  (cf. Groenendijk and Stokhof 1984).  
 b. *EpistemicUncertainty*( $c$ ): Before the imperative, both  $\llbracket P \rrbracket^c(A_c)$  and  $\neg \llbracket P \rrbracket^c(A_c)$  are epistemic possibilities for  $S_c$ .  
 c. *AddresseePracticality*( $c$ ):  $c$  is  $A_c$ -practical,  $c$  has decisive modality, and  $\llbracket P \rrbracket^c(A_c)$  provides an answer to  $\Pi_{c,\alpha}^\Delta$  (cf. Groenendijk and Stokhof 1984, i.e. it eliminates at least one cell of  $\Pi_{c,\alpha}^\Delta$ ).<sup>11</sup>

From the presuppositional status of these conditions it follows that imperatives can only be used felicitously in a context  $c$  that meets all of them. But any case in which they are met and an imperative is uttered goes beyond an assertion of the proposition expressed and results in a directive or expressive speech act. To address the pattern found in Slovenian, we will argue in the next section that the package of presuppositions needs to be revised slightly in order to allow for them to be satisfied by two contexts together.

## 4.2. Predicting Slovenian

The propositional and presuppositional meaning components attributed to imperatives involve several aspects of indexicality: reference is made to the speaker, the addressee, their contextually shared beliefs and questions, as well as what modal parameters are salient. For embedded imperatives, we have shown that at least some of these parameters have to relate to the components of the original context. While unexpected under Kaplan's long-standing prohibition against such phenomena (monsters), the recent literature converges on the view that indexicals can be shifted in at least some languages. In Korean, both the 2P-subject of the imperative and the non-assertive meaning of the imperative are interpreted with respect to the original context  $c_1$  and are treated as shifted indexicals by Pak et al. (2008) (cf. Section 3.2). In Slovenian, the conditions ensuring a non-assertive interpretation of the imperative largely have to be anchored to  $c_1$ , while the person feature behaves like a strict indexical and needs to be interpreted w.r.t. the actual context  $c_{@}$ .

### 4.2.1. Slovenian with shifted indexicality

While part of the imperative meaning can be shifted, all personal, temporal, or spatial indexicals remain anchored to the actual context. Slovenian does therefore not display *Shift Together* of all indexicals, an effect observed for Zazaki (cf. Anand and Nevins 2004), or, within a syntactically limited domain, for Uyghur (cf. Sudo 2012). It is thus more similar to what Schlenker (2003) observes for Amharic. Specifically, the person feature of Slovenian imperatives behaves like a strict indexical in that it invariably depends on the actual context. Things are less straightforward for the

<sup>11</sup>Kaufmann (2012) notes an additional complication regarding partial answers that is orthogonal to our concerns.

presuppositions triggered: we have argued that the non-assertoric aspect that bans distancing is a property of the original context (cf. Section 3.4.1); but the requirement that the prejacent constitutes a possible action for the addressee has to hold in the actual context (cf. Section 3.4.2). If Kaufmann is correct in that both aspects are introduced by the imperative operator, this leaves us with a puzzle. In the literature on shifted indexicality, it is standardly assumed that each indexical can depend on one context only — the actual context (mandatory for strict indexicals) or some other context (an option for shiftable indexicals). To account for our finding about Slovenian imperatives, we adopt a modification of Sudo (2012). According to him, expressions take covert context pronouns as their syntactic arguments, but indexicality is captured as a dependence on the context that functions as a parameter of evaluation. In order to allow for indexicals to shift, Sudo introduces a monster operator that takes a context pronoun as its argument and uses it to overwrite the actual context as the parameter of evaluation. While designed to capture Shift Together in the scope of the monster operator, a slight variant of the framework allows us to capture the Slovenian data. We follow Sudo in assuming that expressions can combine with context pronouns in the syntax, but we assume that they come into play only via binding through attitude predicates. They never get to overwrite the actual context as a parameter of evaluation. Verbs like *rekel* (= ‘say’) quantify over contexts and can therefore bind the context argument of the imperative operator, cf. (26a), where  $k$  is the semantic type of contexts and variables  $h, i, j, \dots$  range over contexts. Strict indexicals like overt and covert 2P pronominals are interpreted directly, cf. (26b).

- (26) a.  $\llbracket rekel \text{ ‘say’} \rrbracket^c = \lambda i_k. \lambda p_{\langle k, t \rangle}. \lambda x. \text{for all } j \text{ compatible with what } x \text{ says in } w_i: p(j) = 1.$   
 b.  $\llbracket ti \text{ ‘you’} \rrbracket^c = \llbracket pro^{2P} \rrbracket^c = A_c$

Non-indexical expressions depend on the world parameter of their context argument. Shiftable indexicals depend on their context argument also for other parameters. Depending on whether their argument is bound by the top-most or an intervening context binder, they may or may not get shifted. In addition, they may or may not depend on the context parameter of evaluation. The imperative operator is a shiftable indexical that depends both on its context argument and on the context parameter of evaluation. While the context argument of a shiftable indexical can, in principle, be indexed to the top-most context pronoun even in embedded contexts (resulting in interpretation w.r.t. the actual context), this is not an option for the imperative operator: its argument pronoun has to be bound by the attitude verb (we leave it open if this is to be explained in terms of vacuous quantification or of a more specific locality condition as in Percus 2000). Finally, we split Kaufmann’s condition of *AddresseePracticality* as follows:

- (27) *AddresseePracticality* [split version]:  
 An imperative ‘OP<sub>Imp</sub>(you)  $P$ ’ is felicitous in context  $c$  only if the following hold:  
 a. *DecisiveModality*( $c$ ):  $c$  is  $\alpha$ -practical for some agent  $\alpha$  and  $g_c$  and  $f_c$  constitute the decisive modality to resolve  $\Pi_{c, \alpha}^\Delta$   
 b. *Answerhood*( $c$ ):  $c$  is  $A_c$ -practical and  $\llbracket P \rrbracket^c(A_c)$  provides an answer to  $\Pi_{c, A}^\Delta$



$$(28) \quad \llbracket \text{OP}_{\text{Imp}} \rrbracket^c = \lambda i_k. \lambda p_{\langle k, t \rangle} : \text{EpistemicAuthority}(i) \ \& \ \text{EpistemicUncertainty}(i) \\ \& \ \text{Answerhood}(c) \ \& \ \text{DecisiveModality}(i). \forall h [w_i R^{f_i, g_i} w_h \rightarrow p(h) = 1]$$

(29) [  $\lambda h$  [ John [ say  $h$  ] Paul [  $\lambda i$  that [ [OP]<sub>imp</sub>  $i$  ]  $\lambda j$  [  $pro^{2p}$  [ listen  $j$  ] ] ] ] ] ]

### 4.2.2. Holding our predictions against the data

(30)  $c_1$ : Paul  $\Rightarrow$  John: *George should really listen to you!*  
 $c_0$ : John  $\Rightarrow$  George: *Paul said to me that LISTEN<sub>IMP.2P.SG</sub> to me!*

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$A_{@}$ . But, other than in certain cases of re-iteration, the original context is not practical for  $A_1$ , so the expectation that  $A_1$  needs to do something (like pass on the imperative) can be cancelled:

- (31) *Paul said to me that LISTEN<sub>IMP,2P.SG</sub> to me, but he also said that I shouldn't interfere.*

Similarly to the proxy constellations, re-iteration constellations are also expected to be fine: since  $A_1 = A_{@}$ , both contexts are addressee-practical. Semantically, *Decisive Modality* has to hold only in  $c_1$ , but in the absence of further qualifications, there seems to be a strong implication that it is still considered decisive by the speaker in  $c_{@}$ .

At this point, we cannot derive the restriction against reverting back imperatives to the original speaker (cf. (19,20)). For starters, we would like to suggest that it might have to do with the fact that, in  $c_{@}$ , the original speaker  $S_1$  (and new addressee  $A_{@}$ ) is presented as having given an answer to a question of what he himself should do ( $A$ -practicality). But since the issue is still unresolved in  $c_{@}$  (qua *Answerhood*),  $S_1$  apparently failed to act on it. We suspect that this might be in conflict with the modality used by  $S_1$  in  $c_1$  being reported as having been decisive in  $c_{@}$ . Future work will have to show if these and similar considerations can shed light on the restriction against reverting imperatives back to the original speaker, but also on cases like (21), where speakers re-iterate their own decisions about another individual's actions to that very individual.

## 5. Relative clauses

The other environment where imperatives appear in embedded contexts in Slovenian are relative clauses. Crucially, imperatives can appear in both non-restrictive and restrictive relative clauses. The latter is shown in (32) and (33), where only a restrictive reading is possible.

- (32) To je piva<sub>i</sub>, ki jo<sub>i</sub> spij, in to je piva<sub>j</sub>, ki jo<sub>j</sub> daj tatu.  
 this is beer<sub>i</sub> that her<sub>i</sub> drink<sub>IMP,2P.SG</sub> and this is beer<sub>j</sub> that her<sub>j</sub> give<sub>IMP,2P.SG</sub> dad<sub>DAT</sub>  
 'This is the beer you should drink and this is the beer you should give dad.'
- (33) Na mizi so vsi članki<sub>i</sub>, ki jih<sub>i</sub> preberi do jutri.  
 on table<sub>LOC</sub> are all paper<sub>SNOM</sub> that them read<sub>IMP,2P.SG</sub> by tomorrow  
 'All the papers that you should read by tomorrow are on the table.'

As with speech reports, we find restrictions on the use of imperatives that we take to originate from their presuppositional meaning component. One such restriction is that imperatives cannot be used when their prejacent is known to be impossible, as illustrated by (34); purchasing the book is impossible from the perspective of  $c_{@}$ . This contrasts with (35), where the implication of future availability of the book renders the embedded imperative acceptable.

- (34) # Knjiga<sub>i</sub>, ki jo<sub>i</sub> kupi, je razprodana.  
 book<sub>i</sub> that her<sub>i</sub> buy<sub>IMP.2P.SG</sub> is sold out  
 'The book which you should buy is sold out.'
- (35) Knjiga<sub>i</sub>, ki jo<sub>i</sub> kupi takoj, ko bo na voljo, še ni izšla.  
 book<sub>i</sub> which her<sub>i</sub> buy<sub>IMP.2P.SG</sub> immediately when will on available yet not out  
 'The book, which you should buy as soon as its available, is not out yet.'

This kind of contrast is actually expected and follows from *EpistemicUncertainty* and the *AddresseePracticality*, which coincide partly for main clause imperatives as well. In particular, *EpistemicUncertainty* states that before the utterance of an imperative,  $S_{@}$  considers possible both prejacent  $p$  and  $\neg p$ . In (35) both  $p$  ('you buy the book') and  $\neg p$  ('you do not buy the book') are possibilities at some point in the future, so the unavailability at  $c_{@}$  is irrelevant. In contrast, (34) entails that the book is not available, so only  $\neg p$  is an epistemic possibility for  $S_{@}$ . This is further confirmed by (36), where the adverbial 'currently' implies the possibility of a future in which the book is available again, so that buying the book is an epistemically possible course of events and the imperative becomes felicitous.

- (36) Knjiga<sub>i</sub>, ki jo<sub>i</sub> kupi, je trenutno razprodana.  
 book<sub>i</sub> that her<sub>i</sub> buy<sub>IMP.2P.SG</sub> is currently sold out  
 'The book which you should buy is currently sold out.'

Interestingly, imperatives in restrictive relative clauses are cross-linguistically rarer than in reported speech (for Ancient Greek, see Medeiros 2013). To some degree this is unexpected given the propositional semantics assigned to imperatives. But the Slovenian examples show that the phenomenon is subject to specific semantic or pragmatic restrictions even in a language where imperatives can appear in restrictive relative clauses in principle. A detailed comparison with German might be particularly interesting: German does not allow for imperatives in canonical restrictive relative clauses, which seems to be a syntactic restriction due to a competition for the C-position (in German, imperativized verbs have to be moved to C). But imperatives can be embedded in V2-relatives (cf. (37)).

- (37) Diese Platte hat eine Seite, die hör dir lieber nicht an.  
 this disk has one side that listen<sub>IMP.2P.SG</sub> you<sub>DAT</sub> better not to  
 'This disk has one side that you should rather not listen to.'

Gärtner (2000) shows that V2-relatives are interpreted restrictively, but have specific discourse properties. Further work will be needed to understand how the specific properties of embedded V2-relatives and possibly other types of non-canonical relative clauses relate to the embedding of imperatives.

## 6. Conclusions and open questions

Across languages, the embedding of imperative clauses is well-known to be subject to various kinds of constraints. In this paper, we have discussed the case of Slovenian as a language that *prima facie* contradicts this picture by permitting imperatives to be embedded in a series of constructions. We have shown that, upon closer consideration, occurrences of embedded imperatives in reported speech and in restrictive relative clauses are subject to a series of semantic or pragmatic constraints that align very well with standardly acknowledged properties of main clause imperatives. We consider this a strong argument for the genuinely imperative nature of the Slovenian forms, whose participation in the formation of complex expressions can thus be used to gain new insights for the analysis of imperatives in general. Technically, we have derived at least some of the restrictions from Kaufmann's modal propositional semantics of imperatives, and we argue that this provides additional support for her treatment of imperative clauses. Finally, the behavior of Slovenian imperatives in reported speech suggests a treatment in terms of shifted indexicality. We argue that it instantiates a hitherto unobserved type of the phenomenon in that one element (the imperative operator) is sensitive to two contexts at the same time. We have implemented a solution to this in a modified version of Sudo's (2012) account. Despite the success in deriving part of the restrictions, we have emphasized that more work will be needed to obtain full coverage. Moreover, we have confined our attention to directive speech acts in two context sequences, and left untested imperatives used for wishes, advice, and permissions, or as occurring in more complex reporting sequences. Further research should also involve a careful study of different embedding predicates. Different types of relative clauses and also different types of heads, particularly quantificational ones, will have to be investigated. A cross-linguistic comparison of what parts of the imperative meaning shift might be able to shed some light on the patterns of what languages allow to embed imperatives in what contexts. Finally, we have confined our attention to 2P-imperatives, hoping that our results will shed light on other person forms as well. This, of course, remains to be investigated as well.

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# Quantificational variability and the genesis of English headed *wh*-relatives

Robert Truswell — *University of Edinburgh*

Nikolas Gisborne — *University of Edinburgh*

**Abstract.** English headed *wh*-relatives developed from Old English free *hw*-relatives, but many descriptive grammars associate free *hw*-relatives primarily with generalizing interpretations quite unlike the standard semantics for headed relatives. We demonstrate that these generalizing interpretations are reducible to factors external to the free relative itself, and that these external factors are less common with clause-final free *hw*-relatives. Clause-final free *hw*-relatives are more likely to be interpreted as definite, which brings them closer to typical interpretation of headed relatives.

**Keywords:** Old English, free relatives, semantic change.

## 1. Introduction

Many principles of linguistic change which have been worked out in some detail for phonology or syntax should apply equally to semantic change. For example, it is well-established that the surface manifestations of phonological and syntactic changes tend to be gradual and incremental — a theory that predicted catastrophic syntactic change to be common would be generally considered a nonstarter. Exactly the same should be true of theories of semantic change.

Most analyses of gradual grammatical change incorporate the notion of **reanalysis** (Andersen 1973, Lightfoot 1979). Reanalysis is useful to analysts in that it builds on the notion of latent structural ambiguity, or the availability of multiple analyses of a given form, to allow substantial structural change paired with minimal change on the surface. A learner can associate a new structure with a given string, and that new structure may subsequently be used in novel ways.

Given the general requirement that natural language grammars be interpreted compositionally, an instance of syntactic reanalysis typically requires a parallel semantic reanalysis: a change in the way in which a lexical item interacts with the syntactic compositional system requires a change in the way in which it interacts with the semantic compositional system. This imposes a constraint on theories of grammatical change: we assume that semantic change, like other types of grammatical change, is typically gradual and incremental, so a good analysis of grammatical change does not entail catastrophic semantic change.

In this paper, we discuss a change in the history of English, namely the development of headed *wh*-relatives in Early Middle English. We propose a natural syntactic explanation for this change, according to which an appositive free relative is reanalysed as an extraposed headed relative.

However, given common assumptions about the semantics of Old English *wh*-words, this natural syntactic explanation entails a catastrophic semantic change: the ‘indefinite’ or ‘general’ meanings classically associated with OE *wh*-words are quite remote from the role of *wh*-phrases within a compositional interpretation of headed relatives.

We show that, in this case, the straightforward syntactic analysis can be maintained once closer attention is paid to the division of labour between factors internal and external to the relative clause in the compositional derivation of the meaning of free relatives. Any ‘general’ interpretation of OE free relatives is not due to the inherent meaning of the *wh*-form, but rather to sensitivity to external factors like the episodic/generic distinction (Jacobson 1995, Dayal 1997) and association with *swa* (similar to Present-Day English *-ever* as analysed by Dayal and by von Stechow 2000).

The point is not to reduce the semantic change to zero, but to avoid real diachronic discontinuities (which often translate into arbitrary synchronic disjunctions) in the interpretation of a form. In fact, we will argue that the development of English headed relatives involves a case of **semantic reanalysis**: a large change in the semantic structure associated with a given utterance, which has only a minimal effect on truth-conditional interpretation. Semantic reanalysis, construed in this way, requires a many-to-one relation between structured semantic representations and truth-conditional interpretations, and so contributes another argument for structured semantic representations.

In what follows, Section 2 sketches relevant aspects of the emergence of headed *wh*-relatives, and Section 3 briefly discusses key ideas emerging from Jacobson’s analysis of free relatives which underpin our examination of OE free relative semantics. After an interim summary in Section 4, Section 5 describes a quantitative analysis of OE free relatives, and Section 6 concludes.

## 2. The diachrony of English relatives: Classical accounts

Old English used *hw*-phrases (the ancestors of *wh*-phrases) in three ways: as NPI-like restricted indefinites (1); as interrogative forms (2); and within free relatives (3).

- (1) and gif **hwa** hyt bletsað, þonne ablinð seo dydrung.  
and if who it blesses then ceases DEM illusion  
‘And if anyone blesses it, then the illusion is dispelled.’ (coaelhom,+AHom\_30:4.4082)
- (2) Saga me on **hwilcne dæg** he gesingode  
Say me on which day he sang  
‘Tell me which day he sang on.’ (coadrian,Ad:2.1.4)



- (3) [eal swa **hwæt** swa ic þe gehet] [eal ic hit gesette]  
 all so what so I thee promised all I it appoint  
 ‘Whatever I promised you, I will do it all.’  
 (coblick,LS\_20\_[AssumptMor[BiHom\_13]]:147.155.1807)

Our focus in this paper is on the development of a fourth use of *hw*-phrases, in headed relatives. Headed relatives in Old English were formed with either a demonstrative phrase in [Spec,CP] (4), a complementizer *þe* in C<sup>0</sup> (5), both, or neither. A demonstrative phrase is associated with a gap from several categories, including PPs and adverbials; if there is no demonstrative phrase, the gap inside the relative clause is always of category NP (Allen 1980).

- (4) he is ure lif [on **pam** we lybbað & styriað \_\_\_\_]  
 he is our life in DEM we live and move  
 ‘He is our life, in whom we live and move.’ (coaelhom,+AHom\_1:280.148)
- (5) ic [ðe \_\_\_\_ to eow sprece]  
 I that to you speak  
 ‘I, that speaks to you.’ (coaelhom,+AHom\_1:63.45)

As the OE inflectional system collapsed, examples like (4) disappeared, leaving *þe* as the primary relativizer. This makes it tempting to hypothesize a functional motivation for the introduction of *wh*-relatives: *þe* can only be associated with an NP gap, but *wh*-phrases come in the same range of categories as inflected demonstrative phrases. This approach might hope to explain the fact noted by Romaine (1982), that headed *wh*-relatives appear first with *wh*-AdvPs and *wh*-PPs, low-accessibility *wh*-phrases in the terms of Keenan and Comrie (1977). However, as already noted by Allen, the chronology does not support a functional motivation: relatives headed by inflected demonstratives largely disappeared several decades before headed *wh*-relatives emerged, and during those decades, English seemed to get on fine with just *þe*. Accordingly, we will not consider functional pressures here, and concentrate instead on formal factors influencing the emergence of headed *wh*-relatives.

A full theory of a change like this typically starts with identification of an ambiguous context in which reanalysis can take place. One such context was noted already by Johnsen (1913), who demonstrated a potential ambiguity between headed *wh*-relatives and free relatives in apposition to universal *eall*. We build on Johnsen’s insight, although we will show that free *hw*-relatives are found in apposition to a range of NPs, not just *eall*. Supplementing Johnsen’s insight, we note that OE free *hw*-relatives almost always occur in peripheral positions within the clause, either left-adjoined or clause-final (except for other peripheral elements such as certain adverbial phrases). Early headed *wh*-relatives, meanwhile, are always clause-final, although they may stand in an extraposition-like relation to a clause-medial antecedent.

Taken together, these considerations mean that free and headed *wh*-relatives overlap in that they can both occur clause-finally, with a *wh*-phrase in [Spec,CP], and an anaphoric relation to a preceding constituent. (6) illustrates this context. It contains two sentences, the second containing a clear free *hw*-relative *hwar ic hine byrede*. However, the first is ambiguous: either *hwar ic þe leigde* is a free relative in apposition to *þa byrigeles* (two separate noun phrases), or it is a headed relative modifying *þa byrigeles* (a single complex noun phrase). This is the latent structural ambiguity required for reanalysis.

- (6) *Þa cwæð ic to him, æteowe me þa byrigeles [hwar ic þe leigde]. Se Hælend me*  
 Then said I to him show me the tomb where I you laid The Saviour me  
*þa beo þære rihthand genam and me ut lædde [hwar ic hine byrede]*  
 then by the right hand took and me out led where I him buried  
 ‘Then I said to him, “Show me the tomb where I laid you”. The Saviour then took me by  
 the right hand and led me out to where I buried him.’ (conicodC,Nic\_[C]:149.161–2)

We can only see clearly that reanalysis has taken place once distributional differences arise between the constructions in question. In this case, this arises once *wh*-relatives occur within clause-medial NPs, as in (7). Such examples are unattested until the mid-13th century, and then gradually increase in frequency over several centuries.

- (7) *For [þe eareste Pilunge [hwer of al þis uuel is]] nis buten of prude.*  
 for the first stripping where of all this evil is NEG.is but of pride  
 ‘For the first stripping, from where all this evil comes, is from nothing but pride.’  
 (cmancriw-1,II.119.1506)

Free and headed *wh*-relatives also have overlapping but distinct internal composition. An OE free *hw*-relative maximally contains a CP-layer like (8), with the paired elements *swa* ... *swa* surrounding the *wh*-phrase *hwylcen dæige*, with a piedpiped preposition.

- (8) *[CP [PP on [NP swa hwylcen dæige]] [C swa] se synfulle gecerred byð to Gode]*  
 on so which day so the sinful turned be to God  
 ‘On whichever day the sinner is turned to God.’ (coalcuin,Alc\_[Warn\_35]:393.290)

The paired *swa*-forms are only found in free *hw*-relatives in OE and early ME, and never in headed relatives. We will examine their distribution among subtypes of free *hw*-relatives below.

In sum, from a syntactic perspective, OE free *hw*-relatives are ripe for reanalysis as headed relatives: they have overlapping distributions, similar internal syntax, and both allow for an anaphoric relation to a preceding phrase. Our main task in this paper is to fill in the semantic half of this reanalysis, and draw out the implications for the interpretation of free and headed *wh*-relatives during this period.

As discussed in the introduction, OE free *hw*-relatives frequently have a ‘general’, or broadly universal interpretation. This is certainly in evidence in (3). However, the crucial question is not so much how (3) is interpreted *in toto*, but how that meaning is derived compositionally, and what the contribution of *hwæt* is to that derivation. In (3), there are clear reasons to suspect that the general interpretation is not due to the semantics of *hwæt* alone: both the free relative and the matrix clause contain the overtly universal *eal*. Indeed, given that natural language prohibits vacuous quantification, it would be surprising if *hwæt* could co-occur with *eal* at all if it had a robustly universal interpretation. This is an initial indication that factors other than the *hw*-forms may contribute the general interpretation associated with free *hw*-relatives.

A related argument was already made by Curme (1912), in a passage which deserves to be quoted at length:

‘This change of meaning from a general conception to a particular reference must have been made more easy by **the use of “seþe” with the general meaning *he that, whoever***: “Seþe gelyfþ on me, he wyrce þa wearc þe ic wyrce” (John 14.12, Corpus) “He that believes on me (he) will do the works that I do.” The relative “seþe,” which usually follows an antecedent, and thus refers to a definite individual, here stands at the beginning of the sentence just as the general relative “swa hwylc swa” and like it has a general meaning. Thus the same form has a general and a particular meaning. Similarly the general relative “swa hwylc swa” passed from the head of the sentence to a position after a definite antecedent and took on definite meaning, for after the analogy of “seþe” it could have both general and definite force... **[T]he meaning of “swa hwylc swa” and “seþe” or “se” was identical[.]**

(Curme 1912:196, emphasis added)

Curme’s argument complements our discussion above. We showed that *hw*-phrases, unlike true universals, can occur as the restriction of universal *eal*, while Curme shows that the clearly non-universal demonstrative *se* can share the general interpretation found with *hw*-relatives. Moreover, the free relative in (6) has a clearly definite interpretation, as revealed by the interpretive relation between the NPs in the two clauses, in contrast to the general interpretation of (3). Taken together, these pieces of evidence strongly suggest that the general interpretation is not due to the lexical semantics of the *hw*-forms.

In this way, Curme’s analysis foreshadows modern semantic analyses, stemming from Jacobson (1995), of free relatives as definite descriptions. We summarize that body of work in Section 3.

### 3. Formal semantics of free relatives

The questions about the quantificational force of OE free relatives that occupied us in Section 2 have also been asked of Present-Day English. It is widely agreed that the free relative in (9) is a definite description, paraphraseable as *the thing(s) that he cooked*.

- (9) I ate [what he cooked].

However, it is less clear whether (10) is definite or universal.

- (10) I ate [whatever he cooked].

The commonsense answer appears to be that *whatever he cooked* is universal, as (10) can be paraphrased as *I ate everything that he cooked*. Specific technical arguments in favour of this view do exist: Larson (1987) argues that free relatives with *-ever*, unlike definites, undergo Quantifier Raising, while Iatridou and Varlokosta (1998) claim that free relatives with *-ever* are ungrammatical in specificational pseudoclefts because they are universal, while specificational sentences are built from definites. However, the pre-eminent current theory of free relatives, stemming from Jacobson (1995), claims that the free relative in (10), like (9), is definite. Jacobson's core argument is that universal-like interpretations are doubly dissociated from the presence of *-ever*. In (11), *-ever* is present but there is no universal interpretation (the free relative can be paraphrased as *the movie the Avon is now showing* — *I forget what it is*). Meanwhile, in (12), *-ever* is absent but the meaning is general: if the babysitter tells you to do something, do it.

- (11) Everyone who went to [whatever movie the Avon is now showing] said it was very boring.  
(Jacobson 1995:454)

- (12) Do [what the babysitter tells you] (Jacobson 1995:455)

Jacobson takes this as evidence that *what* and *whatever* are both definite descriptions, with their denotation differing from that of *the N(s)* primarily in that *what* is number-neutral and can refer to atomic individuals or pluralities. To make this slightly more explicit, assume a lattice structure for the domain of individuals as in Link (1983), and an internal syntax for free relatives as in (13).

- (13)
- 
- ```

graph TD
    CP --> WhN["Wh N'_i"]
    CP --> Cprime["C'"]
    Cprime --> lambda["λx_i"]
    Cprime --> IP["IP"]
    IP --> ellipsis["... x_i ..."]
  
```

The claim in its essentials is that  $C'$  denotes  $\lambda x.P(x)$ , and that  $Wh N'$  denotes  $\lambda P\iota x.P(x) \wedge Q(x)$ , where  $Q$  is the property denoted by  $N'$ . The free relative as a whole then denotes  $\iota x.P(x) \wedge Q(x)$ , the maximal individual bearing the properties described by  $N'$  and  $C'$ .

The take-home message from Jacobson's double dissociation is that apparently universal interpretations of free relatives cannot be reduced to the presence of *-ever*. Two subsequent papers

addressed obvious questions arising from this. First, Dayal (1997) showed that a key determinant of whether a free relative is interpreted as ‘definite’ or ‘universal’ is the external linguistic context: if the clause containing the free relative is interpreted episodically ((14-a) and (15-a)), the free relative is interpreted as definite; if it is interpreted generically ((14-b) and (15-b)), the free relative is interpreted as universal.

- (14) a. Do [what the babysitter told you].  
       b. Do [what the babysitter tells you].
- (15) a. Everyone who went to [whatever movie the Avon was showing] said it was very boring.  
       b. Everyone who goes to [whatever movie the Avon is showing] says it is very boring.

Dayal takes this to show that the denotation of free relatives should be relativized to situations: they denote the maximal entity bearing properties  $P$  and  $Q$  in some situation  $s$ . Episodic sentences are descriptions of particular situations, which means that free relatives in such sentences pick out a particular individual. Generic sentences, meanwhile, involve generic quantification over situations, and accordingly, free relatives will pick out different individuals in different situations.

Finally, von Fintel (2000) addresses the contribution of *-ever*, if it is not a universal quantifier. He claims that *-ever* contributes a presupposition given in (16). In somewhat plainer English, the presupposition states that, within some set of worlds, regardless of the identity of the maximal individual picked out by the free relative, the state of affairs described by the rest of the sentence would have been the same.

- (16)  $whatever(w)(F)(P)(Q)$   
       a. presupposes:  $\forall w' \in \min_w [F \cap (\lambda w'. \iota x. P(w')(x) \neq \iota x. P(w)(x))] :$   
             $Q(w')(\iota x. P(w')(x)) = Q(w)(\iota x. P(w)(x))$   
       b. asserts:  $Q(w)(\iota x. P(w)(x))$  (von Fintel 2000)  
       Where  $w$  is a variable over worlds,  $F$  is a modal base,  $P$  is the free relative denotation,  $Q$  is the predicate of which the free relative is an argument.

Depending on the choice of modal base, this presupposition tends to be interpreted in one of two ways. (17) presupposes that the speaker is ignorant of what Arlo is cooking. In the terms of (16), Arlo is cooking different dishes in different doxastically accessible worlds, but those different dishes have the common property that there’s a lot of garlic in them.

- (17) There’s a lot of garlic in [whatever Arlo’s cooking] (#in this case, porridge).

Meanwhile, in (18), the speaker is indifferent to the identity of the tool. The relevant modal base is roughly a set of worlds which differ minimally from the real world only in the identity of the tool which is handy: in each of those worlds, I grabbed that tool.

(18) I grabbed [whatever tool was handy] (in this case, a hammer).

This completes the analytical separation of *-ever* from universality: we have a different causal explanation for universal readings, and a non-universal compositional contribution of *-ever*. In what follows, we argue that the definite analysis is equally applicable to OE, and that OE *swa* is semantically similar to *-ever*.

#### 4. Back to Old English

Section 3 described recent analyses which dissociate the role of *-ever* from universality. We now take these analyses back to our discussion of Old English. To recap, our question is whether OE free *hw*-relatives can be analysed as definite descriptions, using Jacobson's analysis of PDE free relatives as a model. It is important to note that many OE examples are equally compatible with analyses as universal quantifiers, but that is by the by: we should prefer an analysis of free relatives as definite descriptions *a priori*, as such an analysis fits better with Caponigro's (2003) findings about the crosslinguistic stability of free relative meaning, and also allows for a less discontinuous analysis of the diachronic semantics of *wh*-forms. The aim is not to falsify other conceivable analyses which treat some or all free *hw*-relatives as universals; it is to demonstrate that an analysis where they always denote definites is tenable, and to develop, on the basis of that demonstration, a diachronic account which does not rely on catastrophic semantic change to identify OE free relatives as the historical antecedents of Middle English headed relatives.

A major implication of Jacobson's and Dayal's work on free relatives is that we cannot draw reliable conclusions about quantificational force without controlling for interactions with operators external to the free relative. Accordingly, we conducted a quantitative investigation into patterns of use of free *hw*-relatives in the York–Toronto–Helsinki Corpus of Old English Prose (YCOE, Taylor et al. 2003). If free *hw*-relatives are definite descriptions, they should show the same range of interpretations as PDE free *wh*-(*ever*)-relatives. Based on the work described in Section 3, we can sharpen this into the following specific predictions.

- Apparently universal interpretations should be largely concentrated in generic sentences (though generic sentences may also admit non-universal interpretations).
- Any equivalent of *-ever* is compatible with such quasi-universal interpretations, but not required by such interpretations.
- Episodic sentences will tend to give rise to definite interpretations, with some exceptions.
- An equivalent of *-ever* in episodic sentences will trigger von Stechow's presupposition, typically construable as a presupposition of ignorance or indifference.

We explore these predictions in both quantitative and qualitative analyses in the next section. Before proceeding, we note that a certain amount of noise is ineliminable in work such as this: we do not have intuitions about OE meanings, and attempts to infer fairly subtle contrasts from overt contextual factors are invariably error-prone. Having said that, we believe that in this case, the surprising fact is that there is not more noise, and that fairly clear patterns can be detected.

## 5. Corpus analysis

In this section, we argue for four main conclusions: clause-final and clause-initial free relatives have different properties; clause-initial free relatives are not representative of free relatives in general, because they require *swa*; *swa* is a semantic equivalent of present-day English *-ever*, so only clause-final free relatives have interpretations other than those admitted by *-ever*; and free relatives without *swa* are particularly concentrated in adverbial free relatives.

To establish these conclusions, we extracted 503 free relatives (tagged with the CP-FRL tag) with a *hw*-phrase in [Spec,CP] from YCOE, and classified them according to four factors:

- Position of the free relative (left-peripheral or clause-final);<sup>1</sup>
- Grammatical function of the *hw*-phrase (argument or adverbial);
- Presence or absence of *swa* within the free relative;
- Tense of the main verbs in the free relative and matrix (past or present).

We intend simple present tense as a proxy for generic interpretation, and other tenses as proxies for episodic interpretation. This is clearly a very rough approximation of the actual linguistic facts, especially given that OE does not robustly display PDE's distinctive restrictions on interpretation of the simple present. However, it has the virtue of being explicitly represented in the textual record, while actual interpretation can only be indirectly inferred. Moreover, this simple approach produced very robust results, as will be shown presently.<sup>2</sup>

### 5.1. Results: Present tense

#### 5.1.1. Quantitative analysis

Most work on OE free relatives has tacitly assumed that the canonical OE free *hw*-relative is the generalizing variety with *swa* found in a correlative construction. In this section, we show that the properties of these free relatives are not shared by all free *hw*-relatives. We describe rates of present tense in free *hw*-relatives conditioned by clausal position and grammatical function, and show that,

<sup>1</sup>A token followed only by adjuncts and other peripheral material was classed as clause-final. On that definition, over 90% of free *hw*-relatives in YCOE occur in one of these two peripheral positions. We discarded the relatively rare clause-medial examples because of insufficient data to draw robust comparisons.

<sup>2</sup>It is somewhat surprising that this approach worked as well as it did. We believe that this may reflect a contingent fact about the types of discourses which are most strongly represented in the OE textual record, and in YCOE in particular. Narrative reports, whether historical or fictional, are predominantly episodic and reported in the past tense; other types of documents, such as laws and more philosophical works, tend to express generic propositions in the present tense. Although tense and genericity are doubly dissociable, then, in this corpus they correlate quite strongly.

in comparison to argumental free *hw*-relatives in correlative constructions, both clause-final and adverbial free *hw*-relatives use less present tense.

As a baseline, the tense of all verbs in the YCOE was examined. There are 89,027 present tense verbs (44.4%) and 111,545 past tense verbs (55.6%), as well as 33,967 others, such as imperatives or participles. In comparison, 354 main verbs in free *hw*-relatives (70.7%) are in the present tense, and 147 (29.3%) are in the past tense (2 tokens were excluded, one because it contained no verb and one because the main verb appeared to be an infinitive). On the assumption that rate of present tense reflects rate of generic interpretation, this confirms the impression that free *hw*-relatives are strongly associated with generic interpretation (binomial test,  $p < 2.2 \times 10^{-16}$ ).

However, there are significant differences in the strength of association of different classes of free *hw*-relative with present tense. Table 1 shows rates of present tense among free *hw*-relatives classified according to clausal position and grammatical function (9 tokens were excluded because either the tense or the grammatical function was unclear).

	Argument	Adverbial
Left-peripheral	82.7% (196/237)	63.3% (31/49)
Clause-final	62% (101/163)	46.7% (21/45)

Table 1: Rates of present tense in free *hw*-relatives

A logistic regression analysis revealed no significant interaction between position and grammatical function ( $p = 0.41$ ). Once the interaction was excluded from the model, there were highly significant main effects of position (left-peripheral position favours present tense,  $p = 1.7 \times 10^{-6}$ ) and grammatical function (argumenthood favours present tense,  $p = 7.8 \times 10^{-4}$ ).

In probing the applicability of the Jacobson/Dayal analysis of free relatives to OE, we are interested particularly in non-universal interpretations of free *hw*-relatives, as universal interpretations do not distinguish that analysis from an alternative where OE free *hw*-relatives are lexically specified as universal. We expect such non-universal interpretations to be most common in episodic sentences, expressed using tenses other than the simple present. The results summarized in Table 1 therefore strongly suggest that we should not focus on left-peripheral, argumental free *hw*-relatives, as the literature often has, but rather concentrate on clause-final and adverbial examples.

### 5.1.2. Qualitative analysis

A qualitative examination of a representative set of examples strengthens this impression. We discuss three cases: the standard case where present tense correlates with a universal interpretation; cases where a universal interpretation arises in a correlative construction despite the use of past



tense; and cases where present tense is associated not with a universal interpretation, but with another interpretation which *-ever* can also give rise to.

(19) exemplifies the straightforward case of Dayal's pattern, where simple present tense is paired with a habitual interpretation of the verbal predicates and general interpretation of the free relative. Clearly, *swa hwæt* could be translated as *whatever*.

- (19) and [swa hwæt swa we doþ Godes þearfum on Godes naman], þæt we doð  
and so what so we do God.GEN service.DAT in God.GEN name.DAT that we do  
Gode sylfum.  
God.DAT self.DAT  
'and whatever we do as service to God, in God's name, we do to God himself.'  
(coaelhom,+AHom\_26.3:8.3925)

In fact, though, (20) has the same universal reading despite being in the past tense, and again *swa hwar* could be translated as *wherever*. This suggests that although the correlation between simple present tense and generic sentences is far from perfect, the exceptions strengthen the more interesting claim that left-peripheral free *hw*-relatives are interpretively specialized, as generic sentences and quasi-universal free relatives tend to be found in other tenses in this construction as well.

- (20) Soðlice [swa hwar swa Israhela bearn wæron], þar wæs leoht.  
Truly so where so Israel's children were, there was light  
'all the children of Israel had light in their dwellings.'  
(cootest,Exod:10.23.2788)

Meanwhile in (21), despite the simple present tense, the free relative is clearly intended to refer to a single individual (as multiple individuals cannot all cast the first stone). However, the identity of that individual is unknown, an example of von Stechow's ignorance reading.<sup>3</sup> Once more, *swa hwylc eower* could be translated as *whoever*.

- (21) [Swa hwylc eower swa næfð nane synne on him], awyrpe se ærest ænne  
So which you.GEN.PL so NEG.have no sin in him, cast.out.SBJ he first one  
stan on hy  
stone on her  
'He that is without sin among you, let him first cast a stone at her.'  
(coaelhom,+AHom\_14:214.2117)

We conclude that, even when left-peripheral position does not correlate with present tense and universal interpretation, a stronger correlation persists between left-peripheral position and the range of interpretations associated with *-ever*.

<sup>3</sup>In fact, as (21) is classically understood, there is no person without sin among the addressees, and the use of a definite description is intended to trigger a presupposition failure. This extra detail does not impact on the core semantic analysis of the free relative, though.

## 5.2. Results: The role of *swa*

We have shown that left-peripheral free *hw*-relatives are not representative of free *hw*-relatives as a whole. In this section, we demonstrate that left-peripheral free *hw*-relatives, unlike the clause-final variant, require *swa*. We then claim that *swa* has the same semantic function as *-ever*.

### 5.2.1. Quantitative analysis

Table 2 shows rates of occurrence of *swa*, cross-classified by position and grammatical function as before (once again, 9 tokens were excluded where the classification was unclear).<sup>4</sup> We see that *swa* is almost always present in left-peripheral free *hw*-relatives, regardless of grammatical function. Indeed, a logistic regression analysis reveals that there is no significant interaction between position and grammatical function in conditioning the occurrence of *swa* ( $p = 0.15$ ), and no main effect of grammatical function ( $p = 0.74$  once the interaction is excluded). There is, however, a highly significant main effect of position ( $p = 3.9 \times 10^{-13}$  once grammatical function is excluded).

	Argument	Adverbial
Left-peripheral	97.9% (231/236)	93.9% (46/49)
Clause-final	67.1% (110/164)	68.9% (31/45)

Table 2: Distribution of *swa* in free *hw*-relatives

As well as the facts that *swa* ... *swa* is almost categorically present in left-peripheral free *hw*-relatives, and that such free relatives occur disproportionately often in present tense, the tenses of the main verbs in the free relative and matrix are identical more often than is expected. In 88.5% (255/288) of left-peripheral cases, either both verbs are present or both verbs are past. The same is true of only 65.3% (139/213) of examples with clause-final free *hw*-relatives, a highly significant difference ( $p = 6.1 \times 10^{-10}$ , Fisher's exact test). The cumulative effect is that correlative structures with left-peripheral free *hw*-relatives are unusually fixed: *swa* is omnipresent, and the tenses of the main verbs in the free relative and matrix are normally identical. We cannot find out why free *hw*-relatives in these constructions have the interpretations they do, because these features cannot be adequately teased apart.<sup>5</sup> Clause-final tokens are more promising, as these factors can be better distinguished. Examples with and without *swa* can be found in reasonable quantities for both argumental and adverbial free *hw*-relatives. This gives us more information about how the attested range of interpretations arises.

<sup>4</sup>The two *swas* almost always occur together, but there are 11 examples in which only one or the other *swa* occurs. For present purposes, it makes no difference which *swa* we count; we chose to count the second.

<sup>5</sup>It is not clear how a structure as complex as these correlatives can be so fixed. This poses significant analytical challenges in its own right. Luckily, the point of the above discussion is simply that we have to look elsewhere to understand the compositional interpretation of free *hw*-relatives.

### 5.2.2. Qualitative analysis

Clause-final free *hw*-relatives with *swa* also show *-ever*-like readings. In generic sentences like (22), their interpretation is quasi-universal.

- (22) Fyres gecynd is þæt hit fornymð [swa hwæt swa him gehende bið].  
 Fire.GEN nature is that it consumes so what so it.DAT near is  
 ‘Fire’s nature is that it consumes whatever is near it.’  
 (cocathom1,+ACHom\_I,\_22:360.152.4446)

In episodic sentences, different subcases of von Fintel’s presupposition can be seen. Prior context suggests an ignorance reading for (23): Joseph has been placed in charge of Egypt, which is suffering from famine. The people come to the Pharoah for advice, and the Pharoah utters (23) with no apparent knowledge of what Joseph will tell them to do.

- (23) Gaþ to Iosepe & doþ [swa hwæt swa he eow secge].  
 Go to Joseph and do so what so he you.DAT say.SBJ  
 ‘Go unto Joseph; what he saith to you, do.’ (cootest,Gen:41.55.1711)

Meanwhile, (24) may well be a case of indifference, with the subjunctive mood on *wolden* reinforcing the fact that the speaker is not talking about a definite time.

- (24) he him apas swor & gislas salde, þæt he him gearo wære [swa hwelce dæge  
 he them oaths swore and pledges gave that he them ready be.SBJ so which day  
 swa hie hit habban wolden]  
 so they it have want.PST.SBJ  
 ‘he swore oaths and pledged to them that he would be ready whenever they wanted it.’  
 (cochronA-1,ChronA\_[Plummer]:874.5.844)

Finally, (25) is an interpretive parallel of (21). It is part of the story of Zacchaeus, a tax collector who repents upon meeting Jesus. Other Bible translations typically do not entail that Zacchaeus admits to taking anything, suggesting that the interpretation of *swa hwæt swa ic reafode* is once again not definite.<sup>6</sup>

- (25) and þærtocan ic wylle be feowerfealdum forgyldan [swa hwæt swa ic reafode]  
 and moreover I will by fourfold repay so what so I stole  
 ‘and if I have taken any thing from any man by false accusation, I restore him fourfold.’  
 (coaelhom,+AHom\_17:175.2450)

<sup>6</sup>Jacobson’s denotation for free relatives still carries an existential presupposition, whereas modern Bible translations like the PDE version below typically do not in this case. In principle, this could indicate that the denotation of *swa hwæt swa* is slightly different from *whatever*. Equally, though, it could just be sloppy translation.

Without *swa*, the interpretations are for the most part straightforwardly definite, as in (26).

- (26) Gemyne, [hwæt Sanctus Paulus cwæð]  
 Remember what Saint Paul said  
 ‘Remember what Saint Paul said.’ (cogregdC,GDPref\_and\_3\_[C]:15.207.28.2739)

The picture with present-tense examples is less straightforward, in ways which go beyond the scope of this short paper. (27) is indicative of the kinds of challenges which arise.

- (27) & ða dioflu gearwe bidað, [hwonne heo mec gegrypen & to helle locum gelæde].  
 and the devil ready waits when it me grasp.SBJ and to hell.GEN fold lead.SBJ  
 ‘and the devil lies ready for when it may grasp me and lead me to hell’s fold.’  
 (cobede,Bede\_5:14.440.13.4432)

It appears that the denotation of the free relative is a definite time, but one whose identity is not yet known. It may be that von Fintel’s presupposition for *-ever* accounts for this case, and indeed, (27) may equally well be translated by *when* or *whenever*. Whether it would be equally acceptable in OE to replace *hwonne* with *swa hwonne swa* is, of course, unknown.

Regardless of the correct analysis of these examples, we conclude that free *hw*-relatives without *swa* have the same definite interpretation as PDE definite free *wh*-relatives. Free *hw*-relatives with *swa* are interpreted like PDE *wh-ever*-relatives. Accordingly, *swa* is interpreted like *-ever*.

### 5.3. Discussion

The key finding from this empirical investigation is that OE free *hw*-relatives can be analysed as definite descriptions, using Jacobson (1995), Dayal (1997), and von Fintel (2000) as models. Concerning our broader question, the emergence of headed *wh*-relatives from free *hw*-relatives, this is much more promising than a conceivable alternative, implied by the traditional literature, where free *hw*-relatives are interpreted universally. Although the compositional details of that analysis are rarely spelled out, it seems likely that such an analysis would eventually posit an interpretation of *hw*-forms as universal quantifiers. This is synchronically problematic, in that *hw*-forms never have such interpretations in other syntactic contexts, but also diachronically problematic, as it would require a pairing of a gradual syntactic change with a catastrophic semantic change, the loss of *hw*-forms as universals.

As shown in the above, it is easy to misconstrue free *hw*-relatives as universals when considered as an undifferentiated whole, as the clearly non-universal cases are in a minority relative to the large numbers of examples of the syntactically and semantically quite fixed correlative relatives like (21). However, with a view to explaining the emergence of headed *wh*-relatives, this may turn out to be a blessing in disguise. The clause-final free relatives are a likely diachronic source for



The core propositional content is contained before the relative, while the relative itself functions as an elaboration of the argument *infer*. Such an elaboration could equally well arise from an individual denotation (with an implicit identification of the individuals picked out by the free relative and by *infer*), or by an open proposition, where the individual variable contributed by *hwanon* is anaphorically related to *infer*.

A simplified PDE example may allow us to make things more explicit. The relative in (29) shows the same ambiguity between appositive free relative with individual denotation (29-a) and headed relative with propositional denotation (29-b).

- (29) I arrived in London, where I stayed the night.
- a. ... you know, (the place) where I stayed the night.  
 $arrive(I, London) + \iota x.(stay(I, night, x))$
  - b. ... by the way, I stayed the night there  
 $arrive(I, London) \bullet (stay(I, night, x))$

In both (29-a) and (29-b), the denotation of the relative is built compositionally from the same property  $\lambda x.stay(I, night, x)$ . Between (29-a) and (29-b), though, two things change. The operator in the free relative (29-a) converts that property into a definite description  $\iota x.stay(I, night, x)$ , which is then integrated with the preceding proposition by the mysterious operator  $+$  (we will say nothing about  $+$ , but take the existence of examples like (29-a) as strong evidence that such an operator must exist). Meanwhile, the operator in the headed relative (29-b) supplies a free variable as an argument of that property, converting it into a proposition  $stay(I, night, x)$ . This proposition is then combined with the preceding proposition by the equally mysterious, but possibly distinct, operator  $\bullet$ .

None of these type-theoretic shenanigans affect the global interpretation, because the distinction between the free relative operator  $\lambda P \iota x.P(x)$  and the headed relative operator  $\lambda P.P(x)$  is cancelled out by the mechanisms subsumed under  $+$  and  $\bullet$ , respectively: a referential dependence is formed between *London* and  $\iota x.(stay(I, night, x))$  in the case of the free relative, and between *London* and  $x$  in the case of the headed relative. The same information gets associated with the same referents in the two cases, by quite different compositional routes.

This is precisely what an instance of semantic reanalysis should look like. The relative in (28), just like the relative in (29), can be of type *e* or type *t*. This is a substantial difference within a structured theory of semantics, and all the more so because (28) occurred at a time when *hw*-relatives were not typically associated with denotations of type *t*. However, the superficial interpretive consequences (if there are any) of this quite substantial formal shift are minimal. Such an ambiguity of representation allows new semantic structures to enter the language without catastrophic interpretive consequences, as is familiar from classic discussions of reanalysis in syntax and phonology.

## 6. Conclusions

This paper has examined the emergence of headed *wh*-relatives from free *hw*-relatives, insisting that a successful analysis must not involve catastrophic semantic change, any more than catastrophic syntactic change. Our analysis has been almost entirely synchronic, focusing on a stage when the emergence of distinctively headed *wh*-relatives had barely begun and demonstrating that the semantic properties of free *hw*-relatives at that stage are largely similar to the semantic properties of early headed *wh*-relatives. This similarity is clearest among clause-final relatives, where definite interpretations of free relatives are quite common. This is important because clause-final relatives provide the ambiguous context which feeds reanalysis, in this case reanalysis of free relatives in apposition as possibly extraposed headed relatives.

This reanalysis is syntactically quite unremarkable: a surface string is compatible with two structural analyses, one conservative, one innovative. Diachronic evidence shows the diffusion of the innovative analysis through the system along various dimensions, over the following several centuries. The more novel contribution of this paper is to show that this syntactic reanalysis must be paired with a parallel semantic reanalysis: free relatives, being basically nominal, denote individuals; headed relatives, being clausal, denote propositions, and the emergence of headed relatives is only possible because an individual-denoting constituent can be reanalysed as propositional. Although such a shift would be hair-raising in some cases, the discourse status of these clause-final relatives means that it has little effect on the interpretation of these relatives in the wider context. Just as with phonological and syntactic instances of reanalysis, large shifts in structured semantic representations are possible, so long as those shifts entail only minor interpretive consequences.

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# A Grammatical View of Exhaustification with Focus Movement: Evidence from NPI-Licensing<sup>1</sup>

Yimei Xiang — *Harvard University*

**Abstract.** This paper offers an explanation to the NPI-licensing effect of *only* by incorporating focus movement into the grammatical view of exhaustification. The core assumption is that focus movement is motivated if interpreting focus in-situ yields a G-triviality/contradiction.

**Keywords:** NPI, Focus movement, Exhaustification, Alternative Semantics, *Only*

## 1. Introduction

It is well-known that the emphatic expression *any* is licensed as a (weak) negative polarity item (NPI) under downward-entailing (DE) contexts (Fauconnier 1975, 1979; Ladusaw 1979), such as under negation or in the left argument of a universal quantifier, as exemplified in (1) and (2), respectively. A context is DE if it supports a downward inference; for instance, observe in (3) that a downward inference holds from a set to its subset in the left argument of the universal quantifier *every*, but not in the left argument of the existential quantifier *some*.

- (1) a. John didn't read any papers.  
b. \*John read any papers.
- (2) a. Every student who has read any papers passed the exam.  
b. \*Every student who has read some papers passed any exams.  
c. \*Some student who has read any papers passed the exam.
- (3) a. Every *student* passed the exam.  $\rightarrow$  Every *smart student* passed the exam.  
b. Some *student* passed the exam.  $\nrightarrow$  Some *smart student* passed the exam.

The DE-based account is schematized as in (4), adopted from von Fintel (1999) and Gajewski (2007).<sup>2</sup>

- (4) a. An NPI is grammatical iff it appears in a constituent that is DE w.r.t. this NPI.  
b. A constituent **A** is DE w.r.t.  $\alpha$  of type  $\delta$  iff the function  $\lambda x. \llbracket \mathbf{A}[\alpha/\mathbf{v}_\delta] \rrbracket^{g[v_\delta \rightarrow x]}$  is DE.  
 $[\mathbf{A}[\alpha/\mathbf{v}]]$  is the result of replacing  $\alpha$  with  $\mathbf{v}$  in **A**.]

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<sup>2</sup>' $\subseteq$ ' stands for cross-categorical entailment (von Fintel 1999).

- (1) a. For  $p, q$  of type  $t$ :  $p \subseteq q$  iff  $p$  is false or  $q$  is true.  
b. For  $f, g$  of type  $\langle \sigma, \tau \rangle$ :  $f \subseteq g$  iff for all  $x$  of type  $\sigma$ :  $f(x) \subseteq g(x)$ .  
In particular, for  $a, a'$  of type  $e$ :  $a \subseteq a'$  iff for all  $P$  of type  $\langle e, t \rangle$ :  $\lambda P.P(a) \subseteq \lambda P.P(a')$ .

- c. A function  $f$  of type  $\langle \sigma, \tau \rangle$  is DE iff for all  $x$  and  $y$  of type  $\sigma$  s.t.  $x \subseteq y$ :  $f(y) \subseteq f(x)$ .

Klima (1964) firstly observed that the exclusive focus particle *only* can license NPIs. The emphatic expression *any*, for instance, can be licensed as an NPI in the right argument of NP-*only* or in the immediate scope of VP-*only*. Here and throughout the paper, I use CAPITAL letters to mark stressed items, and the  $F$  subscript to mark the semantic focus.

- |  |  |
|--|--|
| (5) Right argument of NP- <i>only</i>      | (6) Under VP- <i>only</i>                            |
| a. Only JOHN <sub>F</sub> read any papers. | a. Mary only gave any funding to JOHN <sub>F</sub> . |
| b. *JOHN <sub>F</sub> read any papers.     | b. *Mary gave any funding to JOHN <sub>F</sub> .     |

One empirical constraint for the NPI-licensing effect of *only* is that NPIs cannot appear within the semantic focus or any focus (F)-contained island (Wagner 2006 a.o.). In particular, NP-*only* does not license NPIs in its left argument, as shown in (7); and VP-*only*, for instance, cannot associate with or into an *any*P, as shown in (8): when VP-*only* directly associates with the determiner *any*, the entire DP *any paper*, or simply the NP complement *paper*, the NPI use of *any* is not licensed.

- (7) \*Only any students saw John.
- (8) a. \*John only read ANY<sub>F</sub> papers.  
 b. \*John only read [any PAPERS]<sub>F</sub>, (he didn't read every book).  
 c. \*John only read any PAPERS<sub>F</sub>, (he didn't read any books).

(8c) also illustrates the inviability of associating *only* into an NPI-contained island. According to Abels (2003), the complement of a phasal head (e.g. the D<sup>0</sup> *any*) cannot move by itself and strand its embedding phrase head; it always pied-pipes its phasal head. Therefore, the *any*P in (8c) exhibits an island effect, to the extent that *PAPERS* cannot be moved out of the *any*P.

The remainder of this paper is organized as follows. Section 2 and 3 will show that neither the F(ocus)-movement theory (Wagner 2006) nor the G(rammatical)-view of exhaustification can properly address the NPI-licensing effect of *only* by its own. Thus Section 4 will propose an alternative approach that incorporates features of both theories, built up upon an assumption that F-movement is motivated by the requirement of avoiding G-trivialities/contradictions.

## 2. The theory of F-movement

### 2.1. The SDE-condition

The invalidity of downward inferences under *only*, firstly indicated by Atlas (1993), casts a doubt to Fauconnier-Ladusaw's DE-based account of NPI-licensing. While the right argument of NP-*only* and the non-F-associated part of VP-*only* are eligible positions for licensing weak NPIs, these contexts do not support downward inferences, as shown in (9).

- (9) a. Only  $\text{JOHN}_F$  ate vegetables for breakfast.  $\nrightarrow$  Only  $\text{JOHN}_F$  ate kale for breakfast.  
 b. John only ate  $\text{VEGETABLES}_F$  for breakfast.  $\nrightarrow$  John only ate  $\text{KALE}_F$  for breakfast.

Given this problem, von Fintel (1999) proposes that S(trawson)DE environments are sufficient for licensing weak NPIs. The SDE condition, as schematized in (10), grants all presuppositions of the consequence when the validity of a downward inference is assessed. Further, von Fintel (1999) shows that *only* is an SDE function: the complement of *only* is DE when the preadjacent presupposition is satisfied, as illustrated by the reasoning in (11).

- (10) A function  $f$  of type  $\langle \sigma, \tau \rangle$  is SDE iff  
 for all  $x$  and  $y$  of type  $\sigma$  such that  $x \subseteq y$  and  $f(x)$  is defined:  $f(y) \subseteq f(x)$ .
- (11) Kale is a vegetable.  $x \Rightarrow y$   
 John ate kale for breakfast.  $f(x)$  is defined  
Only John ate vegetables for breakfast.  $f(y)$   
 $\therefore$  Only John ate kale for breakfast  $\therefore f(x)$

## 2.2. Wagner (2006)

Recall that *only* cannot license the NPI *any* when associated with or into the *any*P. The SDE condition, nevertheless, still cannot capture the asymmetry between the F-associated part and the non-F-associated part in the scope of *only*. To explain this asymmetry, Wagner (2006) adopts the SDE condition and proposes a theory of F(ocus)-movement.

Wagner assumes that *only* has two syntactic arguments, a syntactic restrictor and a scope. In particular, *only* is SDE in its the scope but not in its restrictor. For instance, when the preadjacent presupposition of *only* is granted, a downward inference is supported in (12) but not in (13).

- |  |  |  |
|--|--|--|
| $  \begin{array}{c}  \text{onlyP} \\  \swarrow \quad \searrow \\  \text{only} \quad \text{restrictor} \quad \text{scope}  \end{array}  $ | <p>(12) Kale is a veg.<br/>         John ate kale.<br/> <u>Only <math>\text{JOHN}_F</math> ate <i>vegs.</i></u><br/> <math>\therefore</math> Only <math>\text{JOHN}_F</math> ate <i>kale</i></p> | <p>(13) Graduates are students.<br/>         Graduates ate kale.<br/> <u>Only <math>\text{STUDENTS}_F</math> ate kale.</u><br/> <math>\nrightarrow</math> Only <math>\text{GRADUATES}_F</math> ate kale.</p> |
|--|--|--|

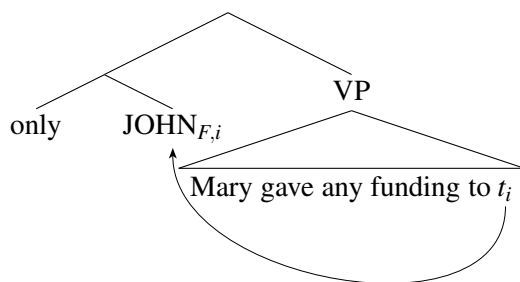
Further, Wagner assumes that VP-*only* association invokes a covert phrasal movement of the focused expression to the restrictor of *only*. For cases where *only* associates into an island, he assumes that F-movement is island-sensitive (cf. Rooth 1985; among the others) and that the expression undertaking F-movement is the minimal F-contained island (Drubig 1994). For instance, what gets F-moved in (14a) and (14b) should be the complex DP and the *when*-clause, respectively. This assumption predicts an *Island Restriction*: “Association with a constituent within an island cannot license an NPI in the same island.” (Wagner 2006: 312)

Moreover, since F-movement is a phrasal movement, this assumption also predicts a *Head Restriction*: “If *only* associates with the head of a constituent, it does not license an NPI in the complement of the head.” Wagner (2006: ex. 42) For instance in (15), the F-moved element has to be the entire VP, including the *anyP*.<sup>3</sup>

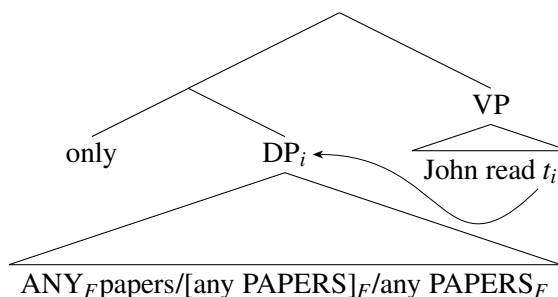
- (14) a. Dr. Smith only rejected [the proposal that JOHN<sub>F,i</sub> submitted].  
 b. Dr. Smith only complains [when BILL<sub>L,F</sub> leaves the lights on].  
 (15) \*John only CUT<sub>F</sub> any vegetables.

This analysis immediately predicts that an NPI is not licensed in the immediate scope of VP-*only* if and only if this NPI appears within the F-moved constituent. This prediction is fully compatible with the observations with the VP-*only* in (6) and (8). In (6a), the focused NP moves alone to the restrictor of *only*, while the NPI *any* stays and gets licensed within the scope part, as illustrated in (16a). As for the ungrammatical sentences in (8), in contrast, the NPI *any* is part of the F-moved constituent and therefore is not licensed, as illustrated in (16b).<sup>4</sup>

- (16) a. NPI is licensed



- b. NPI is not licensed



## 2.3. Problems with the F-movement theory

### 2.3.1. NPI-licensing condition

Like the predecessors, Wagner (2006) does not explain why NPIs are not licensed in non-(S)DE contexts; saying that NPIs must appear in (S)DE contexts is still a description.<sup>5</sup> What's more,

<sup>3</sup>Jon Gajewski points out an insufficiency of this explanation to Wagner (2006: fn. 14): the object *anyP* should be allowed to vacate the VP, and the remnant VP subsequently associate with *only*.

<sup>4</sup>In (8), the F-moved expression has to be the entire *anyP*, regardless of whether *only* associates with the entire *anyP* or with a sub-component of the *anyP*. On the one hand, the D<sup>0</sup> *any* alone cannot take an F-movement, which is a phrasal movement. On the other hand, according to Abels (2003), the complement of D<sup>0</sup> cannot be moved out of the DP; therefore, when the NP complement of *any* is forced to take F-movement, the entire *anyP* gets F-moved.

<sup>5</sup>Hsieh (2012) develops an explanation to the NPI-licensing effect of *only* based on Wagner (2006). But it inherits the problems of the SDE condition and Wagner (2006).

recent works on NPIs point out empirical problems with the SDE condition and criticize that SDE is neither necessary nor sufficient for NPI-licensing. On the one hand, as Crnič (2011) indicates, another prototypical F-sensitive expression *exactly two* can also license NPIs in its left argument, but *exactly two* is non-presuppositional and hence cannot be SDE; therefore the SDE condition is unnecessary for NPI-licensing. On the other hand, the SDE condition appears to be insufficient. For instance, the left arguments of DPs like *the student* and *both students* are SDE, but these positions do not license NPIs, as shown in (18) (Gajewski 2011, Chierchia 2013).

(17) Exactly two students did any reading at all.

(18) a. \* The student who had any linguistics did well.

i. Presupposition:  $|\text{students}_w| = 1$  ii. Assertion:  $\text{students}_w \subseteq \text{did well}_w$

b. \* Both students who had any linguistics did well.

i. Presupposition:  $|\text{students}_w| = 2$  ii. Assertion:  $\text{students}_w \subseteq \text{did well}_w$

### 2.3.2. Motivation of F-movement

Wagner (2006) argues that *only* presupposes an  $\exists$ -premise rather than the truth of its prejacent (Horn 1996, cf. Horn 1969). He schematizes the lexical entry of *only* as in (19), where the arguments  $f$  and  $P$  correspond to the syntactic restrictor/complement and the scope, respectively. The  $\exists$ -presupposition (19b) abstracts over the entire complement of *only*. Accordingly, (20) and (21) have the same semantic focus but different  $\exists$ -presuppositions. Here Wagner uses underlining to mark the syntactic complement/restrictor of *only*,  $\lceil$  corner symbols  $\rceil$  to mark the scope of *only*, and *italics* to mark the semantic focus.

(19) a.  $\llbracket \text{only} \rrbracket(f)(P) = \forall a \in C[P(a) \rightarrow P(f) \subseteq P(a)]$

b. Presupposition:  $\exists x.P(x)$

(20) With F-movement:

a. John only  $\lceil$  played *basketball*  $\rceil$ .

b. Presupposition:  $\exists x.$  John played  $x$ .

(21) Without F-movement:

a. John only  $\lceil$  played *basketball*  $\rceil$

b. Presupposition:  $\exists x.$  John  $x$ -ed.

Next, adopting the *Maximize Presupposition Principle* from Heim (1991), Wagner assumes that F-movement is motivated to strengthen the  $\exists$ -presupposition of *only*: “F-movement minimizes the size the of the syntactic restrictor, which may have an effect on the strength of the statement that is grammatically encoded by the sentence.” (Wagner 2006: 314) For instance, the  $\exists$ -presupposition of *only* in (20) is stronger than the one in (21), motivating an F-movement.

I argue that the motivation of F-movement and the semantics of *only* proposed by Wagner have two empirical problems. First, the semantics of *only* defined in (19) is too weak for cases like (22). It predicts (22) to be felicitous and true even if only John ate kale. To correctly predict the meaning of

(22), Wagner would have to assume that *only* presupposes not just an existential inference but also the truth of its prejacent. Such a move, however, would make the MP Principle inapplicable: the  $\exists$ -presupposition, regardless of its strength, collapses under the prejacent presupposition; therefore, the F-moved form (20) would not be more preferable than the unmoved form (21).

- (22) Only [John and Mary]<sub>F</sub> ate kale.  
 a. Presupposition: Someone ate kale.  
 b. Assertion: Anyone who ate kale is part of *John+Mary*.

Second, the assumed motivation of F-movement is incompatible with the basic example (15), repeated in (23). Accordingly, with or without F-movement, the syntactic complement of *only* in (23) is always the entire VP, and the  $\exists$ -presupposition is always (23a); therefore, if F-movement were used only to strengthen the  $\exists$ -presupposition, it would NOT be motivated in (23).

- (23) \*John only  $\lceil$  CUT<sub>F</sub> any vegetables  $\rceil$ .  
 a. Presupposition:  $\exists x$ . John *x*-ed.  
 b. Assertion: If John did any action to any vegetables, that action is no more than cutting.

Further, a sentence of the form “John only CUT<sub>F</sub> *x*” is not just SDE but also strict DE with respect to *x*: it is SDE because the downward inference holds in the asserted part ((24a-ii) entails (24b-ii)); it is strict DE because the  $\exists$ -presuppositions of (24a-b) are identical.<sup>6</sup> Therefore, Wagner cannot explain the ungrammaticality of (23), regardless of which NPI-licensing condition he adopts.

- (24) a. John only  $\lceil$  CUT<sub>F</sub> vegetables  $\rceil$   
     i. Presupposition: John did something.  
     ii. Assertion: If John did any action to vegetables, that action is no more than cutting.  
 b.  $\Rightarrow$  John only  $\lceil$  CUT<sub>F</sub> kale  $\rceil$   
     i. Presupposition: John did something.  
     ii. Assertion: If John did any action to kale, that action is no more than cutting.

In addition to the empirical problems, the  $\exists$ -presupposition is defined unconventionally: it abstracts over the entire complement of *only*, not just the semantic focus (cf. Horn 1996). To this extent, the  $\exists$ -presupposition is isolated from other major semantic properties of focus, such as the semantic focus or the quantificational domain,<sup>7</sup> which makes the lexicon of *only* quite inconsistent.

<sup>6</sup>Wagner (2006: ex. 44b) himself writes the presupposition of (24b) as “John did something with kale”, which however conflicts with his main assumption that the existential import abstracts over the entire complement of *only*.

<sup>7</sup>Wagner (2006) assumes that the semantic focus is obtained by contextually restricting the alternative set: alternatives to the entire syntactic complement are all considered; but the quantificational domain is contextually restricted, which helps to identify the semantic focus.

This inconsistency cannot be fixed under Wagner’s basic framework. On the one hand, if the  $\exists$ -presupposition is generated by abstracting over the semantic focus, its strength would not be affected by F-movement. On the other hand, if the quantificational domain is generated by abstracting over the complement of *only*, exhaustification would lead to overly strong interpretations for sentences where *only* associates into an island. For instance in (25), due to the Left-Branch Extraction Constraint (Ross 1986), an F-movement theory requests the entire possessive NP *JOHN’s advisors* to be F-moved. If the quantificational domain includes all the contextually relevant individuals, not just individuals that are someone’s advisors, (25) would take the overly strong reading in (25b).

- (25) Sue only  $\sqsupset$  invited JOHN<sub>F</sub>’s advisors  $\sqsubset$ .  
 a.  $\rightarrow$  Sue didn’t invite **anyone’s advisors** except John’s advisors.  
 b.  $\nrightarrow$  Sue didn’t invite **anyone** except John’s advisors.

### 2.3.3. Association with licensed NPIs

Recall Wagner’s prediction that an NPI is not licensed under *only* if it is part of the F-moved constituent. Conjoining this prediction with his claim that F-movement is mandatory for VP-*only* association, we get a stricter constraint stated as follows: VP-*only* cannot associate with an NPI or an NPI-contained island within which the NPI is not licensed. This constraint, however, is too strong for cases like (26), where *only* associates with the *any*P across another NPI-licenser (i.e. the clause-mate negation); the stricter constraint predicts (26) to take the LF in (27), under which the NPI *any* would not be licensed: the *any*P, as the minimal F-contained island, would be moved to the syntactic restrictor of *only*, a context that is non-SDE and cannot license NPIs.

- (26) Mary only didn’t give [any FUNDing]<sub>F</sub> to John. (She did her best to help him.)  
 (27) [only (any funding)<sub>i</sub> [Mary didn’t gave *t<sub>i</sub>* to John]] (×)

## 3. The G-view of exhaustification

### 3.1. The G-view of scalar implicatures

The G-view of exhaustification (Chierchia 2004; among the others) is firstly introduced to analyze scalar implicatures (SIs henceforth). This view argues that the phenomenon of SI is not purely pragmatic, based on the fact that SIs can be generated in embedding contexts.

The main idea of the G-view is as follows. First, propositions containing scalar items are associated with sets of alternatives, which are computed point-wise in the same way as the answer sets of questions (Hamblin 1973) and the alternative sets of focus (Rooth 1985, 1992). Next,

alternatives keep growing until factored into meaning via a covert exhaustivity operator  $O$ . The  $O$ -operator affirms the prejacent and negates all the alternatives that are not entailed by the prejacent, as schematized in (28).<sup>8</sup> Accordingly, an SI is a logic consequence of exhaustifying a sentence that contains a weak scalar item. For instance in (29), applying an  $O$ -operator over the *some*-sentence (notation:  $\phi_{\text{SOME}}$ ) affirms the prejacent  $\phi_{\text{SOME}}$  and negates the stronger alternative  $\phi_{\text{ALL}}$ , yielding the implicature  $\neg\phi_{\text{ALL}}$ .

$$(28) \quad O(p) = p \wedge \forall q \in \text{ALT}(p)[p \not\subseteq q \rightarrow \neg q]$$

(29) a. Some of the students came.  $\rightsquigarrow$  Not all of the students came.

b.  $\text{ALT}(\phi_{\text{SOME}}) = \{\phi_{\text{SOME}}, \phi_{\text{ALL}}\}$

c.  $O(\phi_{\text{SOME}}) = \phi_{\text{SOME}} \wedge \neg\phi_{\text{ALL}}$

### 3.2. The G-view of NPIs

Chierchia (2006, 2013) extends the G-view of SIs to the issue of NPI-licensing with assumptions compatible with the Alternative Semantics (Rooth 1985, 1992, 1996) and the strict DE condition. He proposes that the NPI *any* is an existential indefinite like *some* but encoded with a grammatical feature [D]. This feature obligatorily activates a set of domain (D)-alternatives and must be checked off by a c-commanding  $O_D$ -operator.<sup>9</sup> Exercising an  $O_D$ -operator over a sentence containing an occurrence of *any* has consequences in both syntax and semantics: in syntax, it checks off the [D] feature in the lexicon of *any*, just like a regular feature-checking operation; in semantics, it affirms the assertion and negates D-alternatives that are not entailed by the assertion.

Consider the basic positive sentence (30) to see how the G-view captures the DE condition of NPI-licensing. With an indefinite  $\exists$ -expression *any*, (30) asserts the  $\exists$ -inference in (31b). Moreover, the [D] feature of *any* activates a set of D-alternatives, generated by substituting the total domain  $D$  with a subdomain  $D'$ , as schematized in (31c). Crucially, the monotonicity pattern of the entire clause with respect to the NPI *any* is upward-entailing (UE), and hence the proper D-alternatives are not entailed by the assertion. Last, applying  $O_D$  negates all the proper D-alternatives, yielding

<sup>8</sup>Here and throughout the paper, the symbols  $O$  and  $p$  are sloppily used for both syntactic phrases and truth conditions. A stricter semantic representation for  $O$  is as follows, where  $S$  is the immediate c-commanded phrase of  $O$ .

$$(1) \quad \llbracket \widehat{O} \widehat{S} \rrbracket^{w,g} = \llbracket S \rrbracket(w) \wedge \forall S' \in \text{ALT}(S)[\llbracket S \rrbracket \not\subseteq \llbracket S' \rrbracket \rightarrow \neg \llbracket S' \rrbracket(w)]$$

<sup>9</sup>A schematic example for the total domain  $D$  and its corresponding D-alternative sets is as follows. The the proper D-alternative set does not include the prejacent.

(1) a. Total-D: $\{a, b\}$	Assertion = $\exists x \in \{a, b\} f(x)$
b. Sub-D: $\{a, b\}, \{a\}, \{b\}$	D-ALT = $\{\exists x \in \{a, b\} f(x), \exists x \in \{a\} f(x), \exists x \in \{b\} f(x)\}$
c. Proper sub-D: $\{a\}, \{b\}$	Proper D-ALT = $\{\exists x \in \{a\} f(x), \exists x \in \{b\} f(x)\}$



the exhaustivity inference (31d), which however contradicts to the assertion (31b), as shown in (31e). This contradiction is the source of the ungrammaticality of (30).<sup>10</sup>

(30) \*John read any papers.

- (31) a.  $O_D$  [John read any<sub>D</sub> papers]  
 b. Assertion:  $\exists x \in D[P(x) \wedge R(j, x)]$   
 (John read some papers in the total domain  $D$ )  
 c.  $D\text{-ALT} = \{\exists x \in D'[P(x) \wedge R(j, x)] \mid D' \subseteq D\}$   
 d.  $\forall D'[D' \subset D \rightarrow \neg \exists x \in D'[P(x) \wedge R(j, x)]]$   
 (for any proper subdomain  $D'$ , John read no paper in  $D'$ )  
 e.  $\llbracket(31a)\rrbracket = \llbracket(31b)\rrbracket \wedge \llbracket(31d)\rrbracket = \perp$   
 (# John read some papers in  $D$ , but he read no paper in any proper sub-domain  $D'$ )

The contradiction in (31e) is essentially different from the one in (32). The one in (31e) makes (30) ungrammatical, while the one in (32) makes the utterance infelicitous but not ungrammatical. To tell them apart, Chierchia (2013) adopts the notions from Gajewski (2002) and describes the contradiction in (31e) as “G(rammatical)-triviality”, a special case of L(ogical)-triviality.<sup>11</sup>

(32) # It is raining and it isn't raining.

Under the G-view, the contradiction in (31e) can be avoided if the  $O_D$ -operator is applied *immediately* over a constituent that is DE with respect to the NPI *any*. Consider the basic negative sentence (33) for example. By virtue of negation, all the D-alternatives are entailed by the assertion and therefore unexcludable. The  $O_D$ -operator, although is mandatorily present for the sake of checking off the grammatical feature [D], is semantically vacuous.

(33) John didn't read any papers.

(34) a.  $O$  [John didn't read any<sub>D</sub> papers]

<sup>10</sup>Consider the following mini model for a simpler illustration of this idea. Assume that the total domain  $D$  contains exactly two items, paper  $p_1$  and paper  $p_2$ . The D-alternative set is thus schematized as in (1b), containing exactly three elements: the asserted proposition *John read a paper in  $\{p_1, p_2\}$*  and the proper D-alternatives including *John read a paper in  $\{p_1\}$*  and *John read a paper in  $\{p_2\}$* . The proper D-alternatives are not entailed by the assertion. Therefore, applying an  $O_D$ -operator affirms the assertion and negates both proper D-alternatives, yielding the contradictory inference *John read  $p_1$  or  $p_2$ , and he did not read  $p_1$ , and he did not read  $p_2$* , as schematized in (1c).

- (1) a.  $D = \{p_1, p_2\}$   
 b.  $D\text{-ALT} = \{R(j, p_1) \vee R(j, p_2), R(j, p_1), R(j, p_2)\}$   
 c.  $R(j, p_1) \vee R(j, p_2) \wedge \neg R(j, p_1) \wedge \neg R(j, p_2) = \perp$

<sup>11</sup>L-trivialities are tautologies or contradictions in the traditional sense. While G-triviality means that a sentence receives the same value regardless of how the lexical terminals are replaced in the structure. For the purpose of this paper, it is enough to vaguely understand “G-triviality” as a type of L-triviality assessed at the grammatical level.

- b. Assertion:  $\neg \exists x \in D[P(x) \wedge R(j, x)]$   
(John read no paper in the total domain  $D$ .)
- c. D-ALT =  $\{\neg \exists x \in D'[P(x) \wedge R(j, x)] \mid D' \subseteq D\}$
- d.  $\llbracket (33a) \rrbracket = \llbracket (33b) \rrbracket = \neg \exists x \in D[P(x) \wedge R(j, x)]$   
(John read no paper in the total domain  $D$ .)

### 3.3. Extending the G-view to *only*

Krifka (1995), Lahiri (1998), and Chierchia (2013) extend the G-view of NPIs to the exclusive focus particle *only*. They adopt the lexical entry of *only* from Horn (1969), which assumes that *only* asserts an exhaustivity inference and presupposes the truth of its prejacent. The non-F-associated part of the asserted exhaustivity inference, crucially, is DE and hence is capable of licensing NPIs.

Under the schematic notations in Chierchia (2013), the *only*-sentence (35) takes the LF in (36a). This LF has two exhaustification operators,  $O_D$  and *only*, checking off the [D] feature of *any* and the [F] feature of the semantic focus, respectively. The prejacent presupposition and the asserted exhaustivity inference are schematized as in (36b) and (36c), respectively. The D-alternatives are generated from the assertion by replacing the total domain  $D$  with a subdomain  $D'$ , as in (36d).

(35) Only JOHN read any papers.

- (36) a.  $O_D$  [only [JOHN<sub>F</sub> read any<sub>D</sub> papers ]]
- b. Presupposition:  $\exists x \in D[P(x) \wedge R(j, x)]$   
(John read some paper in the total domain  $D$ .)
- c. Assertion:  $\forall y \in D_e [\underline{\exists x \in D[P(x) \wedge R(y, x)]} \rightarrow j \subseteq y]$   
(For any individual  $y$ , if  $y$  read a paper in the total domain  $D$ , then  $y$  is John.)
- d. D-ALT =  $\{\text{only [JOHN}_F \text{ read any}_{D'} \text{ paper]} : D' \subseteq D\}$   
 $= \{\forall y \in D_e [\exists x \in D'[P(x) \wedge R(y, x)] \rightarrow j \subseteq y] \mid D' \subseteq D\}$

The presupposed component (35b), as firstly argued by Gajewski (2011) and extended by Chierchia (2013), is irrelevant for assessing the [D] feature of a weak NPI like *any*.<sup>12</sup> The asserted component (36c) is DE with respect to the non-F-associated part (underlined), where the NPI *any* appears. Therefore, the NPI *any* is licensed in (35), as it would be in any DE contexts.

<sup>12</sup>Gajewski (2011) proposes that presuppositions and implicatures are relevant only for assessing the [D] feature of strong NPIs, not for that of weak NPIs. This proposal captures the contrast between weak NPI-licensing and strong NPI-licensing under *only*. For instance, *only* does not license the strong NPI *in years* in the non-F-associated part.

(1) \*Only JOHN came in years.

The prejacent presupposition of *only* is purely UE, which, together with the asserted exhaustivity inference, makes the entire *only*-clause non-monotonic with respect to the strong NPI *in years*. Therefore, applying  $O_D$  to assess the [D] features in the presupposition and assertion yields a contradiction, making the strong NPI unlicensed.

In sum, the G-view provides an explanation to the DE condition of NPI-licensing: checking off the [D] feature of an NPI with a covert  $O_D$ -operator yields a contradiction/G-triviality iff the  $O_D$ -operator is applied immediately over a constituent that is non-DE with respect to this NPI. As for case of *only*, the G-view shows that the assertion of an *only*-clause is DE in the non-F-associated part, which therefore gets (weak) NPIs licensed.

### 3.4. Problems with the G-view

The G-view, however, is not the best solution. As a successor of Roothian Alternative Semantics, the G-view assumes that focus is interpreted in-situ and that F-alternatives are propositional. For both NP-*only* and VP-*only*, the G-view defines their quantificational domains as proposition sets.

$$(37) \quad \llbracket \text{only} \rrbracket(p) = \forall q \in ALT(p) [q \rightarrow p \subseteq \boxed{q}]$$

Nevertheless, the assumption that F-alternatives is propositional conflicts with the fact that *only* licenses weak NPIs. In (37), we can easily see that the boxed position for  $\boxed{q}$  is non-DE. To be more accurate, consider a stricter schematic representation for the asserted component of the *only*-sentence (35). If the F-alternatives were propositional, then the asserted component of (35) would be schematized as follows.

$$(38) \quad \forall q \in \{ \exists x \in D [P(x) \wedge R(y, x) \mid y \in D_e] [ \boxed{q} \rightarrow \boxed{\exists x \in D [P(x) \wedge R(j, x)]} \subseteq \boxed{q} ]$$

Here the quantificational domain of *only* is characterized as a set of propositions in the form of “y read a paper in the total domain  $D$ ”, where  $y$  is a contextually relevant individual. This schematic representation has three positions relevant to the assessment of the [D] feature (namely, containing an occurrence of *any*), each marked with a box. The first boxed position, as the restriction of a  $\forall$ -quantification, is DE; but the latter two boxed positions, as within the scope of the  $\forall$ -quantification, are UE. Therefore, under this representation, the entire assertion would be non-monotonic with respect to *any*, which however incorrectly predicts the NPI *any* to be unlicensed in (35).

Thus, to capture the NPI-licensing effect of *only*, the G-view has to give up its own convention and write the quantificational domain of *only* as a set of individuals, as we have seen in (35c), where only the restriction part of the  $\forall$ -quantification is relevant to the assessment of the [D] feature.

## 4. My analysis: grammatical view of exhaustification with F-movement

Wrapping things up, neither the F-movement theory nor the G-view can properly address the NPI-licensing effect of *only* on its own. On the one hand, the F-movement theory is lacking of an explanation to the NPI-licensing condition. On the other hand, the G-view does provide a plausible explanation to the licensing condition, but this explanation is viable only if the theory supports an operation (e.g. F-movement) that can split up the c-commanding domain of *only* and create a DE-

context. In such a case, a natural move would be to incorporate F-movement into the G-view. To integrate F-movement with the G-view, the only needed assumption is as follows.<sup>1314</sup>

(39) **Motivation of F-movement**

The requirement of avoiding G-trivialities motivates F-movement.

The rest of this section is organized as follows. Section 4.1 to 4.3 will focus on three basic cases. Case 1 covers sentences without NPIs or with NPIs that are licensed by operators other than *only*. Discussions on Case 2-3 will explain the NPI-licensing effect of *only*, in particular, why *only* licenses NPIs, and why NPIs cannot appear within the semantic focus or an F-contained island. In section 4.4, I will move onto the so-called “Head Restriction”.

4.1. Case 1: F-movement is not motivated

Under the motivation of F-movement assumed above, focus should be interpreted in-situ as long as interpreting it in-situ does not yield a G-triviality/contradiction. For instance in (40), the NPI *any* can be licensed in-situ by the clause-mate negation and hence the focus does not need to move.

- (40) Mary only didn't give any<sub>D</sub> funding to JOHN<sub>F</sub>  
 Only *O<sub>D</sub>* **not** [Mary gave any<sub>D</sub> funding to JOHN<sub>F</sub>]

Under the present analysis, F-movement is not motivated in (41), because interpreting focus in-situ does not yield a contradiction.

- (41) Mary only didn't give [any FUNDing]<sub>F</sub> to John. She did her best to help him.

When focus is interpreted in-situ, F-alternatives are propositional. The asserted meaning of VP-*only* can be schematized as in (42), à la Rooth 1985. Here *p* stands for the complement of VP-*only*.  $\llbracket p \rrbracket_f$  and  $\llbracket p \rrbracket_0$  correspond to the *focus value* of *p* and the *ordinary value* of *p*, respectively.<sup>15</sup>

<sup>13</sup>It is worthy of noticing that G-triviality is assessed at LF, therefore the rule (39) only applies to movement at LF, not to movement in the overt syntax. For instance, it is not the source of the overt F-movement in Hungarian.

<sup>14</sup>A question arises as to why logical inferences motivate syntactic operations. I would link this question to the architecture of the universal grammar. Chierchia (2006, 2013) indicates that the structure-building apparatus (e.g. Merge, Move, Agree) and the inferential one are not radically different; “grammar only sees functional/logical material; logic sees functional/logical material and whether the lexical material is the same or different.” (Chierchia 2013: 444) The notion of G-triviality, in particular, relates logic tightly to grammar, as a L-triviality taking effects in grammar.

<sup>15</sup>The ordinary value of *p* is simply the truth value of *p*; the focus value of *p* is a set of F-alternatives to *p*, built up compositionally from the focus value of the semantic focus, defined as follows.

- (1) a.  $\llbracket \alpha_F \rrbracket_f = D_{\text{type}(\llbracket \alpha \rrbracket_0)}$   
 b.  $\llbracket \alpha \rrbracket_f = \{ \llbracket \alpha \rrbracket_0 \}$   
 c.  $\llbracket \alpha(\beta) \rrbracket_f = \{ a(b) \mid a \in \llbracket \alpha \rrbracket_f, b \in \llbracket \beta \rrbracket_f \}$

- (42)  $\llbracket \text{only} \rrbracket(p)(w) = \forall q \in \llbracket p \rrbracket_f [q(w) \rightarrow \llbracket p \rrbracket_0 \subseteq q] = \forall q \in \llbracket p \rrbracket_f [q(w) \rightarrow p \subseteq q]$   
 (Any true proposition within the focus value of  $p$  is entailed by the ordinary value of  $p$ .)

Consider the example (25) again, repeated below. The quantificational domain of *only* is the focus value of the prejacent VP, namely a set of propositions in the form of “Sue invited  $x$ ’s advisors”. Exhaustifying over this domain yields the desired reading (43a), as schematized in (44).

- (43) Sue only invited  $\text{JOHN}_F$ ’s advisors.  
 a.  $\rightarrow$  Sue didn’t invite anyone’s advisors except John’s advisors.  
 b.  $\nrightarrow$  Sue didn’t invite anyone except John’s advisors.
- (44) a.  $\llbracket \text{Sue invited } \text{JOHN}_F \text{’s advisor} \rrbracket_0 = I[s, A(j)]$   
 b.  $\llbracket \text{JOHN}_F \rrbracket_f = D_e$   
 c.  $\llbracket \text{Sue invited } \text{JOHN}_F \text{’s advisor} \rrbracket_f = \{I[s, A(x)] \mid x \in D_e\}$   
 d.  $\llbracket (43) \rrbracket = \forall q \in \{I[s, A(x)] \mid x \in D_e\} [q \rightarrow I[s, A(j)] \subseteq q]$   
 (For any true proposition  $q$  in the form of “Sue invited  $x$ ’s advisors”,  
 $q$  is entailed by the prejacent that “Sue invited John’s advisors.”)

#### 4.2. Case 2: F-movement is motivated

Recall the main problem of the G-view: if F-alternatives were propositional, an *only*-sentence with an NPI would be non-DE with respect to this NPI. Therefore, to capture the NPI-licensing effect of *only* in sentences like (45a-b), I assume that in those cases the semantic focus (or F-contained island, if any) has to be moved out of the VP, splitting the VP into two sub-constituents, namely the moved phrase, corresponding to the syntactic restrictor of *only*, and the remnant VP, corresponding to the scope of *only*. In particular, to distinguish between VP-*only* and NP-*only*, I assume that F-movement is covert in (45a) but overt in (45b).

- (45) a. Mary only gave any funding to  $\text{JOHN}_F$ .  
 $[O_D [\text{only } (\text{JOHN}_{F,i}) [\text{Mary gave any}_D \text{ funding to } t_i]]]$  Covert F-movement  
 b. Only  $\text{JOHN}_F$  read any papers.  
 $[O_D [\text{only } (\text{JOHN}_{F,i}) [t_i \text{ read any papers.}]]]$  Overt F-movement

As for the semantics of *only*, I follow Alternative Semantics and assume that the quantificational domain of *only* is the focus value of the F-moved phrase. A cross-categorical definition of *only* is given in (46), where  $f$  and  $g$  correspond to the unmoved and moved part, respectively.

- (46)  $\llbracket \text{only} \rrbracket(f_{\langle \alpha, t \rangle})(g_\alpha) = \forall g' \in \llbracket g \rrbracket_f [f(g') \rightarrow \llbracket g \rrbracket_0 \subseteq g']$

For instance in (47), F-movement is motivated to avoid contradictions. The Left-Branch Extraction Constraint requests the F-contained island,  $\text{JOHN}_F$ ’s advisors, to be moved as a whole. Then the

quantificational domain of *only* would be the focus value of the moved possessive NP, namely the set of contextually relevant individuals who are someone's advisors.

- (47) Mary only gave any<sub>D</sub> funding to JOHN<sub>F</sub>'s advisors.
- $\llbracket \text{JOHN}_F \text{'s advisors} \rrbracket_f = \{A(x) : x \in D_e\}$
  - $\llbracket \text{JOHN}_F \text{'s advisors} \rrbracket_0 = A(j)$
  - $\llbracket (47) \rrbracket = \forall y \in \{A(x) : x \in D_e\} [I(s, y) \rightarrow A(j) \subseteq y]$   
(For anyone's advisors  $y$ , if Mary invited  $y$ , then  $y$  is/are John's advisors.)

### 4.3. Case 3: F-movement is unhelpful

Recall the fact that *only* cannot *directly* associate with an NPI or with/into an NPI-contained island without crossing another NPI-licenser. Relevant examples discussed above are collected in (48). I will show that the reason why NPIs are not licensed in these examples is that F-movement cannot salvage their G-trivialities/contradictions.

- (48) a. \*John read only ANY<sub>F</sub> papers.  
 b. \*John read only [any PAPERS]<sub>F</sub>, (he didn't read every book).  
 c. \*John read only any PAPERS<sub>F</sub>, (he didn't read any books).  
 d. \*Mary only gave a book to John [because BILL<sub>F</sub> gave any book to him].

Consider (48b) for example, where *only* associates with the entire *any*P. To pursue a stipulation-free analysis, I will consider all possible syntactically well-formed LFs, including LFs where the [D] feature of *any* is assessed by a covert  $O_D$ , as well as LFs where the [D] feature is assessed by overt *only*, as structured in (49) and (50), respectively.

- (49) **Assessing [D] with  $O_D$**
- $O_D$  [only [John read [any<sub>D</sub> PAPERS]<sub>F</sub>]] Without F-movement
  - $O_D$  [only (any<sub>D</sub> PAPERS)<sub>F,i</sub> [John read  $t_i$ ]] With F-movement
- (50) **Assessing [D] with *only***
- only [John read [any<sub>D</sub> PAPERS]<sub>F</sub>] Without F-movement
  - [only (any<sub>D</sub> PAPERS)<sub>F,i</sub> [John read  $t_i$ ]] With F-movement

Let us start with the option that only the covert operator  $O_D$  can assess a [D] feature. If the *any*P is interpreted in-situ, as in (51a), then the [D] feature of *any* would be assessed within the boxed part, which is within the scope of a  $\forall$ -quantification and is non-DE. Then applying  $O_D$  over the *only*-clause to check off the [D] feature would yield a semantic contradiction. Alternatively, if the focused *any*P is F-moved, it would be interpreted under the immediate scope of  $O_D$ , a context that

is also non-DE. The main difference between (51) and (52) in semantics is that the quantificational domain of *only* is a set of propositions in (51) but a set of generalized quantifiers in (52).<sup>16</sup>

- (51) a.  $O_D$  [only [John read [any<sub>D</sub> PAPERS]<sub>F</sub>]]  
 b. Assertion:  $\forall q \in \{Q[\lambda x.R(j, x)] \mid Q \in D_{\langle et, t \rangle}\} [q \rightarrow \boxed{\exists x \in D[P(x) \wedge R(j, x)]} \subseteq q]$
- (52) a.  $O_D$  [only (any<sub>D</sub> PAPERS)<sub>F,i</sub> [John read  $t_i$ ]]  
 b. Assertion:  $\forall Q_{\langle et, t \rangle} [Q[\lambda y.R(j, y)] \rightarrow \boxed{\lambda S.\exists x \in D[P(x) \wedge S(x)]} \subseteq Q]$

Now move onto the option that the overt exclusive particle *only* can check off any alternative-related features, including the [D] feature. In such a case, the  $O_D$ -operator ought to be eliminated from the LF of a *only*-sentence, because there is no unchecked [D] left for  $O_D$ . This option has not been considered by the canonical G-view. But in theory, there is no reason to rule it out.

First, consider the possibility of interpreting *anyP* in-situ. Under the LF (53a), the *only*-sentence presupposes its prejacent as in (53d) and asserts the exhaustivity inference as in (53e). The quantificational domain of *only* consists of F-alternatives and D-alternatives: F-alternatives are in the form of “John read  $X$ ”, where  $X$  is a generalized quantifier; D-alternatives are in the form of “John read a book in  $D'$ ”, where  $D'$  is a subset of the total domain  $D$ . The asserted exhaustivity inference entails the negation of all the proper D-alternatives, yielding the inference *John didn't read any paper in any proper subdomain  $D'$* , as in (53f). This inference, however, contradicts the prejacent presupposition *John read a paper in the total domain  $D$* , predicting the NPI *any* to be unlicensed.<sup>17</sup>

- (53) a. only [John read [any<sub>D</sub> PAPERS]<sub>F</sub>]  
 b.  $ALT_F = \{Q[\lambda x.R(j, x)] \mid Q \in D_{\langle et, t \rangle}\}$   
 c.  $ALT_D = \{\exists x \in D'[P(x) \wedge R(j, x)] \mid D' \subseteq D\}$   
 d.  $\exists x \in D[P(x) \wedge R(j, x)]$  Presupposition  
 e.  $\forall q \in ALT_{F,D} [\exists x \in D[P(x) \wedge R(j, x)] \not\subseteq q \rightarrow \neg q]$  Assertion  
 f.  $\Rightarrow \forall D' [D' \subset D \rightarrow \neg \exists x \in D'[P(x) \wedge R(j, x)]]$   
     (John didn't read any paper in any proper subdomain  $D'$ )

<sup>16</sup>Individuals of type  $e$  can also be type-shifted into generalized quantifiers.

<sup>17</sup>Consider the mini-model below for a simpler illustration of (53). Assume that the total domain  $D$  contains exactly two papers,  $p_1$  and  $p_2$ . The D-alternative set thus contains three propositions, *John read  $p_1$  or  $p_2$* , *John read  $p_1$* , and *John read  $p_2$* , as in (1b). The exhaustivity assertion negates both proper sub-D alternatives, yielding the inference *John didn't read  $p_1$  or  $p_2$*  in (1c), which contradicts the prejacent presupposition *John read  $p_1$  or  $p_2$*  in (1d).

- (1) a.  $D = \{p_1, p_2\}$   
 b.  $D\text{-ALT} = \{R(j, p_1) \vee R(j, p_2), R(j, p_1), R(j, p_2)\}$   
 c. Assertion entails:  $\neg R(j, p_1) \wedge \neg R(j, p_2)$   
 d. Prejacent Presupposition:  $R(j, p_1) \vee R(j, p_2)$

This reasoning also applies to the LF in (54), where the *any*P takes covert F-movement to the complement of *only*: the exhaustivity assertion in (54e) entails the inference in (54f), which contradicts the prejacent presupposition in (54d). The major difference between the schematic derivations in (53) and (54) is the semantic type of their alternatives: in (53), all the alternatives are propositions; but in (54), all the alternatives are generalized quantifiers. In particular, the D-alternatives in (54c) are existential quantifiers quantifying over papers in a subset domain  $D'$ .

- (54) a. [only (any<sub>D</sub> PAPERS)<sub>F,i</sub> [John read  $t_i$ ]]  
 b.  $ALT_F = D_{\langle et, t \rangle}$   
 c.  $ALT_D = \{\lambda S. \exists x \in D' [P(x) \wedge S(x)] \mid D' \subseteq D\}$   
 d.  $\exists x \in D [P(x) \wedge R(j, x)]$  Presupposition  
 e.  $\forall Q \in ALT_{F,D} [Q \not\subseteq \lambda S. \exists x \in D [P(x) \wedge S(x)] \rightarrow \neg Q[\lambda y. R(j, y)]]$  Assertion  
 f.  $\Rightarrow \forall D' [D' \subset D \rightarrow \neg \exists x \in D' [P(x) \wedge R(j, x)]]$   
 (John didn't read any paper in any proper subdomain  $D'$ )

To sum up, if *only* associates with an *any*P, all the syntactically well-formed LFs of (48b) yield a G-triviality; therefore the NPI *any* is not licensed in (48b). First, if the [D] feature of *any* is assessed by a covert  $O_D$ , then the G-triviality would be a logical consequence of the affirmed exhaustivity assertion and the negated proper D-alternatives. Second, if the [D] feature is assessed by overt *only*, then the G-triviality would result from the contradiction between the prejacent presupposition of *only* and the negation of the proper sub-D alternatives.

#### 4.4. The “Head Restriction”

The present analysis can easily capture the “Head Restriction”. In (55), although the *any*P can vacate from the VP before the [D] feature gets assessed, it can and can only be raised to the place sandwiched between  $O_D$  and *only*, which is still non-DE. In contrast, the conditional (56) is DE in its antecedent; therefore, once the *any*P undertakes QR over *only*, the whole conditional would be DE with respect to the NPI.

- (55) \*John only CUT<sub>F</sub> any vegetables.  
 [ $O_D$  [any<sub>D</sub> vegs]<sub>i</sub> [ only [ John CUT<sub>F</sub>  $t_i$  ] ]]  
 (56) If John only CUT<sub>F</sub> any vegs (and didn't STEAM<sub>F</sub> any vegs), Mary would be unhappy.

Note that the NPI *any* is not licensed once if the *any*P cannot take quantifier raising over *only*, even if the *only*-sentence is uttered as the antecedent of a conditional or in some other DE context. For instance, the NPI *any* is not licensed in (57), a conditional where *only* associates into an *any*P. First, the determiner *any* cannot take F-movement alone, ruling out the possibility in (57a). Second, since an *only*-associated focus cannot be moved from beneath *only* (Tancredi 1990), the F-contained *any*P cannot raise over *only*, ruling out the possibility in (57b).



- (57) \*If John only invited [anyone's ADVISORS<sub>F</sub>], the students would be unhappy.
- a. If John only invited anyone's ADVISORS<sub>F</sub>, ... (×)
- b. If John only invited anyone's ADVISORS<sub>F</sub>, ... (×)
- 

## 5. Conclusions

The goal of this paper has been to explain the NPI-licensing effect of *only*. I incorporated F-movement into the G-view of exhaustification with a simple assumption that F-movement is motivated by the requirement of avoiding contradictions.

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# Lake Pátzcuaro P'urhepecha and the Semantic Typology of Degree Constructions<sup>1</sup>

Erik Zyman — *University of California, Santa Cruz*

**Abstract.** Degree constructions are an area of grammar characterized by considerable crosslinguistic variation (Beck et al. 2009, Bhatt and Takahashi 2011, a.o.). As part of the project of describing and understanding the variation and nonvariation in this domain, I investigate the degree system of the Lake Pátzcuaro variety of P'urhepecha, an indigenous language of Mexico which is an isolate. By applying to Lake Pátzcuaro P'urhepecha the diagnostics developed by Beck et al. (2009), I show that this language has positive settings for the Degree Semantics Parameter, the Degree Abstraction Parameter, and the Degree Phrase Parameter, just like English. This is captured by extending to Lake Pátzcuaro P'urhepecha the semantic analysis of some core English degree constructions developed in Heim (2001) and related work. A prediction of this analysis—namely, that some Degree Phrases should participate in scope ambiguities—is shown to be correct for Lake Pátzcuaro P'urhepecha. Comparison between Lake Pátzcuaro P'urhepecha and English shows that two languages can have extremely similar degree systems even if they differ considerably along a number of dimensions in other areas of grammar, suggesting that crosslinguistic variation in degree systems may be largely independent of variation in other grammatical domains.

## 1. Introduction

Degree constructions are an area of grammar characterized by considerable crosslinguistic variation (Kennedy 2007, Krasikova 2008, Beck et al. 2009, Bhatt and Takahashi 2011, Bochnak 2013, a.o.). To contribute to the project of understanding the variation and nonvariation in this domain, I investigate the degree system of the Lake Pátzcuaro variety of the Mexican language P'urhepecha and provide semantic analyses of a number of its degree constructions.

P'urhepecha is an indigenous language of Mexico spoken by over 120,000 people (INEGI 2010), primarily in the central-western state of Michoacán. It has a number of properties that make it interesting for the student of degree construction typology. First, it is an isolate; therefore, if striking similarities are found between P'urhepecha and better-studied languages, these cannot be dismissed as an expected correlate of historical kinship. Secondly, it is typologically quite differ-

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ent from the languages that have received the most attention in formal linguistics, being a highly agglutinating language with fairly flexible constituent order (Capistrán 2002, Chamoreau 2007, Vázquez-Rojas Maldonado 2011). Finally, degree constructions display considerable variation *within* P'urhepecha, both cross-regionally and diachronically (see Chamoreau 2012 on MORE-comparatives); P'urhepecha therefore offers an opportunity for illuminating microcomparative work on degree constructions and their semantics.

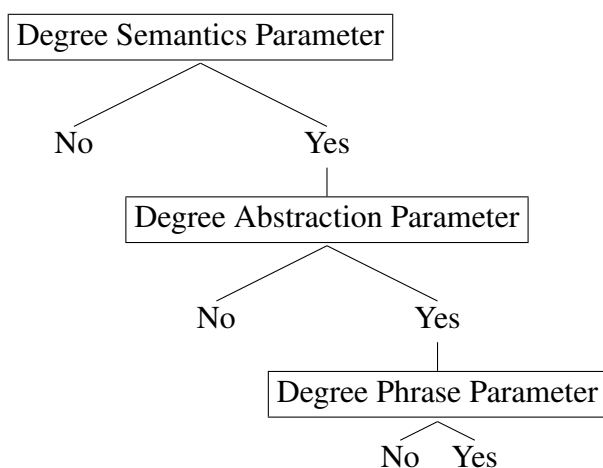
The paper is organized as follows. Section 2 lays out the analysis of crosslinguistic variation in degree semantics put forth in Beck et al. (2009), and applies Beck *et al.*'s diagnostics to Lake Pátzcuaro P'urhepecha. The findings are accounted for in section 3, which extends to Lake Pátzcuaro P'urhepecha the semantic analysis of some English degree constructions developed in Heim (2001). Section 4 tests a prediction of this analysis—namely, that some Degree Phrases should participate in scope ambiguities—and shows that the prediction is correct for Lake Pátzcuaro P'urhepecha. Section 5 concludes.

## 2. How does Lake Pátzcuaro P'urhepecha fit into the typology of degree constructions?

### 2.1. Beck et al.'s (2009) analysis of crosslinguistic variation in degree constructions

Beck et al. (2009) analyze the degree constructions of 14 languages.<sup>2</sup> On the basis of their results, they propose that the degree systems of human languages are regulated by three parameters, which form the following hierarchy:

#### (1) *Beck et al. (2009) parameter hierarchy*



<sup>2</sup>Bulgarian, Guarani, Hindi-Urdu, Hungarian, Mandarin, Mooré, Motu, Romanian, Russian, Samoan, Spanish, Thai, Turkish, and Yoruba.

In the remainder of this section, I apply to Lake Pátzcuaro P'urhepecha Beck *et al.*'s diagnostics for determining what settings a language has for these three parameters, and by extension how it fits into the typology of degree constructions. When presenting the data, I will keep my commentary to a minimum; the implications of the findings will mostly be discussed after they have all been laid out.

## 2.2. The Degree Semantics Parameter

The first parameter in Beck *et al.*'s hierarchy is the Degree Semantics Parameter, whose content is the following:

- (2) A language {does/does not} have gradable predicates (type  $\langle d, et \rangle$  and related), i.e., lexical items that introduce degree arguments.

If a language has the Degree Semantics Parameter set to “yes,” it has predicates that take as one of their arguments an expression of type  $d$  (a degree argument). This will lead us to expect that the language may well have expressions that manipulate degree arguments. These may include comparative, superlative, and equative morphemes (such as English *-er*, *-est*, and *as*) and equivalents of *too* and *enough*.

Such expressions certainly exist in Lake Pátzcuaro P'urhepecha. For example, there is a comparative degree word *sanderu* ~ *sandaru* ((3a-3b)) and an equative degree word *xani* ((3c)). These seem to correspond to English *-er* and *as* respectively. *Xani* also has a use as an “extreme degree” word, in which function it resembles English *so* ((3d)).<sup>3</sup>

- (3) a. María *sanderu* iótasti eski Ána. (SFL)  
 María **sanderu** ióta-s-Ø-ti eski Ána.  
 Mary **-er** be.tall-PFV-PRS-IND+3 SUB Anna  
 ‘Mary is taller than Anna.’
- b. Iasī *sanderu* aparekuaresīti eska uitsindekua. (J)  
 Iasī **sanderu** apare-kuare-sī-Ø-ti eska uitsindekua.  
 today **-er** be.hot-REFL-PFV-PRS-IND+3 SUB yesterday  
 ‘It’s hotter today than it was yesterday.’

<sup>3</sup>**Abbreviations:** ADV = adverbializer; COND = conditional; COP = copula; DIST = distal (demonstrative); FUT = future; HAB = habitual; IND = indicative; INF = infinitive; INT = interrogative; J = Janitzio P'urhepecha (spoken on the island of Janitzio on Lake Pátzcuaro); lit. = literally; LOC = locative; MED = medial (demonstrative); PFV = perfective; PL = plural; PRS = present; REFL = reflexive; SFL = Santa Fe de la Laguna P'urhepecha (spoken in the town of Santa Fe de la Laguna); SJV = subjunctive; SUB = subordinator; 3 = third person; 3pS = third person plural subject.

- c. Juanu xani iostarasti eska Petu. (J)  
 Juanu **xani** iostara-s-Ø-ti eska Petu.  
 John **as** be.tall-PFV-PRS-IND+3 SUB Peter  
 'John is as tall as Peter.'
- d. ¡I japonda **xani** jauamesti! (J)  
 ¡I japonda **xani** jauame-s-Ø-ti!  
 this lake so be.deep-PFV-PRS-IND+3  
 'This lake is so deep!'

If a language has a “yes” setting for the Degree Semantics Parameter, we may well expect it to also allow difference comparatives like *This wall is **six meters longer** than that one* (where *six meters* is analyzed as of type *d*). If the language has a “no” setting for this parameter, by contrast, it should not allow difference comparatives, since it will not have any predicates that can take the degree-denoting phrase as an argument.<sup>4</sup> Lake Pátzcuaro P'urhepecha does have difference comparatives:

- (4) a. I tsintsíkata kuimu metrhu sandaru iosikasiti eska ima. (J)  
 I tsintsíkata **kuimu metrhu sandaru** iosika-si-Ø-ti eska ima.  
 this wall **six meter -er** be.long-PFV-PRS-IND+3 SUB that(DIST)  
 'This wall is six meters longer than that one.'
- b. María tsimáni centímetru sanderu iótasti eski Ána. (SFL)  
 María **tsimáni centímetru sanderu** ióta-s-Ø-ti eski Ána.  
 Mary **two centimeter -er** be.tall-PFV-PRS-IND+3 SUB Anna  
 'Mary is 2 centimeters taller than Anna.'

Finally, a language with a “yes” setting for the Degree Semantics Parameter may also be expected to allow comparison with a degree, as in *This ant is longer **than one centimeter***. By contrast, a language with a “no” setting for this parameter should not allow comparison with a degree, because it will not have any predicates that can take the degree-denoting phrase (e.g., (*than*) *one centimeter*) as an argument. The reasoning here is precisely parallel to that reviewed in connection with difference comparatives. Like the constructions we have examined so far, comparison with a degree is available in Lake Pátzcuaro P'urhepecha ((5)). As in English, the degree-denoting phrase may either contain a unit-of-measurement word ((5a)) or not ((5b)).

<sup>4</sup>On Beck *et al.*'s analysis of difference comparatives, the degree-denoting phrase is an argument of the degree morpheme (e.g., English *-er*).

- (5) a. Inde japonda sanderu jauamesti eska tembeni ts'eretakua. (J)  
 Inde japonda sanderu jauame-s-Ø-ti **eska tembeni ts'eretakua.**  
 that(MED) lake -er be.deep-PFV-PRS-IND+3 SUB **ten meter**  
 'That lake is deeper than ten meters.'
- b. Kachukutarakua sanderu iosikasiti eska jauanekua cajarhu. (J)  
 Kachukutarakua sanderu iosika-si-Ø-ti **eska jauanekua caja-rhu.**  
 knife -er be.long-PFV-PRS-IND+3 SUB **depth drawer-LOC**  
 'The knife is longer than the depth of [*lit.* 'in, at'] the drawer.'

### 2.3. The Degree Phrase Parameter

Although the Degree Semantics Parameter is followed in Beck *et al.*'s hierarchy by the Degree Abstraction Parameter, I will postpone discussion of the latter until section 2.4. The reason is that the evidence bearing on the setting of the Degree Abstraction Parameter in Lake Pátzcuaro P'urhepecha is less clear than that bearing on the setting in this language of the third parameter, the Degree Phrase Parameter ((6)), to which we now turn.

- (6) The degree argument position of a gradable predicate {may/may not} be overtly filled.

If a language has the Degree Phrase Parameter set to "yes," we may well expect it to allow degree questions, such as *How tall is Mary?* In this question, the degree argument position of the gradable adjective *tall* ([Spec,AP] according to Heim 2001 and Beck et al. 2009) is occupied by the *wh*-word *how*. Importantly, if movement of *how* in English did not pied-pipe *tall* (contrary to fact), the degree argument slot of *tall* would be occupied by the unpronounced lowest copy of *how*, and would therefore still count as "overtly filled" in Beck *et al.*'s sense. Therefore, English-style degree questions count as evidence for a "yes" setting for the Degree Phrase Parameter regardless of whether they involve pied-piping of the gradable predicate or not.<sup>5</sup> Degree questions of this sort do appear to be available in Lake Pátzcuaro P'urhepecha. In this language, one can question the degree argument of a verb ((7a)), an adjective ((7b)), an adverb ((7c)), or a determiner ((7d)), at least.<sup>6</sup>

<sup>5</sup>If a degree argument position occupied by a silent copy of a *wh*-word counts as "overtly filled" in Beck *et al.*'s sense, what does it take for such a position to be present but *not* overtly filled? The answer, for the authors, is ellipsis. If a degree argument position that would otherwise be overtly filled is inside a constituent that has been elided, it will not count as overtly filled after all. Although these assumptions concerning what counts as an "overtly filled" degree argument position allow Beck et al. (2009) to account for their crosslinguistic data, they seem somewhat unnatural, suggesting that the Degree Phrase Parameter may have to be revised or split up into separate parameters—a possibility the authors consider on independent grounds.

<sup>6</sup>I assume that *na xani* in (7d) is questioning the degree argument not of *jauiri* 'hair' (which presumably does not have one) but rather of a silent version of the mass determiner *kanekua* 'much'. Note that *Juánu* 'John' has been topicalized past the moved *wh*-phrase *na xani*.

- (7) a. ¿Naxani iostarasiki Maria? (J)  
 ¿Na-xani iostara-si-Ø-ki Maria?  
 how-XANI be.tall-PFV-PRS-INT Mary  
 ‘How tall is Mary?’
- b. ¿Naxani miritsiski Xumo? (J)  
 ¿Na-xani miritsi-i-s-Ø-ki Xumo?  
 how-XANI forgetful-COP-PFV-PRS-INT Xumo  
 ‘How forgetful is Xumo?’
- c. ¿Naxani uinani ua uiriani Maria? (J)  
 ¿Na-xani uina-ni u-a-Ø-Ø uiria-ni Maria?  
 how-XANI strong-ADV be.able-FUT-PRS-INT run-INF Mary  
 ‘How fast can Mary run?’
- d. ¿Juánu na xani jauiri jukáski? (SFL)  
 ¿Juánu na xani jauiri juká-s-Ø-ki?  
 John how XANI hair wear-PFV-PRS-INT  
 ‘How much hair does John have?’

Secondly, if a language has a “yes” setting for the Degree Phrase Parameter, we may also expect it to allow measure phrase constructions like *Katie is **six feet** tall*, where the degree argument position of the gradable predicate *tall* is occupied by the type-*d* phrase *six feet*. A language with a “no” setting for the Degree Phrase Parameter will not allow this position to be overtly filled, and hence will not allow measure phrase constructions. These constructions are robustly possible in Lake Pátzcuaro P'urhepecha; two examples follow.

- (8) a. Kurucha tanimu sentimetrhu iosikasiti. (J)  
 Kurucha **tanimu sentimetrhu** iosika-si-Ø-ti.  
 fish **three centimeter** be.long-PFV-PRS-IND+3  
 ‘The fish is three centimeters long.’
- b. Juánu tsimáni métru iótasti. (SFL)  
 Juánu **tsimáni métru** ióta-s-Ø-ti.  
 John **two meter** be.tall-PFV-PRS-IND+3  
 ‘John is 2 meters tall.’

Thirdly, a language with a “yes” setting for the Degree Phrase Parameter may also be expected to allow subcomparatives, such as *The lake is deeper than the wall is long*. In this construction, the degree argument slot of the gradable predicate in the embedded clause is occupied by the lowest copy of a moved degree operator: *...than Op<sub>1</sub> the wall is t<sub>1</sub> long*. Here, the degree argument slot of



*long* counts as “overtly filled” in Beck *et al.*’s sense. Therefore, a language with a “no” setting for the Degree Phrase Parameter should not allow English-style subcomparatives. These constructions are available in Lake Pátzcuaro P'urhepecha:

- (9) a. Luisi sanderu iostarasiti eska koskaka kojtsitarakua. (J)  
 Luisi sanderu iostara-si-Ø-ti eska koska-Ø-Ø-ka kojtsitarakua.  
 Louis -er be.tall-PFV-PRS-IND+3 SUB be.wide-PFV-PRS-SJV table  
 ‘Louis is taller than the table is wide.’
- b. I xanaru sanderu iuakurasiti eska iorhekua jauameka. (J)  
 I xanaru sanderu iuakura-si-Ø-ti eska iorhekua jauame-Ø-Ø-ka.  
 this street -er be.long-PFV-PRS-IND+3 SUB river be.deep-PFV-PRS-SJV  
 ‘This street is longer than the river is deep.’

Another construction, minimally different from the subcomparative, can also be used to diagnose a language’s setting for the Degree Phrase Parameter. This is the subequative, identical to the subcomparative except that its main-clause degree word is *AS* rather than *-ER*.<sup>7</sup> By the same logic discussed in connection with subcomparatives, a language with a “yes” setting for the Degree Phrase Parameter may well be expected to allow subequatives, whereas a language with a “no” setting for this parameter certainly will not. Lake Pátzcuaro P'urhepecha does allow subequatives: changing *sanderu* ‘-er’ to *xani* ‘as’ in (9a-9b) yields perfectly acceptable sentences meaning, respectively, ‘Louis is as tall as the table is wide’ and ‘The street is as long as the river is deep.’

## 2.4. The Degree Abstraction Parameter

Now let us return to the middle parameter in Beck *et al.*’s hierarchy: the Degree Abstraction Parameter ((10)).

- (10) A language {does/does not} have binding of degree variables in the syntax.

In languages with a “yes” setting for this parameter, the degree argument slot of a gradable predicate can be filled by a phrase that moves, leaving a trace (or lowest copy) of type *d*. When the moving element merges with a constituent of type *τ*, this produces a  $\lambda$ -abstract of type  $\langle d, \tau \rangle$ . If Beck *et al.* (2009) are right to posit a Degree Abstraction Parameter, this type of derivation—which results in a trace of type *d* that is bound by some higher element—is available only in some languages, not in all.

<sup>7</sup>In English, the element introducing the embedded clause is also different: *as* rather than *than*.

One type of evidence bearing on the setting of the Degree Abstraction Parameter has to do with scope ambiguities involving modals. Consider the sentence in (11) (adapted from Heim 2001:224), which is, at least for some speakers, two-ways ambiguous:

- (11) [Context: I hand you a 10-page paper. You say. . .]  
 Your paper has to be exactly 5 pages longer than this.
- a)  $\forall w \in \text{ACC}$ :  $[[\text{exactly 5 pages -er than 10 pages}]_1 \lambda_1 \text{ your paper is } t_1 \text{ long in } w]$   
 $\rightarrow$  In every world in which the rules are followed, my paper is 15 pages long. A 20-page paper will not be accepted.
- b)  $[[\text{exactly 5 pages -er than 10 pages}]_1 \lambda_1 [\forall w \in \text{ACC}: [\text{your paper is } t_1 \text{ long in } w]]]$   
 $\rightarrow$  The maximum degree  $d$  such that, in every world in which the rules are followed, my paper is at least  $d$ -long is exactly 5 pages longer than 10 pages. In other words, a 20-page paper may be acceptable.

The ambiguity can be captured by positing that the degree expression *exactly 5 pages -er than this* (where *this* = 10 pages) can take scope either below or above the modal *has to*. Assuming that the inverse scope reading ((11b)) can only come about if *[exactly 5 pages -er than 10 pages]* moves covertly to a position above the modal, and binds its type- $d$  trace long-distance, this reading will certainly not be available in a language that does not allow binding of degree variables (i.e., has a negative setting for the Degree Abstraction Parameter). I have not been able to reproduce this kind of scope ambiguity in Lake Pátzcuaro P'urhepecha: sentences analogous to (11) seem to have only the surface scope reading ((11a)). The question of how this fact should be interpreted will be addressed shortly.<sup>8</sup>

Let us take stock of what we have learned about the Lake Pátzcuaro P'urhepecha degree system by applying Beck *et al.*'s (2009) diagnostics. The results we have obtained so far are summarized in (12).

<sup>8</sup>Beck et al. (2009) also provide a second diagnostic for determining a language's setting for the Degree Abstraction Parameter. In languages with a positive setting for this parameter, the embedded clause in a clausal comparative should show negative island effects (note, for example, the unacceptability of *\*Katie is taller than nobody is* and *\*\*The lake is deeper than the wall isn't long*). I have been unable to run this test in Lake Pátzcuaro P'urhepecha, owing to the presence of a variety of confounds.

(12) *The Lake Pátzcuaro P'urhepecha degree system, as revealed by Beck et al.'s diagnostics*

Parameter	Consequences of “Yes” setting	LPP
Degree Semantics Parameter	a. expressions that plausibly manipulate degree arguments	✓
	b. difference comparatives	✓
	c. comparison with a degree	✓
Degree Abstraction Parameter	a. -ER able to outscope a surface-c-commanding modal	✗
	b. negative islands	?
Degree Phrase Parameter	a. degree questions	✓
	b. measure phrases	✓
	c. subcomparatives	✓
	d. subequatives	✓

It might seem at first that Lake Pátzcuaro P'urhepecha has positive settings for the Degree Semantics Parameter and the Degree Phrase Parameter, but a negative setting for the Degree Abstraction Parameter ([+DSP, –DAP, +DegPP]). According to Beck et al. (2009), this is an impossible parameter setting (cf. the hierarchy in (1)). Does Lake Pátzcuaro P'urhepecha challenge this view?

I suggest that the answer is no. The main piece of evidence in (12) that might suggest a negative setting for the Degree Abstraction Parameter in Lake Pátzcuaro P'urhepecha is the apparent inability of a comparative Degree Phrase to outscope a modal that c-commands it in surface syntax. But this in itself does not *entail* a [–Degree Abstraction Parameter] setting. Even in English, the scope ambiguity only shows up with some modals: *has to* allows it, but *should* does not (Heim 2001). Therefore, the seeming unavailability of inverse scope in the relevant sentences of Lake Pátzcuaro P'urhepecha may be due to a peculiarity of the modals involved—or to something else—rather than to a [–Degree Abstraction Parameter] setting for the language as a whole.

There is, then, no compelling evidence that Lake Pátzcuaro P'urhepecha has a negative setting for the Degree Abstraction Parameter. But the language allows at least three degree constructions—degree questions, subcomparatives, and subequatives—that on the analysis of Heim (2001) and Beck et al. (2009) crucially involve abstraction over degrees. This fact suggests that Lake Pátzcuaro P'urhepecha in fact has a positive setting for the Degree Abstraction Parameter, and hence for all three Beck et al. parameters, exactly like English.

If Lake Pátzcuaro P'urhepecha really does have a positive setting for the Degree Abstraction Parameter, then we may expect at least *some* of its Degree Phrases to participate in scope ambiguities—a prediction I return to in section 4.

### 3. The semantics of Lake Pátzcuaro P'urhepecha degree constructions

We have just concluded that Lake Pátzcuaro P'urhepecha has positive settings for the Degree Semantics Parameter, the Degree Abstraction Parameter, and the Degree Phrase Parameter, just like English. If this is so, we may well expect to be able to extend to at least some of the language's degree constructions the analysis (or an analysis) that has been offered for their English counterparts. In this section, I show briefly that the approach to the semantics of English degree constructions put forth by Heim (2001) and adopted in Beck et al. (2009) extends readily to some of the core degree constructions we have examined in Lake Pátzcuaro P'urhepecha. A prediction of this analysis having to do with scope ambiguities will be tested in section 4.

On Heim's analysis, as alluded to above, gradable predicates are of type  $\langle d, et \rangle$ . For example, the predicate *iosika-* 'be long' has the denotation in (13).<sup>9</sup> When a gradable predicate like *iosika-* is given two individual arguments—one of type  $d$  and one of type  $e$ —the result is a measure phrase construction like (14a), which has the truth conditions given in (14b).

$$(13) \quad \llbracket \text{iosika-} \rrbracket = \lambda d . \lambda x . \delta_{\text{long}}(x) \geq d$$

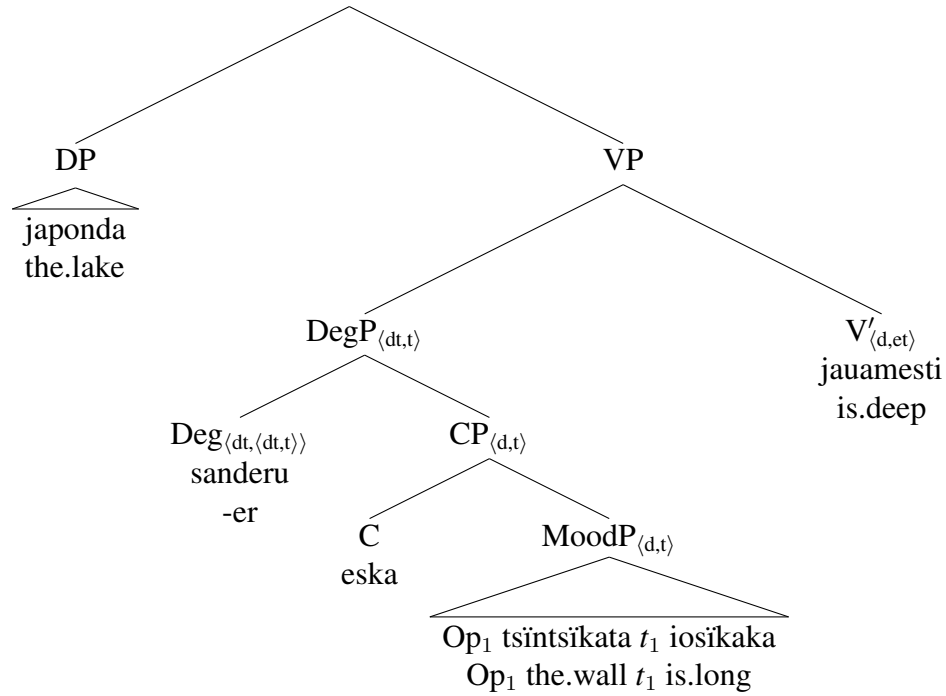
- (14) a. Kurucha tanimu sentimetrhu iosikasiti. (J) (= (8a))  
 Kurucha tanimu sentimetrhu iosika-si-Ø-ti.  
 fish three centimeter be.long-PFV-PRS-IND+3  
 'The fish is three centimeters long.'
- b. *Truth conditions:* (14a) is true iff. . .  
 $\delta_{\text{long}}(\iota x [\text{fish}'(x)]) \geq 3 \text{ cm}$

Next it will be useful to consider subcomparatives such as (15). As is standard, I assume that the embedded clause in (15), *eska tsintsikata iosikaka* 'than the wall is long', is the complement of the degree word *sanderu* '-er', but has been extraposed. In other words, (15) derives from a more remote structure along the lines of (16).

- (15) Japonda sanderu jauamesti eska tsintsikata iosikaka. (J)  
 Japonda sanderu jauame-s-Ø-ti eska tsintsikata iosika-Ø-Ø-ka.  
 lake -er be.deep-PFV-PRS-IND+3 SUB wall be.long-PFV-PRS-SJV  
 'The lake is deeper than the wall is long.'

<sup>9</sup> $\delta_{\text{long}}$  is the measure function that maps every individual to the maximal degree to which it is long.

(16)



Suppose we extend to the *sanderu* in subcomparatives the denotation proposed by Heim (2001) and Beck et al. (2009) for the *-er* in English subcomparatives, as in (17).<sup>10</sup>

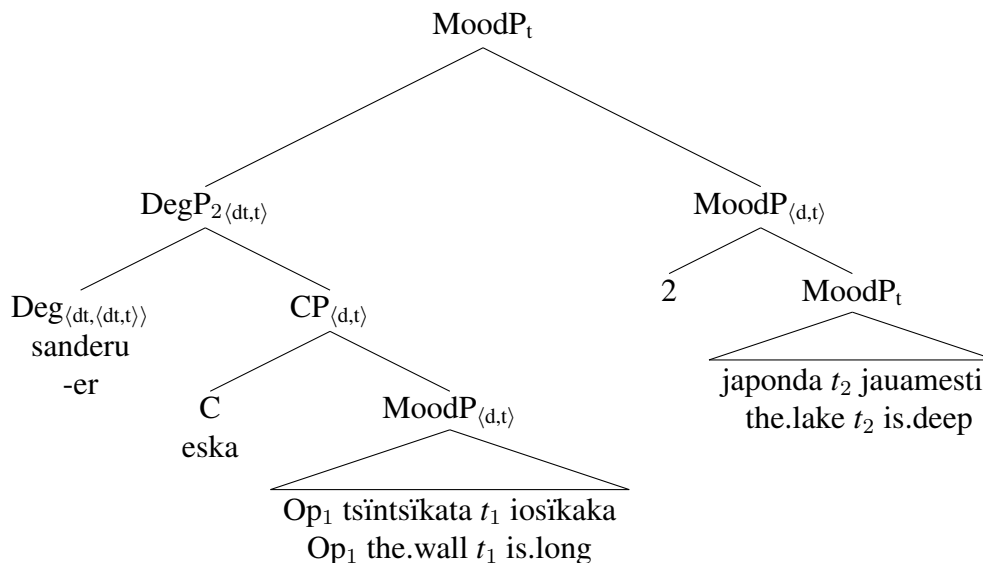
$$(17) \quad \llbracket \text{sanderu} \rrbracket = \lambda P_{\langle d,t \rangle} . \lambda Q_{\langle d,t \rangle} . \max(Q) > \max(P) \quad [\text{adapted from Beck et al. 2009, (6b)}]$$

Then, there is a type clash in (16), because  $\llbracket \text{DegP} \rrbracket$  (type  $\langle dt, t \rangle$ ) cannot compose with the denotation of its sister ( $\llbracket V' \rrbracket$ ), which is of type  $\langle d, et \rangle$ . This problem can be solved by (covertly) QRing DegP to the root of the tree, producing the following LF:

<sup>10</sup>With “max” defined as follows (Heim 2001:216):

$$(1) \quad \max(P) := \iota d . P(d) = 1 \ \& \ \forall d' [P(d') \rightarrow d' \leq d]$$

(18)



The covert movement of the DegP leaves a trace ( $t_2$ ) which is interpreted as a variable of type  $d$ . The sister of DegP is interpreted (by Predicate Abstraction) as a  $\lambda$ -abstract of type  $\langle d, t \rangle$ . This is precisely the type of argument that the DegP (type  $\langle dt, t \rangle$ ) needs, so the type clash has been fixed.

The complement of *eska* in (18) denotes the characteristic function of the set of degrees  $d$  such that the wall is at least  $d$ -long. Assuming that *eska* is semantically vacuous, this denotation percolates up to CP. The sister of DegP denotes the characteristic function of the set of degrees  $d'$  such that the lake is at least  $d'$ -deep. Putting all this together with the denotation of *sanderu* ((17)), we get the following truth conditions for the subcomparative sentence in (15):

(19) *Truth conditions:* (15)/(18) is true iff. . .

$$\max(\lambda d' . \text{the lake is } d'\text{-deep}) > \max(\lambda d . \text{the wall is } d\text{-long})$$

Changing *sanderu* ‘-er’ to *xani* ‘as’ in (15) produces the (impeccable) subequative sentence *Japonda xani jauamesti eska tsintsikata iosikaka* ‘The lake is as deep as the wall is long.’ Suppose that the *xani* found in subequatives has the denotation in (20a).<sup>11</sup> Then the syntacticosemantic derivation for this subequative sentence will be precisely parallel to that for the subcomparative in (15), yielding the truth conditions in (20b).

(20) a.  $\llbracket \mathbf{xani} \rrbracket = \lambda P_{\langle d, t \rangle} . \lambda Q_{\langle d, t \rangle} . \max(Q) \geq \max(P)$

<sup>11</sup> An important empirical question here is whether the (in)equality relation in *xani*-equatives is  $\geq$  (as in (20a)) or  $=$ . Negated equatives, equatives in yes/no questions, and equatives in quantifier restrictors reveal that the answer is  $\geq$ .

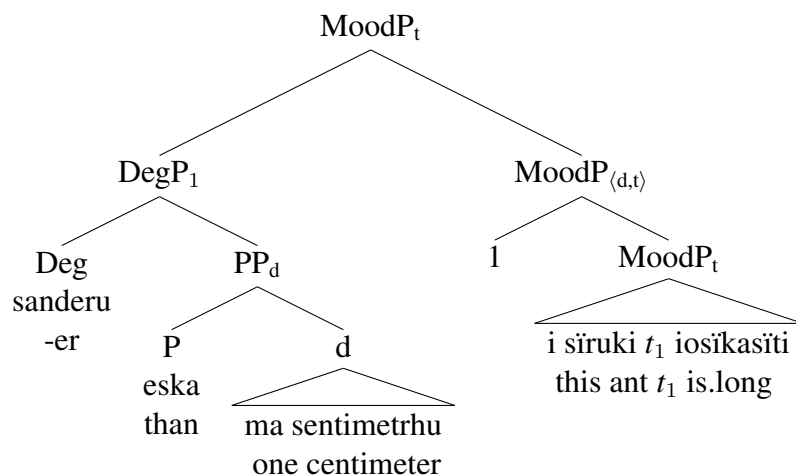
- b. *Truth conditions:* Japonda xani jauamesti eska tsintsikata iosikaka is true iff. . .  
 $\max(\lambda d' . \text{the lake is } d'\text{-deep}) \geq \max(\lambda d . \text{the wall is } d\text{-long})$

Now consider comparison with a degree, as in (21). Let us attempt to extend to this construction the kind of analysis we have given for Lake Pátzcuaro P'urhepecha subcomparatives and subequatives. Pursuing this approach, we are led to posit for (21) the LF in (22).

- (21) I s̄iruki sanderu ios̄ikas̄iti eska ma sentimetrhu. (J)

I s̄iruki sanderu ios̄ika-s̄i-Ø-ti eska ma sentimetrhu.  
 this ant -er be.long-PFV-PRS-IND+3 SUB one centimeter  
 'This ant is longer than one centimeter.'

- (22)



The phrase *ma sentimetrhu* 'one centimeter' denotes a particular degree on the scale of linear extent. Assuming (as above) that *eska* is semantically vacuous, this denotation is inherited by the PP. The sister of the QRed DegP denotes the function  $\lambda d . \text{this ant is } d\text{-long}$ . To complete the analysis, all we need to assume is that the *sanderu* '-er' in comparison-with-a-degree constructions has a slightly different denotation than the one in subcomparatives—namely, that in (23a).<sup>12</sup> This yields the truth conditions in (23b).

- (23) a.  $\llbracket \text{sanderu} \rrbracket = \lambda d . \lambda Q_{(d,t)} . \max(Q) > d$  (cf. Beck et al. 2009, (6a))  
 b. *Truth conditions:* (21)/(22) is true iff. . .  
 $\max(\lambda d . \text{this ant is } d\text{-long}) > 1 \text{ cm}$

<sup>12</sup>Alternatively, as pointed out to me by Amy Rose Deal, it could be that there is only one *sanderu*, with the type- $\langle dt, \langle dt, t \rangle \rangle$  denotation given in (17), and the *eska* found in comparison-with-a-degree constructions maps the denotation of its complement, which is a particular degree  $d$ , to some set of degrees of which  $d$  is the maximum.

Although I have certainly not provided a detailed compositional semantics for every degree construction in Lake Pátzcuaro P'urhepecha that we have seen here, I have shown that standard analyses of core English degree constructions—measure phrase constructions, subcomparatives, subequatives, and comparison with a degree—carry over directly to Lake Pátzcuaro P'urhepecha. This is no surprise if, as we concluded in section 2, the degree systems of the two languages are governed by the same parameter settings.

#### 4. A prediction: scopally ambiguous DegPs

Let us now turn to a prediction of the Heim (2001)/Beck et al. (2009) analysis of degree constructions that we have just extended to Lake Pátzcuaro P'urhepecha. On this analysis, many degree constructions involve a constituent called DegP, which often consists of a degree word (Deg<sup>0</sup>) and its (frequently surface-extraposed) complement. As we have seen, a DegP often has a denotation of type  $\langle dt, t \rangle$ —i.e., it is a generalized degree quantifier. When a DegP of type  $\langle dt, t \rangle$  is merged in the degree argument slot of a gradable predicate (of type  $\langle d, et \rangle$ ), it must QR for interpretability.

All a constituent needs to be interpretable is access to a syntactic position where its denotation can compose with that of its sister. Because there are often positions of this sort available both below and above particular scope-bearing elements in the structure, the DegPs-as-generalized-degree-quantifiers analysis predicts that at least some DegPs should participate in scope ambiguities, exactly like generalized individual quantifiers (type  $\langle et, t \rangle$ ) (Heim 2001). We can test this prediction in Lake Pátzcuaro P'urhepecha to gain some insight into whether our analysis is on the right track.

The prediction, it turns out, is borne out in Lake Pátzcuaro P'urhepecha. To see this, consider the language's result construction, exemplified in (24).

- (24) Juchiti uakasī xani k'eri-sī eska uatsapicha cheresīndiksī. (J)  
 Juchiti uakasī **xani** k'eri-i-sī-Ø-ti **eska** uatsapi-cha  
 my cow **so** big-COP-PFV-PRS-IND+3 SUB child-PL  
 chere-sīn-Ø-ti=ksī.  
 be.afraid.of-HAB-PRS-IND+3=3pS  
 'My cow is so big that the children are afraid of it.'

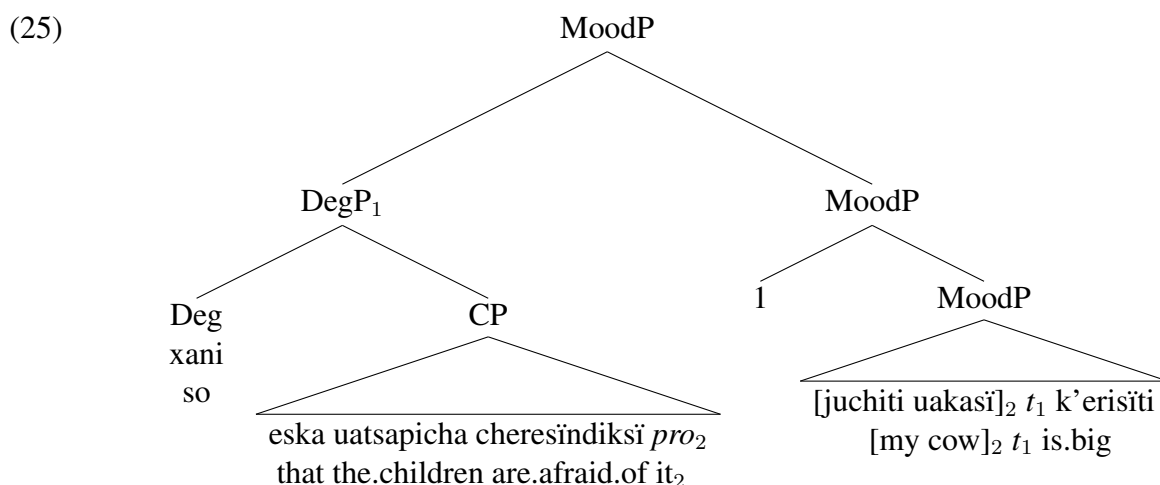
The Lake Pátzcuaro P'urhepecha *xani*-result construction is a degree construction involving a main-clause degree word *xani* (in this usage apparently similar to English *so*) and an extraposed gapless clause which is the complement to *xani*, introduced by the subordinator *eska* (apparently similar to English *that*).

The *xani*-result construction has at least three semantic components. First, it entails the truth of the corresponding “absolute” or “positive” sentence. Secondly, it entails the truth of its result clause. Finally, it conveys—informally speaking—that there is a causal relation between the content of the



main clause (cause) and the content of the embedded clause (effect). For example, (24) conveys the following: **1)** My cow is big. **2)** The children are afraid of my cow. **3)** The children are afraid of my cow *because* it's big.

Suppose that, in (24), the underlying DegP *xani eska uatsapicha cheresindiksi* 'so...that the children are afraid of it' is a generalized degree quantifier (type  $\langle dt, t \rangle$ ) that QRs for interpretability. Then the LF of (24) is (25). This LF, combined with the (intensional) denotation for result *xani* given in (26a), yields the truth conditions in (26b).



- (26) a.  $\llbracket \mathbf{xani} \rrbracket^w = \lambda p_{\langle s, t \rangle} \cdot \lambda P_{\langle d, \langle s, t \rangle \rangle} \cdot \exists d [d > d_{\text{standard}} \ \& \ P_w(d) \ \& \ \text{CAUSE}_w(P(d))(p)]$   
 b. *Truth conditions:* (24)/(25) is true in a world  $w$  iff. . .  
 $\exists d [d > d_{\text{standard}}^{13} \ \& \ \text{my cow is } d\text{-big in } w \ \& \ \text{CAUSE}_w(\{w' : \text{my cow is } d\text{-big in } w'\})$   
 $(\{w'' : \text{the children are afraid of my cow in } w''\})]$

Now suppose that we embed a *xani*-result construction under the intensional verb *uekasindi* 'wants'. All else being equal, the DegP headed by *xani* should be able to QR to the left edge of its own clause or to the left edge of the higher clause. Therefore, it should be possible to interpret it either within or outside the scope of *uekasindi*, yielding a scope ambiguity.

This prediction is correct. Consider the following minimal pair:<sup>14</sup>

<sup>13</sup>Cf. Kennedy's (1997:158-160) analysis of absolute constructions with no overt measure phrase.

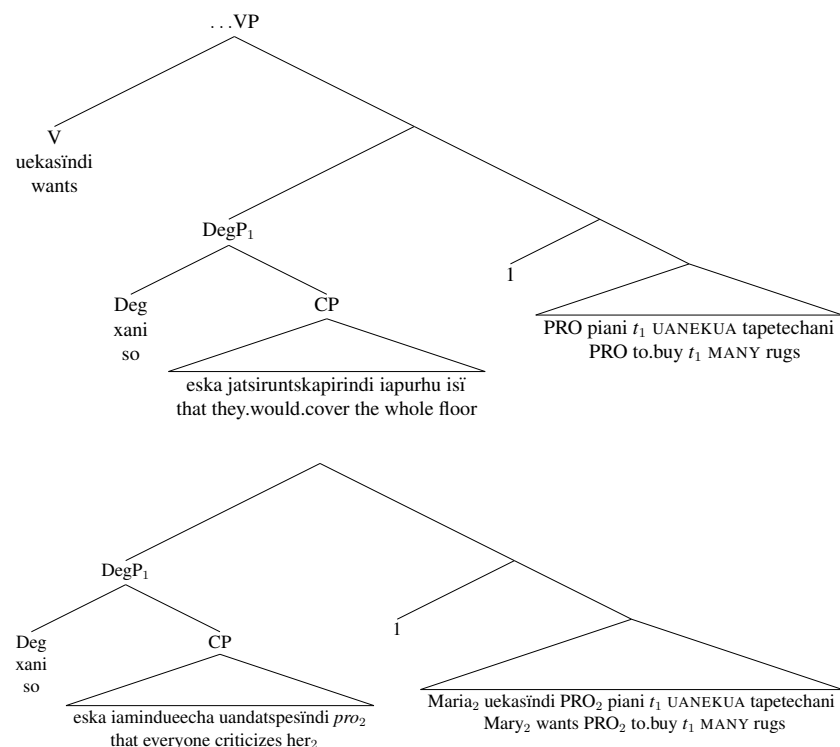
<sup>14</sup>See Meier (2003:99-100) for discussion of a similar case in English.

- (27) a. [Context: Mary doesn't like the floor of her house, because it's dirty and covered in stains. She wants to buy carpets in order to be able to cover it all.]  
 Maria uekasindi piani xani tapetechani eska jatsirunskapirindi iapurhu isi. (J)  
 Maria **ueka-sin-Ø-ti** pia-ni **xani** tapete-cha-ni eska  
 Mary **want**-HAB-PRS-IND+3 buy-INF **so** rug-PL-ACC SUB  
 jatsirunskapirin-Ø-ti iapurhu isi.  
 cover-COND-PRS-IND+3 wherever thus  
 'Mary wants to buy so many rugs that they would cover the whole floor.'
- b. [Context: Everyone criticizes Mary, because she's said that she wants to buy 500 rugs, and they think that doing such a thing would be a ridiculous excess.]  
 Maria uekasindi piani xani tapetechani eska iamindueecha uandatspesindi. (J)  
 Maria **ueka-sin-Ø-ti** pia-ni **xani** tapete-cha-ni eska iamindu-eecha  
 Mary **want**-HAB-PRS-IND+3 buy-INF **so** rug-PL-ACC SUB all-PL  
 uandatspe-sin-Ø-ti.  
 criticize-HAB-PRS-IND+3  
 'Mary wants to buy so many rugs that everyone criticizes her.'

The sentence in (27a) could be paraphrased as follows: "In every possible world that's compatible with Mary's desires, she buys a lot of rugs, they would cover the whole floor (under particular circumstances—i.e., if she laid them out on the floor), and they would cover the floor *because* she bought a lot of rugs." The causal relation contributed by *xani* 'so' holds between Mary buying a lot of rugs and it being the case that they would cover the whole floor. Mary's wanting something is not one of the causal relata; rather, the causal relation holds in every possible world compatible with Mary's desires. This indicates that the *xani*-DegP is interpreted within the scope of 'wants'.

In (27b), by contrast, everyone criticizes Mary not because she's bought a lot of rugs (which, indeed, the context doesn't say has happened) but because she *wants* to buy a lot of rugs. Her desire to do this is one of the causal relata, indicating that, in this example, the *xani*-DegP takes scope higher than *uekasindi* 'wants'. If we were to argue that, in this example, *xani eska iamindueecha uandatspesindi* 'so...that everyone criticizes her' is interpreted within its clause of origin, and hence inside the scope of *uekasindi* 'wants', we would be claiming, implausibly, that (27b) conveys that Mary wants everyone to criticize her, which is not what the context suggests at all.

These considerations suggest that (27a) and (27b) have the following LFs, respectively:



The argument that DegPs in Lake Pátzcuaro P'urhepecha can participate in scope ambiguities depends crucially on the existence of sentences such as (27b), in which a DegP is interpreted higher than a scope-bearing element that c-commands it in surface syntax. It is therefore worth noting that sentences of this type were accepted without reservation, in contexts like the one given for (27b), on a number of different occasions. This lends support to the semantic analysis proposed here, according to which Lake Pátzcuaro P'urhepecha has DegPs that QR for interpretability.

## 5. Conclusion

Although it is a regional variety of a language isolate, and differs typologically from English along a number of dimensions, Lake Pátzcuaro P'urhepecha has a degree system that is very similar to that of English in its overall architecture. In particular, it makes full use of degrees as a basic semantic type and of abstraction over degrees. In the terms of Beck et al. (2009), it has positive settings for the Degree Semantics Parameter, the Degree Abstraction Parameter, and the Degree Phrase Parameter, just like English. These observations were captured here by extending to Lake Pátzcuaro P'urhepecha Heim's (2001) analysis of some core English degree constructions, a move that correctly predicted that Lake Pátzcuaro P'urhepecha should have Degree Phrases that participate in scope ambiguities. That Lake Pátzcuaro P'urhepecha and English have such similar degree systems is an interesting finding, because if we are to learn about the nature and limits of semantic variation, we must take into account not only those cases in which understudied languages diverge from familiar ones but also those in which they do not. The striking similarity between the degree systems of these two languages, which differ along numerous dimensions in other domains, may

be a clue that the parameters regulating languages' degree systems—however they ultimately turn out to be best stated—may be largely independent of those governing other areas of grammar.

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